

**ENGINEERING SPECIFICATIONS
AND
STANDARD DETAILS**

**CITY OF BURLINGTON
BURLINGTON, NORTH CAROLINA**



ENGINEERING DEPARTMENT

NOVEMBER, 2004

www.burlingtonnc.gov

**WATER, SANITARY SEWER, STORM DRAINAGE,
EROSION CONTROL AND STREET IMPROVEMENTS
SPECIFICATIONS AND STANDARD DETAILS**

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WATER AND SEWER SPECIFICATIONS

SECTION A - MATERIALS

All materials are subject to approval by the Engineer. Only materials meeting specifications and/or the Engineer's approval shall be used.

ABBREVIATIONS

All references to specifications by the following entities, institutes, associations, and societies shall be made to the latest revision of each specification:

ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
ASHTO	American Association of State Highway and Transportation Officials
NCAC	North Carolina Administrative Code
NCDOT	North Carolina Department of Transportation
NSF	National Science Foundation

BRICK

All brick used on the work will be hard, tough, sound clay or shale brick, of first quality, thoroughly vitrified and especially suitable to the class of work for which it is to be used and will meet ASTM C-32, Grade MS or higher.

CAST IRON SOIL PIPE AND FITTINGS

All cast iron soil pipe and fittings will conform to ASTM A74 and be classified as SV (service weight). Single or double hub is acceptable. No-hub pipe shall not be used. All pipe and fittings shall be uniformly coated with bituminous coating. Joints will be rubber gaskets. Rubber gaskets shall conform to ASTM C564, 4" x 4" combination wye and eighth bends shall be long pattern, 4" cleanouts shall consist of a 4" service weight cast iron ferrule (with 4" iron pipe size tap) and a 4" brass plug. The plug shall have a low raised square head (Southern Code). Approved manufacturers include Charlotte Pipe and Foundry, Griffin Pipe Products Company and Tyler Pipe Industries.

CEMENT

All cement used in mortar shall conform to Specifications for Portland Cement of ASTM C-150. Brand of cement proposed for use by the Contractor will be subject to the approval of the Engineer. Type I or II may be used in all work. Type III cement may be used with permission of the Engineer

COARSE AGGREGATE

Coarse aggregate will consist of broken stone, sound, hard and tough, and will conform to the specifications for coarse aggregate given in ASTM Specification C-33. Stone will be broken to the sizes hereinafter specified under "Concrete" for the various classes of concrete, and grading will be well within the limits specified.

CONCRETE

Concrete mix design shall be approved by the Engineer. All concrete will be ready-mixed concrete and shall meet the mixing requirements of ASTM C94, as revised. Concrete mixed on the job site shall be approved by the Engineer and shall conform to ASTM C33, as revised. Concrete shall be of three (3) classes based on the ultimate compressive strength when twenty-eight (28) days old:

Class A	3000 psi - Slump not to exceed 3-inches
Class B	2500 psi - Slump not to exceed 3-inches
Class C	2000 psi - Slump not to exceed 3-inches

Unless specified on the drawings concrete shall be Class A concrete.

Concrete shall be poured continuously in layers not exceeding 12-inches. Concrete will not be thrown or dropped from a height sufficient to cause jarring of concrete already in place. After being placed, the concrete shall be worked sufficiently by vibration, spading, rodding or forking to fill all voids and hold any steel reinforcement.

No concrete will be poured when the air temperature is below 40 degrees Fahrenheit unless the Engineer's prior approval has first been obtained for the specific pour.

In connecting new concrete with concrete already set, the surface will be again thoroughly washed to remove dust and debris and the surface covered with a thin layer of mortar of the same proportions of sand and cement as is used in making the concrete.

Formwork will be of standard form plywood. All forms will be clean, smooth and tight with all angles, interior and exterior, chamfered to prevent leaving any sharp edges in the finished concrete. Forms will be constructed true to line and grade, and braced so as to maintain such line and grade when concrete is placed. Twisted wires will not be used to tie forms together. All concrete edges at the top of the forms (unless chamfered) will be rounded with a suitable edging tool.

Necessary precautions should be taken to prevent loss of moisture from concrete after it has been poured. The method and period of curing shall be determined by the Engineer.

Formwork for columns, walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from form removal operations. All other formwork shall be removed as permitted by the Engineer.

All exposed concrete surfaces shall be smooth and free of any form marks.

No waterproofing material or admixture will be used in the concrete without the Engineer's approval.

COPPER PIPE

All copper pipe will conform to ASTM B88. All copper shall be Type K, soft copper and all joints shall be flared or compression type fittings. Compression type fittings shall be Mueller 110 or Inst-

tite; Ford Grip Joint or Quick Joint; or equal. Pack joint type compression fittings will not be allowed.

CORPORATION COCKS

All corporation cocks shall be made of red brass in accordance with ASTM B62 and AWWA C800. All corporation cocks shall have a tapered inlet and copper flared outlet.

The following materials are acceptable:

- A. 3/4" water connection - 3/4" corporation cock - F600 by Ford, H-15000 by Mueller, 5200 by Hayes Manufacturing Company, or 4701 by A.Y. McDonald Mfg. Co.
- B. 1" water connection - 1" corporation cock - F600 by Ford, H-15000 by Mueller, 5200 by Hayes Manufacturing Company, or 4701 by A.Y. McDonald Mfg. Co.
- C. 1-1/2" water connection - 1-1/2" corporation cock - FB600 or FB1000-6-G by Ford, B-25000 by Mueller, 4400 by Hayes Manufacturing Company, or 4701 by A.Y. McDonald Mfg. Co.
- D. 2" water connection - 2" corporation cock - FB600 or FB1000-7-G by Ford, B-25000 by Mueller, 4400 by Hayes Manufacturing Company, or 4701 by A.Y. McDonald Mfg. Co.

DUCTILE IRON PIPE

Ductile iron pipe shall conform to ANSI/AWWA C-151/A21.51-91. The pipe shall be thickness class 51 or greater. The pipe shall also be designed for trench condition type 2, (ANSI A-21.50) unless otherwise shown on the drawings. Thickness design of ductile iron pipe shall be in accordance with ANSI/AWWA C-150A/21.50-91. If for any reason, the Engineer finds any or all ductile iron pipe unacceptable, the contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final.

Joints:

Push-on Pipe joints shall be single rubber gasket push on type or mechanical joint type employing a single elongated rubber gasket to effect the joint seal and shall conform to ANSI A21.11 or AWWA C-111.

Restrained Pipe Joints shall be push-on type with bolted retainer rings and welded retainer bars or the boltless type which includes ductile iron locking segments and rubber or neoprene retainers.

Restrained Pipe and fittings shall be:

- 1) American Lok-ring
- 2) American Flex-ring
- 3) Griffin Snap-Lok
- 4) Clow Super-Lock
- 5) U.S. Pipe TR Flex
- 6) Or Approved Equal

Cement Lining: For water service pipe and fittings shall be cement lined in accordance with ANSI A21.3 or AWWA C-104.

Coating:

For water service pipe and fittings shall be coated inside and outside with a bituminous coating in accordance with ANSI A21.4 or AWWA C-104, Section 4-14. For sanitary sewer service interior lining shall be Protecto 401 Ceramic Epoxy coated and outside with a bituminous coating.

Protecto 401 Ceramic Epoxy Coating: All sanitary sewer ductile iron pipe and fittings shall be delivered to the application facility without asphalt cement lining, or any other linings on the interior surface and no coating shall have been applied to the first six inches of the exterior of the spigot end.

Protecto 401 Ceramic Epoxy Coating material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sanitary sewer service, a test report verifying the following properties, and a certification of the test results

- a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66 Procedure A with a test duration of 30 days.
- b. The following test must be run on coupons from the factory lined ductile iron pipe:
 1. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after one year.
 2. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77° F. Results to equal no more than 0.5 undercutting after 30 days.
 3. Immersion Testing rated using ASTM D-714-87.
 - i. 20% Sulfuric Acid - No effect after one year.
 - ii. 25% Sodium Hydroxide - No effect after one year.
 - iii. 160 ° Distilled Water - No effect after one year.
 - iv. 120 ° Tap Water (scribed panel) - 0.0 undercutting after one year with no effect.

The lining shall be applied by a competent firm with a successful history of applying linings to the interior of Ductile Iron pipe and fittings.

Prior to abrasive blasting, the entire area to receive the proactive compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance that can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of oil, grease or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

After the surface preparation and within 8 hours of surface preparation, the pipe interior shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and

dust free. If flange pipe or fittings are included in the project the lining shall not be used on the face of the flange.

Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

Protecto 401 Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

Inspection:

1. All Ductile Iron pipe and fittings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.
2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500-volt test. Any defects found shall be repaired prior to shipment.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

FILTER FABRIC

Filter Fabric shall be in accordance with NCDOT specifications consisting of strong rot-proof synthetic fibers formed into a woven fabric and meeting the following specifications:

(1) Minimum Tensile Strength	200 lb.
(2) Elongation	15% Min.
(3) Minimum Burst Strength	400 psi
(4) Minimum Puncture Strength	80 lb.
(5) Apparent Opening Size – Max/Min (U.S. Standard Sieve)	30 / 130
(6) Minimum Ultraviolet Exposure Strength Retention	140 lb.
(7) Fungus Resistance	No Growth

FIRE HYDRANTS

All fire hydrants shall be dry-barrel fire hydrants that comply with ANSI/AWWA C-502. The operating nut shall be one piece, all bronze non-rising, measuring 1-1/2 inches from point to flat. Weather cap shall be affixed with an arrow cast on it indicating the direction of opening and fire hydrants shall open counter-clockwise. The bonnet will be one-piece cast iron gasketed and attached to upper barrel by a minimum of six (6) bolts. Design of the hydrant shall be such that it can be lubricated externally, sealed top and bottom with "O" rings. An antifriction washer shall be between the thrust collar and hold down nut to reduce operating torque. There shall be a minimum of two (2) "O" rings to separate waterway from lubricated cavity and additionally an "O" ring to seal between brass ferrule and stem. A travel stop in the bonnet is unacceptable. Hydrants to be of the "3-way" design with two (2) 2-1/2" hose nozzles, national standard threads and one 4-1/2" pumper nozzle with national standard threads. Nozzles shall be "O" ring sealed and locked in place with a "brad" or stainless steel set screw. Leaded nozzles or those requiring shims or field drilling are unacceptable. The union between the upper and lower barrel shall be made by a two-piece cast iron breakable flange. The design will be such that the barrel can be rotated 360 degrees without disassembly. Breakable bolts or lugs or threaded on flanges are not acceptable. The upper and lower stem shall be connected by a coupling designed to break at impact and attached to the stem by stainless steel pins.

All hydrants shall have a main valve opening of 4-1/2" diameter, when attached to a 6-inch diameter main or 5-1/4" diameter, when attached to a water main larger than 6-inch in diameter. They shall be of the compression type, closing with the pressure; composition of the main valve shall be molded rubber or neoprene. Hydrants shall be equipped with a mechanically retained drain valve that will drain the barrel when the hydrant is closed and from a seal when the hydrant is fully opened. The drain valve shall be attached to the upper valve plate. Springs, toggles, tubes, are not acceptable. The upper valve plate, seat ring and seat ring insert must be bronze and the seat ring must have an upper and lower "O" ring for sealing purposes. Shoe connection shall be specified. The interior surface of the shoe shall be epoxy coated and will include a travel stop and be attached to the lower barrel by a minimum of eight (8) bolts and nuts. The upper barrel, lower barrel and hydrant shoe shall be constructed of cast iron class "B" (ASTM 126). A bury line shall be cast in the lower barrel. The hydrant shall be such that the main valve can be removed with a short, lightweight wrench without disassembly of the upper barrel. The bonnet and nozzle caps shall be painted with silver reflective coating material. The hydrant barrel shall be painted red.

Acceptable hydrants are those as manufactured by:

- (1) Centurion, manufactured by Mueller Company
- (2) Guardian, manufactured by Kennedy Valve Company
- (3) Medallion, manufactured by Clow Valve Company

Hydrants shall be provided with a 54-inch bury depth. Extensions manufactured by the same fire hydrant manufacturer will be provided and installed by the contractor to bring the hydrant to grade. The use of multiple extensions to bring hydrants to finish grade is unacceptable, one extension permitted per hydrant installation.

FITTINGS (DUCTILE IRON AND GRAY IRON)

Ductile iron and gray iron fittings shall meet all requirements of ANSI A21.10 (AWWA C110) and will be of the mechanical joint type unless otherwise specified. The interior of all fittings will be cement lined with an asphaltic seal coat in accordance with ANSI A21.4 (AWWA C104), except that Sanitary Sewer service fittings shall be coated with Protecto 401 Ceramic Epoxy. The exterior of all fittings shall be coated with a bituminous coating. Fittings will be a minimum of Class 250 unless otherwise specified by the Engineer. Fittings are subject to approval by the Engineer, and his acceptance or rejection shall be final. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Ductile iron compact fittings (3"-24") conforming to ANSI A21.53 (AWWA C153) are acceptable.

Fittings shall be as manufactured by:

- (1) Griffin Pipe Products Company
- (2) United States Pipe and Foundry Company
- (3) American Cast Iron Pipe Company
- (4) Tyler Pipe Corporation
- (5) Or approved equal

FITTINGS (WATER SERVICE)

Water Service fittings and couplings shall meet all requirements of ASTM B62 (85-5-5-5). All water service line fittings shall be flared end nut for use with type K copper pipe meeting the standards of AWWA C800. When approved by the City Engineer, 1-1/2" and 2" compression type fittings and couplings may be substituted except pack type compression fitting and coupling will not be allowed. Fittings are subject to approval by the Engineer, and his acceptance or rejection shall be final.

Fittings (Water Service) shall be as manufactured by:

- (1) Mueller Company
- (2) A.Y. McDonald Mfg. Co.
- (3) Ford Meter Box Company
- (4) or approved equal

FLOWABLE FILL

Flowable Fill (controlled low-strength material) shall meet the requirements of NCDOT Standard Specifications for Roads and Bridges, (latest revision). Flowable fill shall have a minimum 28-day compressive strength of 125 psi and shall be mixed such that cement content is 100 to 150 pounds per cubic yard, air content is less than 35% and slump is between 7 and 9 inches. Amounts of fly ash and fine aggregate shall be used singly or in combination to make mix yield one cubic yard.

FORCE MAINS

Air release valves shall be located at all high points along force mains, in accordance with NCAC 2H.0219(i)(2)(L). The provisions of NCAC 2H.0219 (i)(2)(M) shall govern measures that are necessary to control odor and corrosion. All force mains will be inspected and tested in accordance with the provisions for water lines, Section 13 of AWWA Standard C-620.

IRON AND STEEL (MISCELLANEOUS)

All miscellaneous iron and steel such as angle iron, checkered plate covers, valve stem guides and supports, etc. will be galvanized.

Galvanizing will be by the hot-dip process after the materials have been cut, assembled and all holes punched. Any field welds or bolts which may be used to fasten iron or steel together will be painted immediately after installation with two coats of aluminum paint.

LANDSCAPE MATERIALS

All materials shall meet the following requirements:

Limestone shall be agricultural grade ground limestone. Only dolomitic limestone shall be used and shall meet the most current requirements of the North Carolina Board of Agriculture.

Fertilizer shall meet the most current requirements of the North Carolina Board of Agriculture and manufactured from cured stock. Any hardened or caked fertilizer shall be pulverized to its original condition before being used.

Seed quality shall meet the most recent requirements of the North Carolina Board of Agriculture. No seed will be accepted with a date of test more than eight (8) months prior to the date of sowing, excluding the month in which the test was completed. Each of the species or varieties of seed shall be furnished and delivered in separate bags. Seed shall be stored in such a manner as to prevent damage caused by heat, moisture, rodents or other causes.

Mulch shall consist of grain straw or other acceptable material approved by the Engineer and shall be reasonably free from roots, Johnson grass, nutgrass, wild garlic, wild onion, bermuda grass and other noxious weeds as defined by the North Carolina Board of Agriculture. Straw mulch that is matted or lumpy shall be loosened and separated before being used. Asphalt or other approved binding material shall be used to hold the mulch in place.

Jute Matting shall be of a uniform open plain weave of single jute yarn, forty-eight (48") inches in width plus or minus one (1") inch. The yarn shall be of a loosely twisted construction and have an average weight of 1.22 pounds per linear yard of the matting with a tolerance of plus or minus five (5%) percent.

Excelsior Matting shall consist of a machine produced mat of curled wood excelsior at least forty-seven (47") inches in width weighing 0.98 pounds per square yard with a tolerance of ten (10%) percent. One side of the excelsior matting shall be covered with a woven fabric of twisted paper cord or cotton cord or with an extruded plastic mesh.

MANHOLE RINGS & COVERS

Manhole rings and covers will be made of cast iron and will conform to ASTM A48, Class 30B. All castings will conform to the shape and dimensions shown on the detail drawings and will be free of any defects. Rings and covers will have machined seats so that the cover will not rattle. All castings will be thoroughly coated with an asphaltic varnish. All manhole rings and covers shall be made in the U.S.A. Rings and covers shall be manufactured by:

- (1) East Jordan Iron Works, Inc.
- (2) U.S. Foundry and Manufacturing Corporation
- (3) Neenah Foundry Co.
- (4) Approved equal

Confined space lettering shall be cast in raised lettering and placed in the perimeter face of the manhole cover as follows: "DANGER PERMIT REQUIRED - CONFINED SPACE DO NOT ENTER". The words "WATER", "SANITARY SEWER" or "STORM SEWER" shall be cast in raised lettering on all covers for the indicated intended service.

MANHOLE STEPS

All manhole steps shall conform to current OSHA standards. The manhole step shall be resistant to corrosion by hydrogen sulfide and other sewer gases if used in a sanitary manhole. The approved step is shown on a City of Burlington Detail Drawing. All other steps must be approved by the Engineer prior to being installed.

MECHANICAL JOINT RESTRAINT

Mechanical joint restraint shall be used at the dead end of all lines, hydrants, crosses, tees, bends, valves, and other locations as directed by the Engineer. The devices shall be manufactured of ductile iron conforming to ASTM A 536-80 such that the device can be used with standardized mechanical joint pipe and conform to ANSI/AWWA A 21.531 C153 and shall be EBAA Iron, Inc., Megalug or Uni Flange Corporation.

METERS

All meters shall be installed by the City of Burlington, Water and Sewer Pipe Maintenance Division.

METER BOXES (3/4" METERS)

Cast iron meter boxes shall conform to ASTM A48, Class 30B. All boxes will conform to the shape and dimensions shown on the detail drawings and will be free of any defects. All boxes shall be thoroughly coated with an asphaltic varnish. Meter boxes shall be manufactured by:

- (1) Tyler Pipe Inc.
- (2) Vulcan Foundry, Inc.
- (3) Russell Pipe and Foundry Co. Inc.
- (4) Charlotte Pipe and Foundry

METER BOXES (1-1/2" and 2" METERS)

Meter boxes for 1-1/2" and 2" meters shall be as manufactured by Quazite Corporation, Stay-Right Tank Company, Inc. or CDR Systems Corporation. The box shall have two 4" x 4" mouse hole openings (one on each end) with a 4" x 4" knockout above each opening. The cover shall be non-locking with a 6" x 9" steel meter lid centered on the cover. The meter lid must open to at least the vertical position. The cover shall also have two pull slots, a skid resistant surface and the word "water" cast into the cover. Boxes subject to traffic loads will be submitted to the City Engineer for approval.

METER SETTERS AND ACCESSORIES

All red brass shall conform to ASTM B62 and AWWA C800.
The following materials are acceptable:

A. 3/4" Water Connection (Residential)

1. Meter Setter - B 2404-2 by Mueller
2. Angle ball valve with lock wing stop
3. Angle dual-check valve
4. Multipurpose inlet and outlet connections
5. 7" riser height

B. 3/4" Water Connection (Commercial)

1. Meter Setter - B 2404-2 by Mueller
2. Angle ball valve with lock wing stop
3. Angle dual-check valve
4. Multipurpose inlet and outlet connections
5. 7" riser height
6. Double check valve assembly with 1/4 turn ball valves and body unions above grade in backflow device enclosure

C. 1" Water Connection

1. Meter Setter - B2404 by Mueller
2. Angle ball valve with lock wing stop
3. Elbow
4. Double check valve assembly with 1/4 turn ball valves and body unions above grade in backflow device enclosure
5. 7" riser height

D. 1-1/2" and 2" Water Connection

1. Custom setter H-1423 by Mueller
2. Female iron pipe inlet and outlet
3. Locking angle meter stops on inlet and outlet risers with double drilled flanges
4. Bottom by-pass with lockable by-pass valve
5. Bracing "eyes" for support pipe
6. 12" riser height
7. Double check valve assembly with 1/4 turn ball valves and body unions above grade in backflow device enclosure

Materials by Ford Meter Box Company, Hayes Manufacturing Company, and A.Y. McDonald Manufacturing Company are acceptable that meet the above specifications.

Backflow devices specified are for domestic use only. Irrigation systems and other special applications shall require a reduced pressure backflow device mounted above ground. All backflow devices shall be approved by the University of Southern California Foundation for Cross Connection and Hydraulic Research. All double check assemblies must conform to ANSI/AWWA C510. All Reduced pressure (RPZ) assemblies must conform to ANSI/AWWA C511.

MORTAR

Unless otherwise provided, cement mortar will be Class A only. Class A mortar will consist of Portland Cement and sand mixed in the proportion of one part cement to two parts sand with not more than 6-1/2 gallons of water per bag of cement. This mixture may be varied to increase workability only by reducing the amount of sand or blending of one or more sands. Mortar in which cement has been placed for more than one hour will not be used.

PRECAST MANHOLES

Precast manholes shall be constructed of reinforced concrete and shall comply with the requirements of ASTM Designation C-478 "PRECAST REINFORCED CONCRETE MANHOLE SECTION".

Manhole steps for precast manholes, unless otherwise approved by the Engineer, shall be as hereinbefore specified and shall be set at a spacing of 15-inches on centers.

Manhole rings and covers for precast manholes shall be as hereinbefore specified. Precast manholes shall be as constructed by Oldcastle Precast, Greensboro, North Carolina, N.C. Products Corporation, Raleigh, North Carolina, Carolina Precast Concrete, Inc., Dunn, North Carolina, Stay-Right Tank Company, Inc., Raleigh, North Carolina or equal.

PRECAST DRAINAGE STRUCTURES

Precast drainage structures shall be solid wall, not waffled wall, and meet the requirements of ASTM C-913, with reinforcing conforming to the requirements of ASTM C-890 and shall utilize grade 60 re-bars conforming to the requirements of ASTM A-615 or WWF conforming to the requirements of ASTM A-185 or both. Additional re-bars shall be placed diagonally around all openings. Concrete compressive strength shall be a minimum of 4,000 psi. Structure shall be designed for an H20-44 loading. Steps shall be required for structures over 3'-6" in depth. Where fittings enter the structure, they shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned. Pipe connections shall be made so that the pipe does not project beyond the inside wall of the drainage structure, and shall be grouted as necessary to make smooth and uniform surfaces on the inside of the structure. Joints are to be sealed with butyl rubber joint sealant conforming to the requirements of ASTM C-990. Inverts shall be grouted to drain to the discharge outlet invert.

RIP RAP

Stone for Rip Rap shall be of a hard, durable nature and shall be placed as shown on the drawings or as directed by the Engineer. All stone shall meet the approval of the Engineer and shall be of the following classes:

- (1) Class A Rip Rap. Stone shall vary in size from 2" to 6".
- (2) Class B Rip Rap. Stone shall vary in size from 5" to 15".
- (3) Class 1 Rip Rap. Stone shall vary in weight from 5 to 200 pounds and 30% shall weigh a minimum of 60 pounds and no more than 10% shall weigh less than 15 pounds.
- (4) Class 2 Rip Rap. Stone shall vary in weight from 25 lbs. to 250 pounds. 60% shall weigh a minimum of 100 pounds and no more than 5% shall weigh less than 50 lbs.

All rip rap shall be in accordance with NCDOT specifications.

SADDLES

Water line saddles for ¾" – 30" shall be as manufactured by the following:

- (1) Ford Brass Double Strap Saddle Style 202B or equal.
- (2) Mueller Bronze Double Strap Saddle Style H16100 Series
- (3) A.Y. McDonald Bronze Double Strap Model 3826
- (4) or equal.

Sanitary sewer saddles shall be as manufactured by the following

- (1) 4" Taps - Romac Industries Inc. Style "CB" Sewer Saddle or approved equal.

SAND

All sand used in mortar shall be clean, sharp, practically free from loam, clay or vegetable matter, and so graded as to insure workability and watertightness when mixed with other ingredients. Sand will conform to ASTM Specifications C-33 and when made into mortar will have a compressive strength at 7 and 28 days of not less than 100% mortar made with standard sand.

STEEL ENCASUREMENT PIPE

Wherever a water or sewer line must be encased under a highway where traffic bearing loads are a consideration, it must be encased in a steel pipe that has been manufactured in conformance with the standards of AWWA C-202 and NCAC 2H.0219(i)(2)(H). Joints, coatings, and method of installation shall be in conformance with the requirements of the North Carolina Department of Transportation. In general, the encasement pipe will be installed by boring with an auger so as not to displace material on the outside of the casing. The minimum wall thickness shall be as follows:

0.1875" for 12" and 14" diameter steel pipe; 0.250" for 16", 18", and 20"; 0.344" for 24" diameter steel pipe; 0.344" for 30" diameter steel pipe; and 0.375" for 36" diameter steel pipe.

Manufactured casing spacers shall be used in sufficient quantity to assure proper alignment of the carrier pipe within the encasement pipe. The spacing of these spacers shall not exceed 10 feet on center. Spacers shall be equal to Spider Supports and Spacers as manufactured by Spider Manufacturing Inc., or approved equal.

Carrier pipe through the steel encasement pipe, plus a minimum of five feet on each end shall be restrained joint ductile iron pipe.

STEEL FOR REINFORCEMENT

All reinforcement steel will fulfill the Standard Specifications for Billet Steel Concrete Reinforcement Bars. Designation A615 of ASTM. Intermediate Grade 60 will be used.

All steel will be free from rust, scale, or other coatings, which would reduce or destroy the bond when placed in the forms, and the Contractor will provide such protection as is necessary to insure the steel will not be injured during the construction period.

STONE

Graded stone material shall be in accordance with Section 1005 of the NCDOT Standard Specifications and gradation requirements in accordance with table 1005-1 of NCDOT Standard Specifications.

STONE SCREENINGS

Stone screenings shall conform to section 1012-1 (c) 3 of the NCDOT Standard Specifications for Roads and Structures.

Stone screenings shall be placed on the road surface to prevent excavated material from adhering to the road surface.

STORM DRAINAGE PIPE

All storm drainage pipe shall be reinforced concrete pipe (RCP), or High Density Polyethylene (HDPE) pipe where indicated and approved. High Density Polyethylene (HDPE) pipe shall have a minimum cover of 18 inches of suitable material.

Reinforced concrete pipe shall meet the requirements of AASHTO M170 for Class III RCP. Joint materials for RCP shall be flexible plastic and meet the requirements of AASHTO M198 for Type B flexible plastic gaskets.

High Density Polyethylene Pipe shall meet the requirements of AASHTO M-294 for pipe with smooth interior, Type "S" or Type "D". HDPE joint shall be bell and spigot type joint with "O"-ring gasket meeting ASTM F-477 placed on the spigot end; a minimum of two (2) corrugations of the spigot end must insert in the bell end of the pipe. Pipe bands and fittings for HDPE pipe shall meet the requirements of AASHTO M-294. HDPE pipe shall require the approval of the City Engineer prior to installation.

STRUCTURAL STEEL

A. General: The American Institute of Steel Construction's "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" latest edition, and the American Institute of Steel Construction's "Code of Standard Practice for Steel Buildings and Bridges", latest edition, are hereby made a part of these Specifications to the same extent as if they were written herein, except that they may be amended or superseded by these Specifications or the Drawings.

B. Materials:

- 1) Structural steel shall conform to "Specifications for Structural Steel", ASTM A-36, latest edition.
- 2) Bolts, nuts, and circular washers - where required - shall conform to the requirements of the latest edition of "Specifications for High Strength Carbon Steel Bolts for Structural Steel Joints", ASTM A-325.
- 3) Bolt and nut dimensions shall conform to the current requirements of the American Standards Association for heavy hex structural bolts and nuts, ASA Standard B18.2.1.

T-HEAD BOLTS AND HEXAGONAL NUTS

All T-head bolts and nuts used for mechanical joint pipe, valves, hydrants or fittings shall be high-strength, low alloy steel in accordance with ANSI A21.11 (AWWA C111). Cast iron bolts will not be accepted.

THREADED RODS

Threaded rods used for thrust restraint shall be 3/4" low carbon steel rods that conform to ASTM A307. The minimum yield strength shall be 36,000 psi and the tensile strength shall be at least 60,000 psi. All rods shall be zinc coated.

TIE BOLTS

Tie bolts used for thrust restraint shall be Star Figure No. SST 7 (or SST 753) - 3/4" tie bolts. Galvanized washers shall be used with all tie bolts.

VALVES – AIR RELEASE

Air release valves shall be designed for 150 psi working pressure and to allow air to escape automatically while the main is in service and under pressure. The valve shall be housed in a precast manhole in accordance with detail drawings. Air release valves shall be manufactured by:

- (1) Empire Specialty Valves
- (2) Crispin Valve Company
- (3) Golden-Anderson Industries
- (4) Or equal

VALVES – AUTOMATIC FLUSHING

Automatic flushing valve assembly shall be metered. Discharge shall have a 4-inch air gap between the discharge from the valve and the drain line accepting the discharge. Automatic flushing valve assembly shall drain to storm drainage system or to air with appropriate erosion control measures. The valve shall be housed in a weather tight enclosure in accordance with detail drawings. Automatic flushing valves shall be manufactured by:

- (1) Kupferle Foundry Model #9600TS
- (2) Hydro-Guard Model HG5AIR
- (3) Cla-val Model 136-AM
- (4) Or Equal

VALVES (BUTTERFLY) (16" AND LARGER ONLY)

All butterfly valves shall conform to the latest revision of AWWA Standard C-504, Class 150-B unless otherwise indicated and meet the following:

- 1) Valve bodies shall be cast iron, ASTM A-126 Class B. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125; or in sizes 16" through 48" where indicated, mechanical joint in accordance with AWWA Standard C-111. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands). All valves shall conform to AWWA C-504, Table 3, Laying Lengths for Flanged Valves and Minimum Body Shell Thickness for all Body Types.
- 2) Valve disc shall be ductile iron ASTM A-536, grade 65-45-12. Valve disc shall be of the offset design providing 360 degree uninterrupted seating, and for sizes 30" and larger shall be of the flow through type.
- 3) The resilient seat shall be natural rubber retained by an 18-8, Type 304 stainless steel retaining ring secured to the disc by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and field replaceable without the need for special tools. Valve body seat shall be 18-8, Type 304 Stainless Steel.
- 4) Valve shafts shall be 18-8, type 304 stainless steel. Shafts shall be of the two-piece stub design and attached to the disc by means of "O" Ring sealed taper pins with lock nuts.
- 5) The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.
- 6) Shaft bearings shall be contained in the integral hubs of the valve body and shall be self-lubricated sleeve type.
- 7) Valve shaft seal shall consist of "O" Rings. Where the valve shaft projects through the valve body for the actuator connection, the "O" Ring packing seal shall be field replaceable as a part of a removable bronze cartridge.
- 8) When manual actuators are required, they shall be amply sized for line conditions. All 16" through 24" butterfly valve manual actuators shall be capable of withstanding 450 foot pounds of input torque against the open and closed stops. All actuators shall have adjustable mechanical stop limits. The closed position stop shall be externally adjustable.
- 9) All valves shall be coated in conformance with AWWA Standard C-550, latest revision. Interior wetted ferrous surfaces shall be coated a nominal 10 mils thick for long life; and body exterior shall have a minimum 3 to 4 mils coating thickness in order to provide protection in shipment and storage, and to afford a superior base for field-applied finish coats.
- 10) Alternatives to any portion of these specifications must be approved in writing at least forty-eight (48) hours before bid date.

- 11) Valves shall be Mueller Line Seal III, Kennedy Valve Company or Clow Valve Company.
- 12) All valves shall open counter-clockwise.

VALVES (GATE) (RESILIENT SEAT)

The stem shall be non-rising type, shall be cast or rolled bronze and sealed by at least two (2) O-Rings which can be replaced with valve fully open and subjected to full rated working pressure with no leakage. The sealing mechanism shall be a replaceable contoured molded rubber disc seat ring attached to the face of the disc with self-locking stainless steel screws or a wedge constructed of cast iron or ductile iron and completely encapsulated with urethane or synthetic rubber. When the wedge type sealing mechanism valve is used, then the valve body and bonnet shall be epoxy coated, inside and out. The minimum design working pressures shall be 175 psi for valves with diameters of 12" or less. All valves shall open counter-clockwise.

All valves shall be as manufactured by:

- (1) Mueller Company
- (2) American Flow Control/ACIPCO
- (3) Clow Valve Company
- (4) or approved equal

VALVES (TAPPING)

Tapping sleeves and valves shall be used for "wet" taps into existing water mains as shown on the Engineer's drawings. The contractor shall verify the type of material, size, etc. of the existing main prior to ordering the sleeve. Tapping sleeves shall be of ductile iron, the split sleeve type with mechanical joint ends, and with a Class 125 outlet flange. The end gaskets shall be Duck-Tipped Rubber Gaskets and all end and side gaskets shall be totally confined to eliminate cold flow. Tapping Valves shall be equal in all respects to the gate valves hereinbefore specified except that they shall come equipped with one end having a Class 125 flange and the other end having a mechanical joint. All stainless steel fully gasketed tapping sleeve (Ford Fs Series) maybe used when tapping lines 16" and larger except for size on size taps.

Tapping sleeves shall be as manufactured by one of the following:

- (1) Mueller Company - No. H-615
- (2) Kennedy Valve Company - No. 960
- (3) American Flow Control/ACIPCO
- (4) Romac FTS 425 (For 30" only)
- (5) or approved equal

Tapping valves shall be as manufactured by one of the following:

- (1) Mueller Company - No. H-667
- (2) Clow Resilient Wedge Tapping Valve
- (3) American Flow Control/ACIPCO

- (4) or approved equal

VALVE BOXES

Valve Boxes shall be of cast iron conforming to ASTM Specification A-48, Class 30B. Valve Boxes shall be a slip type and conform to the detail drawing. Valve Boxes shall have the word "WATER" cast on top of the lid. Valve Boxes shall be manufactured by:

- (1) Charlotte Pipe and Foundry
- (2) Opelika Foundry Company, Inc.
- (3) Mueller Company
- (4) Tyler Pipe
- (5) or approved equal

VITRIFIED CLAY PIPE AND FITTINGS

Vitrified clay pipe shall be extra strength clay pipe, bell and spigot ASTM designation C700-86 with "O" ring compression joint, ASTM designation C425-86.

In addition to the minimum ASTM standards, vitrified clay pipe must also meet the following requirements:

- 1) Minimum strength (3-Edge Bearing) must be 125% of ASTM as follows:

8" dia.	2750 lbf/linear ft.
10" dia.	3000 lbf/linear ft
12" dia.	3250 lbf/linear ft.
15" dia.	3625 lbf/linear ft
18" dia.	4125 lbf/linear ft.
21" dia.	4812 lbf/linear ft
24" dia.	5500 lbf/linear ft

- 2) The minimum o-ring size of 8" diameter and larger pipe shall be 7/16" diameter.
- 3) Lengths of vitrified clay pipe shall be as follows:

PIPE DIAMETER	LENGTHS
8"	5'
10"	5'
12"	6'
15"	7'
18"	7'
21"	7'
24"	7'

- 4) Vitrified clay pipe shall not deviate from straight by more than 1/4" per full length of pipe when the maximum offset is measured on the concave side of the pipe.
- 5) The vitrified clay pipe body shall be composed of a minimum of 30% fire clay.
- 6) Assembled joints shall not leak when subjected to a shear load force of 300 lbf/in of nominal diameter as applied by ASTM C425-86. (This is twice the ASTM Specifications).
- 7) The wall permeability of vitrified clay pipe shall not be greater than 25/gallons/in dia./mile/day when subjected to an internal pressure of a 10 foot head of water.

The owner shall have the option of selecting a maximum of two pieces of vitrified clay pipe per truckload to run the following tests:

- A) Wall Permeability Test - A piece of vitrified clay pipe is plugged at both ends. A hose is connected through one plug and is attached to a water container at other end set at a height of 10 ft. above pipe. The water container and pipe is filled with water and left for four hours for absorption to be completed. Container of water is filled to a marked level. After twenty-four hours measured amounts of water are added to the container to bring it back to the original level. This amount is then converted to gallons/inch dia./mile/ day. Maximum allowable - 25 gal/inch dia/mile/day.
- B) Joint shear load test according to C425-86 paragraph 7.1.2. Minimum allowable - 300 lbf/in.
- C) Three edge bearing strength according to ASTM C301-87 Section five.

Minimum Allowable - 125% of C700-86 Table 1.

If any pipe specimen fails any of the above tests, the City has the option of rejecting all pipes from the truckload the sample was taken.

WATER

Water used for mixing concrete and mortar will be clean and free from deleterious amounts of acids, alkalis, and organic materials. Water from doubtful sources shall not be used unless approved by the Engineer.

SECTION B - METHODS OF CONSTRUCTION

1. GENERAL REQUIREMENTS

BONDS AND PERMITS REQUIRED BY NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

The Owner, at his own expense, will secure from the North Carolina Department of Transportation the "Encroachment Agreement" required prior to the installation of that portion of this project that lies within the right-of-way of the said NCDOT. Any or all other bonds and/or permits required by said NCDOT in connection with this project will be provided and paid for by the contractor. This relates especially to the "Permit to Open Pavement".

CLEARING AND GRUBBING

The work of clearing and grubbing shall consist of the cutting, removal and satisfactory disposal of all vegetation and surface debris within the temporary easement as shown on the plans.

Clearing and grubbing operations shall be completed sufficiently in advance of trenching operations as may be necessary to prevent any of the debris from clearing and grubbing operations from interfering with the trench excavation or backfilling operations.

All work shall be performed in a manner that will cause a minimum of soil erosion. The Contractor shall perform such erosion control work, temporary or permanent as may be directed by the Engineer, in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

The Contractor shall conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. When any such injuries unavoidably occur, all rough edges of scarred areas shall first be made reasonably smooth in accordance with generally accepted horticultural practice, and the scars then thoroughly covered with asphaltum base tree paint. Any such plants that are damaged by any construction operations to such an extent as to destroy their value for shade or other landscape purposes, shall be cut and disposed of by the Contractor, without extra compensation, when so directed by the Engineer.

EASEMENTS

The necessary easements for construction of the project, and all easements essential for access to the project, for all pipe lines not on street right-of-way will be secured by the City of Burlington. Easements will normally be as follows: permanent sewer easements 30 feet; temporary sewer construction easements 50 feet; permanent water easements 20 feet; temporary water construction easements 40 feet. The contractor shall confine work area within the construction easement. If the contractor desires an additional easement for easier access, storage, or any other purpose, it will be the contractor's responsibility to obtain the easement from the individual property owner and present a signed easement agreement satisfactory to the City prior to entering upon such additional easement to perform the work of the project. Such work will begin only after the contractor receives approval from the City. The City will not be responsible for and the contractor shall hold

the City harmless from any damages or claims from property owners resulting from the contractor working outside the easements obtained by the City.

EXISTING UTILITIES

The contractor shall be responsible for making a field inspection of existing utilities prior to the bid opening. The Contractor shall be responsible for any damage to existing utilities resulting from his work. Approximate locations are shown on the plan view of each sheet.

The contractor shall excavate and expose all existing underground lines in advance of trenching operations to assure that there will be no conflicts with the proposed grade and alignment. The Contractor shall repair all water and sewer connections damaged during construction.

Any mailboxes, fences, water meter boxes, valve boxes, existing storm sewer pipes or other pipes that may need to be removed during construction will be reinstalled and the cost included in the unit prices named for pipe. Should such pipe be damaged while being handled, it will be replaced with new pipe of the same class at no extra charge. The contractor shall replace any defective pipe encountered by the contractor. The contractor shall be reimbursed for the cost of the pipe only.

The contractor shall comply with the Underground Damage Prevention Act, G.S. Chapter 87.

HANDLING PIPE AND MATERIALS

Loading and unloading of pipe, valves, hydrants, and accessories shall at all times be performed with care to avoid damage. The practice of unloading pipe by dropping from a truck will absolutely not be tolerated. Pipe shall be lifted by slings or clamps rather than by hooks that could cause damage to the lining.

Sanitary precautions will be taken at all times to prevent pipe from being contaminated on the ground. Pipe shall be strung out along the shoulder of a road in such a manner as to prevent storm water from running through the pipe.

Pipe coating damaged in handling shall be removed from the project or repaired in a manner satisfactory to the Engineer.

Protection from freezing damage shall be afforded valves and hydrants by proper storage before installation.

INGRESS AND EGRESS TO BUSINESS ESTABLISHMENTS

The contractor will be required to conduct his construction work so that ingress and egress to business establishments will be maintained at all times. No direct payment will be made for providing ingress and egress, as the cost of this work will be considered incidental to the work.

INSPECTION AND CONSTRUCTION STAKEOUT

Construction stakeout will be done by the Consulting Engineer or by the City. The Contractor shall make every reasonable and available effort to protect hubs and grade stakes. Cut sheets will be provided by the Consulting Engineer or by the City. If in the opinion of the Engineer these stakes are destroyed through carelessness or neglect on the Contractor's part, then it will be the

Contractor's responsibility and expense to see that the destroyed points are reestablished by the Engineer.

Construction inspection will be made by the Engineering Department and/or the Consulting Engineer. The Contractor shall cooperate with and shall adhere to the instructions of the inspector.

INSTALLATION OF STEEL ENCASEMENT PIPE

Encasement pipe shall be installed by dry boring and jacking. The boring auger shall be mounted inside the encasement pipe. The installation of the pipe and the boring of the hole shall be done simultaneously. As the boring operation progresses each new section of encasement pipe shall be butt welded to the previously installed section. Voids are to be filled with a Portland cement grout consisting of one (1) part Portland cement grout to three (3) parts sand at sufficient pressure to insure there will be no settlement of the highway or railroad. Encasement pipe shall be sealed at the ends with brick and mortar or an EPDM Neoprene rubber boot with stainless steel pipe clamps to prevent flowing water or debris from entering the space between the encasement pipe and the carrier pipe.

In the event that an obstruction is encountered during the dry boring operation, the auger is to be withdrawn, the excess pipe cut off and capped, and the void is to be completely filled with Portland cement grout as described above before moving to another boring site. Open cutting will not be allowed on State roads unless approved by the North Carolina Department of Transportation.

PAVEMENT CUTTING, REMOVAL AND REPLACEMENT WITH ABC STONE

Wherever it becomes necessary to cut pavement, the cuts should be the width of the required trench (a minimum width of fifty-four (54") inches, unless otherwise directed by the Engineer) plus one (1) foot of pavement removal on each side of the trench. All pavement to be removed shall be marked for cutting by chalk line or other acceptable method. After marking, bituminous pavement shall be cut to its full depth to a neat and true line along the mark. Concrete pavement shall be sawed to a minimum depth necessary for a smooth cut when broken out. All pavement cut shall be removed from the site of the work and shall not be used to backfill trenches. Following compaction of the backfill material, ten (10") inches of ABC stone shall be placed and compacted within all excavated areas and brought to an elevation as determined in the field by the Engineer.

PROPERTY PROTECTION

Trees, fences, poles, and all other property shall be protected unless their removal is authorized, and any property damaged shall be satisfactorily restored by the contractor. Tractors or other equipment shall not have cleats, spikes or any other type of tread devices that will cause damage to street pavement.

During all operations of construction and seeding, extreme care shall be exercised to prevent unnecessary cutting of roots and to prevent scarring or damage to trees and shrubs. Where trimming of branches or cutting of roots is necessary, all cuts shall be made cleanly with proper tools in accordance with generally accepted horticultural practices and in a manner satisfactory to the Engineer. All scarred areas and all cut surfaces one inch or more in diameter shall be thoroughly and completely covered with tree paint.

Tree paint shall be an asphaltum base paint prepared especially for tree surgery and shall be approved by the Engineer before used.

RELATION OF SEWER MAINS TO WATER MAINS

- A. Lateral Separation of Sewer and Water Mains. Sewer lines shall be laid at least ten (10') feet laterally from existing or proposed water mains, unless local conditions or barriers prevent a ten (10') foot lateral separation in which case:
- (1) The sewer is laid in a separate trench, with the elevation of the top of the sewer at least eighteen (18") inches below the bottom of the water main; or
 - (2) The sewer is laid in the same trench as the water main with the water main located at one side of a bench of undisturbed earth, and with the elevation of the bottom of the water main at least eighteen (18") inches above the top of the sewer.
- B. Crossing of a Sewer under a Water Main. Whenever it is necessary for a sewer to cross under a water main, the sewer shall be laid at such an elevation that the top of the sewer is at least eighteen (18") inches below the bottom of the water main, unless local conditions or barriers prevent an eighteen (18") inch vertical separation in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing.
- C. Crossing of Sewer over a Water Main. Whenever it is necessary for a sewer to cross over a water main, both the sewer and water main shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.
- D. Minimum Separations Between Sewer Lines and the following.
- | | | |
|----|---|----------|
| a) | Any private or public water supply source, including any WS-1 waters of Class I or Class II impounded reservoirs used as a source of drinking water | 100 feet |
| b) | Waters classified WS-II, WS-III, B, SA, ORW, HQW, or SB [from normal high water (or tide elevation)] | 50 feet |
| c) | Any stream, lake or impoundment | 10 feet |
| d) | Any building foundation | 5 feet |
| e) | Any basement | 10 feet |
| f) | top slope of embankment or cuts of 2 feet or more vertical height | 10 feet |
| g) | Interceptor drains | 5 feet |
| h) | Groundwater lowering and surface drainage ditches | 10 feet |
| i) | Any swimming pool | 10 feet |

RELATION OF SEWER SYSTEM TO FLOOD PLAINS

Sewer manholes located within the 100-year flood plain shall be constructed in accordance with Standard Specification Drawings for watertight manholes SS-18, or sewer manholes located within the 100-year flood plain shall have a minimum height of two (2) feet above the 100-year flood elevation. The 100-year flood elevation shall be determined from elevations provided by the U.S.

Army Corp. of Engineers in the "Flood Insurance Study" for the City of Burlington and published by the Federal Emergency Management Agency on December 22, 1998.

RESTRICTION OF LOAD LIMITS

Equipment of such weight or so loaded as to cause damage to drainage structures, existing pavement, subgrade, subbase or base course, or to any type of construction, either being constructed or previously constructed, shall not be operated in any location where damage would be caused. It shall be the responsibility of the contractor to correct any damage to any type of construction incurred as a result of exceeding a safe load limit. Repair of such damage shall be at the contractor's expense.

SAFETY PROVISIONS AND TRAFFIC CONTROL

Signs, barricades, warning lights, and flagmen shall be employed as necessary when construction endangers either vehicular or pedestrian traffic; these safety devices shall remain in place until traffic may proceed normally again.

Detours with the exception of simple block detours, shall be approved by the Police Traffic Department and/or the North Carolina Department of Transportation. Notice must be given well in advance of the detour so that necessary notification of the traveling public may be made. The Contractor will furnish all barricades, signs, lights, and other safety devices to protect his construction, and the contractor is in no way relieved of liability for providing this protection because the detour is set up and maintained by others.

Signs and signing procedures shall conform fully to the manual on "Uniform Traffic Control Devices" for Streets and Highways Part VI as prepared by North Carolina Department of Transportation, Division of Highways.

Where the Contractor is allowed to close a travel lane but required to maintain traffic, the Contractor shall be required to provide flagmen with stop and slow paddles and provide all signs as shown on the traffic control detail sheet.

Spoil material from the excavated trench placed on the roadway shall be placed on stone screenings to prevent pavement damage and to assist the contractor with clean up operations. A power brush broom shall be on the job site and used to sweep the roadway at the end of each day's work. The contractor shall take all precautions such that the pavement will not be damaged during construction. Any damage to the pavement will be repaired at the contractor's expense.

All shoulders shall be reconstructed to the North Carolina Department of Transportation Standards and "Soft Shoulder" signs shall be placed on the shoulder after construction.

SOIL EROSION AND SEDIMENTATION CONTROL PROVISIONS

A. General Requirements. Control of erosion and sedimentation resulting from land disturbing activities is subject to the requirements of the City of Burlington Soil Erosion and Sedimentation Control Ordinance. Any authorized representative or agent of the City of Burlington shall be granted entry or access for purposes of inspection; he shall not be obstructed, hampered, or interfered with while he is in the process of carrying out his official duties. The requirements for

erosion and sedimentation control apply to areas which are involved in borrow, waste disposal, and topsoil storage activities; and to areas which are directly involved with the construction of buildings, paving, curb, gutter; and to areas where storm drainage, water, and sewer lines and structures are installed.

Land disturbing activities shall be planned and carried out to achieve the following objectives:

- 1) Minimize exposed areas at any one time.
- 2) Limit exposures of areas to the shortest possible time.
- 3) Control surface water runoff to reduce erosion and sediment loss.
- 4) Hold offsite erosion and sedimentation damage to a minimum.

With reference to requirement No. 2 above, portions of the site on which land disturbing activities have been undertaken, but upon which no further active construction takes place for a period of fifteen (15) working days, shall be planted or otherwise provided with a ground cover sufficient to restrain erosion. The Contractor shall be responsible for maintaining all temporary and permanent erosion and sedimentation measures and facilities until the project is accepted by the Owner, or until removal of facilities and cessation of control measures is authorized by the Engineer.

B Work Included: This section includes the labor, materials, equipment and related services required for the installation of berms, drainage structures, storm water drains, straw barriers, vegetative covers, and other devices or methods for control of erosion and sedimentation shown on the Drawings or specified herein.

C. Facilities and Measures for Erosion and Sedimentation Control.

1. **Phased Construction:** The installation of improvements will be done in phases as specified on the construction drawings. This phasing of construction will help limit erosion caused during the installation of the improvements, and will act as an erosion control measure.

2. **Clearing and Grubbing:** The Contractor is to clear the entire width of the permanent easement of trees, stumps, shrubs, and brush. The natural vegetative cover is to remain intact until the installation of the line begins, except that which has to be removed during the clearing and grubbing operation. Stumps, brush, and rubbish resulting from the clearing operation shall not be disposed of by placing on adjoining privately owned property unless the Contractor has a written instrument from the property owner. All other spoil is expected to be trucked off to a sanitary or permitted demolition landfill for disposal.

3. **Creek Crossing:** Where the pipe line crosses a creek, it shall be installed true to line and grade. Material excavated will not be dumped into the stream, but shall be finely spread over the adjacent easement for seeding. Rock will be removed from the site. Creek banks will be stabilized immediately after installation of the line with Class I Rip Rap.

4. **Berms:** Drainage berms and ditches shall be installed as shown on the Drawings.

STONE PLACEMENT

The work of incidental stone shall consist of furnishing, placing and shaping a graded stone material for use in driveways, temporary maintenance of traffic, adjacent to mailboxes and at any other locations directed by the Engineer. The type of stone used will be as directed by the Engineer.

The work of stone stabilization shall consist of furnishing, placing and shaping either #5 or #57 stone in accordance with "Installation of Sanitary Sewer Pipe" hereinafter specified or as directed by the Engineer when unstable soil conditions required the stabilization of the trench during the installation of water and sewer mains. All vitrified clay pipe shall laid on either #5 or #57 stone in accordance with a class "B" or class "C" bedding requirements. See drawing detail SS-1.

STORM SEWER PIPE REPLACEMENT

Existing storm sewer pipes that may need to be removed during construction and are suitable for replacement as determined by the Engineer will be replaced to the line and grade prior to construction or as directed by the Engineer. Where existing storm sewer pipes are unsuitable, new reinforced concrete pipes shall be used to replace existing storm sewer pipes. The new pipe will be replaced to the line and grade prior to construction or as directed by the Engineer. The contractor at his expense will replace pipe damaged due to contractor negligence.

STREET CLOSINGS

A written notice from the contractor to the Engineer forty-eight (48) hours in advance will be needed for the closing of a street. The name of the street should be in this notice. Following a review of the request for closing the street, the City Engineer will notify the contractor of approval or denial of the request.

SUBSURFACE INFORMATION NOT GUARANTEED

Borings and subsurface information shown is for general information of bidders and is not guaranteed.

The contractor shall take all risks and shall be responsible for all expenses and damages attending the presence or proximity of any gas or water pipes, sewers or drains, conduits, or other structures appearing in such manner as shall not, in the opinion of the Engineer, require shifting or removing.

SUPERVISION

The contractor is hereby instructed that the City Engineer reserves the right to request the removal of any person employed on any part of the work where he may be considered by the City Engineer to be incompetent or disorderly and that a request from the City Engineer for the removal of such a person will be immediately observed. The contractor is responsible for furnishing qualified personnel for all phases of the work. Proper supervision of the work shall be maintained at all times. Each crew shall consist of a foreman, equipment operators and laborers enough to install the pipe line, conforming in every respect to the plans and specifications.

TRENCH EXCAVATION AND BACKFILLING

A Alignment and Grade

All pipe shall be laid to the line and grade shown on the plans. Protection shall be afforded to all underground and surface structures, using methods acceptable to the Engineer. The contractor at his own expense shall furnish this protection.

Deviations from line and grade may be made only with the permission of the Engineer when such deviations arise from grade or line conflicts with existing utilities, structures, or other sources of conflict. It is generally intended that no extra compensation shall be allowed for measures necessary to protect existing utilities or structures during excavation of construction or for measures necessary to negotiate crossings of existing utilities or structures.

In cases where an existing utility follows a parallel path in close proximity to the utility under construction, and it is not practicable to remove the existing utility or redesign the utility under construction, the Engineer may order special methods to be employed and allow extra compensation for such measures as are required.

B. Excavation and Preparation of Trench

Trench excavation shall be carried out in such a manner as to conform to the line and depth of cover shown on the plans, excavation shall proceed in advance of pipe laying at least fifty (50') feet, but only so far as the Engineer will permit. The trench shall be so braced and drained that workmen may work therein safely and efficiently. It is essential that discharge from pumps be led to natural drainage channels, to drains, or to storm sewers.

Trench width may vary with the depth of trench and nature of the excavated material, but in any case shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench shall be twenty (20") inches, but in no case shall the width be less than twelve (12") inches greater than the nominal diameter of the pipe.

Pipe foundation shall at all times be such that the pipe rests uniformly along its entire barrel length on the trench bottom. Bell holes shall be dug, and no pipe will be accepted where the bells of the pipe are supporting the weight of the pipe. Any part of the trench excavated below grade shall be corrected with approved compacted material before the pipe is laid. Where the subgrade is unstable or water is present in quantities sufficient to make uniform earth bedding of the pipe impossible, the contractor shall stabilize the trench bottom with #5 or #57 stone. The contractor shall keep all trenches free from water during the excavation for and laying of the utility lines.

Pipe clearance in rock shall be a minimum of six (6") inches below the grade line of the pipe and nine (9") inches clearance on each side of the nominal diameter of the pipe shall be provided. Should rock be encountered in trenches, the trenches will be brought back to grade with crushed stone and properly compacted.

Piling of excavated material shall be done in such a manner that danger to the work and inconvenience to the public is kept to a minimum. Street drainage shall be maintained by suitable means.

The contractor shall remove by pumping any water, which may accumulate in the trenches and other excavations under this contract and shall build all dams and do all other work necessary to keep the trenches or other excavation free from water. The Contractor shall at all time have sufficient pumping machinery ready for immediate use. All surface water shall be prevented from entering the open ditches or excavations by proper grading of the ground surface in the vicinity of the excavation.

C. Rock Excavation

Any material shall be considered rock that in the opinion of the Engineer cannot be excavated except by drilling and blasting or drilling and wedging. Any materials, which can be removed by means other than those above specified, but which for reasons of economy, the contractor prefers to remove by drilling and wedging, will not be classified as rock.

No soft or disintegrated rock, which can be removed with a pick, nor any material which can be broken down by sledge hammer, nor ledge or boulders less than 1/2 cubic yard in volume, nor loose, shaken or previously blasted rock, nor broken stone in rock fillings or elsewhere will be considered as rock excavation.

All blasting operations shall be conducted in a safe and satisfactory manner. Any rock excavation within five (5') feet of underground utilities shall be done with a very light charge of explosives and the utmost care shall be used to avoid disturbing the existing utility. All exposed pipe lines and other structures shall be carefully protected from the effects of blasts and any damage done to them by blasting shall be properly repaired by the contractor, at his own expense. Sufficient warning shall be given to all persons in the vicinity of the work before blasting. The site of the blast shall be covered with blasting mats or other devices to prevent damage from flying rock. The time of blasting and the number and size of charges must be satisfactory to the Engineer. Blasting shall be performed by experienced persons.

Where blasting takes place within one thousand (1,000') feet of a utility, structure or property which could be damaged by vibration, concussion, or falling rock, the contractor shall be required to keep a blasting log containing the following information for each and every shot:

- (1) Date of shot
- (2) Time of shot
- (3) Foreman's name
- (4) Number and depth of holes (provide sketch)
- (5) Approximate depth of overburden
- (6) Amount and type of explosive used in each hole
- (7) Type of caps used (instant or number of delays)
- (8) Weather Conditions including temperature and humidity
- (9) Station number or reference to the construction base line survey data
- (10) Manufacturer and type of explosive

This blasting log shall be made available to the Engineer upon request and shall be kept in an orderly manner. Compliance of the contractor with these specifications does in no way relieve him of legal liabilities relative to blasting operation. All blasting operations will be conducted in strict accordance with existing ordinances and accepted safe practices relative to the storage and use of explosives.

Where blasting takes place within five hundred (500') feet of a structure, the contractor

1. Shall employ the services of an independent qualified blasting consultant to inspect the blast site and provide sufficient written and photographic documentation to accurately reflect the pre-blast condition of the structure.
2. Provide vibration-recording instruments to record peak particle velocity (2.0 inches per second maximum allowable) and frequency (15 hertz minimum allowable).
3. Provide post blast inspection upon completion of the project.

D. Backfilling Trenches

Backfill material shall be of good quality and free of cinders, frozen material, ashes, refuse, boulders, rocks or organic material. Rock and boulders shall be excluded from backfill for at least two (2') feet above the top of the pipe, and no stone larger than eight (8") inches in its largest dimension shall be used in backfilling.

Backfilling along the sides of the pipe and immediately above the pipe will be done with extreme care to assure that backfill material is distributed properly and to proper grade and alignment. Backfill material will be placed and compacted in six (6") inch layers or as directed by the Engineer.

All trench backfill under paved areas (or proposed paved areas), parking areas, sidewalks, and shoulders shall be compacted to a density of ninety-five (95%) of maximum dry density as determined by AASHTO Method T-99. Cross-country water lines shall have backfill compaction of ninety (90%) percent of maximum dry density unless otherwise directed by the Engineer. Dry material used in refilling will be sufficiently moistened, as directed by the Engineer, so that moisture content will be within five (5%) percent of optimum and future settlement will be at a minimum.

It shall be the contractor's responsibility to maintain all pavement cuts until paved or accepted by the owner.

No water tamping of backfill will be allowed. Under no circumstances shall pipe be allowed to be laid in water. The contractor shall not have open in excess of two hundred (200') feet of water and/or sewer main trench at one time. Backfilling shall be completed at the end of each day's work.

E. Trench and Excavation Safety

The contractor shall at no extra cost to the City follow guidelines set up by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor for safe trenching and excavation work.

All trenching over five (5') feet deep will be sloped, shored, sheeted, braced and otherwise supported. When soil conditions are unstable, excavations shallower than five (5') feet also must be sloped, supported or shored. The type of OSHA construction safety standard used is optional to the contractor. Shoring or sheeting below the top of the pipe should be left cut off above the pipe.

2. SANITARY SEWER

INSTALLATION OF SANITARY SEWER PIPE

All materials for laying and jointing the pipe in the trench will conform to the specifications for such material herein given and will be furnished by the contractor. Grade lines for aligning and grading the pipe in the trench will be established by the Engineer, and all labor and materials required will be furnished by the Contractor. Pipe laying in general will conform to ASTM C-12.

Prior to being lowered into the trench, each pipe will be inspected by the crew foreman. Faulty pipe shall be rejected and removed from the work site.

No pipe will be laid in the trench until the Engineer has been notified of the intention of the contractor to lay pipe, giving the Engineer sufficient time to check the lines and grades before pipe laying is begun. The Engineer may order the removal of and relaying of any pipe laid without such notice having been given and without direction from the Engineer to proceed having been received.

No pipe will be stockpiled or temporarily laid out within ten (10) feet of excavation in earth or within thirty (30') feet of rock that must be blasted for removal. The open end of all pipes will be plugged when pipe laying is not in progress, and all pipe will be protected against injury from falling rock when blasting.

Pipes having any defects which are insufficient to cause the rejection of the pipe will be laid so as to bring defects in the top half of the sewer, observing such special directions as the Engineer may give with reference thereto.

Pipe will be laid uphill with the bell of the uphill end of the pipe. A bell hole will be dug for each bell, but only of sufficient size to insure that the pipe will bear evenly throughout its length on the bottom of the trench.

Unless rock is encountered, all vitrified clay pipe shall be laid in accordance with class "B" or class "C" bedding requirements. See drawing detail SS-1. All vitrified clay pipe laid shall have #5 or #57 stone placed beneath the pipe a minimum of four (4") inches or one-eighth of the outside diameter of the pipe, whichever is greater. (See TRENCH EXCAVATION AND BACKFILLING, paragraph B. Excavation and Preparation of Trench.)

The pipe and fittings will be laid in the trench so that after the sewer is completed the invert of the pipe will conform accurately to the line and grade given by the Engineer. A laser beam shall be used to obtain horizontal and vertical alignment.

Whenever the Engineer's drawings show, or for other reasons it may be necessary to change from ductile iron pipe to vitrified clay pipe, or visa versa) the Contractor will furnish a donut

manufactured by Fernco Joint Sealer Company, or approved equal, or a flexible coupling with two stainless steel clamps, manufactured by Fernco, or approved equal, to make the joint. A brick and mortar collar will be constructed around all joints where couplings or donuts are used.

In trenches of excessive depth, concrete encasement may be required. Class C concrete will be placed around the pipe as indicated on the drawings. In severe soil conditions requiring unusual treatment, the actual amount of concrete placed around the pipe will be determined by the Engineer.

Whenever the Contractor, through carelessness or otherwise, has excavated trenches of widths or depths not in accordance with the specifications, the extra amount of concrete or other material required to properly bed the pipe and secure the results above specified will be placed by the Contractor at his own expense.

Concrete placed in trenches that require sheathing will be permitted to set not less than three (3) days before sheathing is removed.

Backfilling of trenches, whether the pipe is bedded in concrete or not, will be carefully done with selected material thoroughly tamped to a point above the top of the pipe as specified under "Trench Excavation and Backfilling".

Upon completion of the entire work, all lines will present a clean and unbroken barrel. All lines will be thoroughly cleaned and inspected by the Contractor before asking for final inspection by the Engineer. Any defective lines will be repaired and any deposits removed by the contractor, at his own expense. Any materials left along the line of the trench after work on the sewer is completed will be removed by the contractor, and if not owned by the contractor, stored as directed by the Engineer.

SANITARY SEWER MANHOLES

Manholes shall be built at the locations shown on the Engineer's drawings. Manholes shall be constructed of precast reinforced concrete. Construction will conform to the City Standard Detail Drawings. Depth of manholes shall be as shown on the Engineer's drawings. The contractor shall at no extra cost to the City follow guidelines set up by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor for confined space entry.

Manhole shelves and channels can be constructed of brick and mortar or be of the precast type. Channels shall be built to a depth of three-quarters of the diameter of the pipe and shall conform to the inside diameter of the influent and effluent pipes. If there is a total elevation difference of six (6") inches or less between the influent and effluent pipes, the channel shall be constructed from the invert of the influent pipe to the invert of the effluent pipe (unless precast type is used). If the elevation difference is 6" - 30", the channel shall be constructed from the invert of the effluent pipe to a point on the wall of the manhole below the invert of the influent pipe which is half way between the bottom of the manhole and the influent pipe. The channel shall be smooth in order to avoid any turbulence in the manhole.

Manhole shelves or benches shall slope from the manhole wall to the invert channel. The shelf at the wall shall be a minimum of three (3") inches higher than the shelf at the channel.

A maximum of two (2") inches shall be allowed for the intrusion of the influent and effluent pipes beyond the inside wall of the manhole.

All proposed sanitary sewer mains and service laterals that will tie into a precast concrete manhole shall be cored at the elevations shown on the drawings or as directed by the Engineer. The openings through the existing manhole walls shall be cored with a suitable coring machine. A watertight flexible coupling shall be used to make the connection between the pipe and manhole. The contractor shall reconstruct the shelf and channel as required to provide a smooth invert in the existing manhole. Angle of flow through the manhole shall be not less than 90 degrees. The contractor shall furnish all labor, equipment and materials to make the connection. Manholes on outfalls shall be built 24" above finished grade unless manhole is in a yard, then the manhole shall be watertight at grade. All manholes along outfalls, the manhole ring shall be cast into the manhole or bolted to the precast concrete manhole

The utility contractor shall be responsible for adjusting the manhole ring and cover to the street or shoulder grade. Manholes within the pavement area shall conform to grade and crown for a smooth riding surface. Castings shall be embedded in mortar (See Section B, Paragraph 4 – Final Preparations, subparagraph - Utility Adjustments for additional specifications) when the utility contractor is not responsible for making final adjustments to the manholes as provided in the Project Special Provisions, then the utility contractor shall adjust the manhole rings and covers to within plus or minus one-half inch of street grade and final adjustment made by paving contractor.

SANITARY SEWER - MAXIMUM GRADE AND VELOCITY

No sanitary sewer lines installed under the provisions of these regulations shall have a grade that exceeds twenty (20%) percent nor shall result in wastewater having a velocity greater than 15 feet per second. Supplemental specifications for such installations shall be prepared and included as a part of the plans submitted to the Division of Water Quality for approval.

DROP MANHOLES

Drop connections shall be constructed according to the "Standard Specification Drawings" for outside drop manholes. Drop connections shall be used when the difference in invert elevation between the influent and effluent pipes of the sewer lines is greater than thirty (30") inches. Drop connections may be used to allow for reduction of the grade to less than the maximum of ten (10%) percent. Drop connections inside manholes shall not be used except in hazardous situations (i.e. twenty (20') ft. cuts in an unstable fill, in traffic hazard areas, or when adjacent property is subject to damages), and shall be approved by the Engineer. Manholes where inside drops are required shall be a minimum of 5 feet in diameter.

In all junction manholes where the grade line of one sewer is considerably higher than that of the other, or where directed by the Engineer, the connection shall be made by means of a drop connection as shown in the construction drawings. Pipe and special fittings used shall conform to these specifications. Concrete for encasing shall be Class "B" concrete as specified in these specifications. Joints may be cement mortar. Care shall be taken to have all pipes laid to correct lines and grades as established by the Engineer.

TESTING

During construction and at the completion of the work, the contractor shall test all pipelines as directed by the Engineer to ascertain if the pipe is properly aligned and the joints installed in accordance with manufacturer's specifications. The Engineer will conduct the tests, but the contractor shall furnish all apparatus required and shall pay all costs connected therewith. Defective work shall be repaired immediately at the contractor's expense.

All sanitary sewer lines shall be thoroughly flushed with water to obtain a free flow through all lines. All obstructions shall be removed and defects corrected prior to testing. The contractor shall be responsible for accomplishing all required flushing and cleaning.

The pipe when laid and completed from manhole to manhole will not be accepted unless daylight or the light of a lamp is visible as a full moon through the pipe, looking from one manhole to the next. The leakage shall not exceed 100 gallons per inch diameter of pipe per mile in twenty-four (24) hours.

All sanitary sewer pipe lines and services shall be air tested in accordance with ASTM Standard C-828.

As a safety precaution, pressurizing equipment may include a regulator or relief valve to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

The following table shall be used to determine the length of time required to satisfactorily pass the test.

AIR TEST TABLE
Based on Equations from ASTM C 828
TIME IN MINUTES REQUIRED FOR PRESSURE DROP FROM 3.5 PSIG TO 2.5 PSIG WHEN TESTING ONE PIPE DIAMETER ONLY

		DIA. (in)	4	6	8	10	12	15	18	21	24	27	30	36	42
		T(min)	0.3	0.7	1.2	1.5	1.8	2.1	2.4	3	3.6	4.2	4.8	6	7.3
LENGTH OF LINE (FEET)	25	feet	00:05	00:11	00:18	00:23	00:27	00:32	00:36	00:45	00:54	01:03	01:12	01:30	01:49
	50	feet	00:09	00:21	00:36	00:45	00:54	01:03	01:12	01:30	01:48	02:06	02:24	03:00	03:39
	75	feet	00:14	00:32	00:54	01:07	01:21	01:34	01:48	02:15	02:42	03:09	03:36	04:30	05:28
	100	feet	00:18	00:42	01:12	01:30	01:48	02:06	02:24	03:00	03:36	04:12	04:48	06:00	07:18
	125	feet	00:23	00:53	01:30	01:52	02:15	02:38	03:00	03:45	04:30	05:15	06:00	07:30	09:07
	150	feet	00:27	01:03	01:48	02:15	02:42	03:09	03:36	04:30	05:24	06:18	07:12	09:00	10:57
	175	feet	00:32	01:14	02:06	02:38	03:09	03:41	04:12	05:15	06:18	07:21	08:24	10:30	12:46
	200	feet	00:36	01:24	02:24	03:00	03:36	04:12	04:48	06:00	07:12	08:24	09:36	12:00	14:36
	225	feet	00:41	01:34	02:42	03:23	04:03	04:44	05:24	06:45	08:06	09:27	10:48	13:30	16:25
	250	feet	00:45	01:45	03:00	03:45	04:30	05:15	06:00	07:30	09:00	10:30	12:00	15:00	18:15
	275	feet	00:49	01:56	03:18	04:07	04:57	05:47	06:36	08:15	09:54	11:33	13:12	16:30	20:04
	300	feet	00:54	02:06	03:36	04:30	05:24	06:18	07:12	09:00	10:48	12:36	14:24	18:00	21:54
	350	feet	01:03	02:27	04:12	05:15	06:18	07:21	08:24	10:30	12:36	14:42	16:48	21:00	25:33
	400	feet	01:12	02:48	04:48	06:00	07:12	08:24	09:36	12:00	14:24	16:48	19:12	24:00	29:12
	450	feet	01:21	03:09	05:24	06:45	08:06	09:27	10:48	13:30	16:12	18:54	21:36	27:00	32:51
500	feet	01:30	03:30	06:00	07:30	09:00	10:30	12:00	15:00	18:00	21:00	24:00	30:00	36:30	

VACUUM TESTING OF MANHOLES

All sanitary sewer manholes constructed by the Contractor shall be vacuum tested for leakage in the presence of a City Inspector. The vacuum test will not apply to any existing manholes that have been converted to drop manholes by the Contractor.

The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

Each manhole shall be tested after assembly and unless directed otherwise by the Engineer prior to backfilling

All lifting holes shall be plugged with an approved non-shrink grout.

All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole.

The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time for the vacuum to drop to 9 inches of mercury shall not be less than that shown in the table below:

Manhole Depth	Diameter of Manhole		
	48" Dia.	60" Dia.	72" Dia.
10 Ft. or Less	60 Sec.	75 Sec.	90 Sec.
>10 Ft. But <15 Ft.	75 Sec.	90 Sec.	105 Sec.
>15 Ft. But <25 Ft.	90 Sec.	105 Sec.	120 Sec.

(Times shown are minimum elapsed times for a drop in vacuum of 1 inch of mercury.)

If the manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed and continue until a satisfactory test is accomplished.

VIDEOTAPING OF SANITARY SEWER

All sanitary sewer lines shall be videotaped prior to acceptance and placement into service. The contractor or developer shall be responsible for taping and all costs associated with taping for all projects. A VHS format tape shall be furnished by the contractor at the initial inspection and upon the completion of any repairs. The video shall be clear and well lit, with the top of pipe in the top of the screen. A written inspection log for all video inspections shall accompany each tape. Logs shall accurately measure distances measured from center point of each manhole and shall clearly show location in relation to the manhole all points of significance in the sewer line. As a minimum, each log shall include the location and left/right orientation of all service laterals, location and depth of sags, offset pipes, or any other points of significance. Additionally, each record shall accurately describe the above ground location of the manhole section including street name, direction traveled (north, south, etc.) direction of flow, adjoining house numbers, and any other landmarks that will clearly and quickly identify the section. All defects and deficiencies discovered in this inspection shall be corrected by the contractor to the satisfaction of the City Engineer and at the contractor's expense. Once the defects and deficiencies are corrected the sanitary sewer shall be videotaped again to show that the defect and deficiencies have been resolved.

3. WATER

INSTALLATION OF WATER PIPE

Pipe laying in general will conform to ANSI/AWWA 600.

Handling of pipe and accessories shall at all times be done in such a manner as to prevent damage to lining or body. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench by approved methods. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. All pipe shall be given a careful inspection prior to placing in trench to be certain there are no cracks in the material and that the lining and exterior coating are not damaged.

Pipe shall be swabbed clean before it is laid and any pipe which cannot be cleaned with a swab shall be removed and cleaned with a suitable apparatus. Any pipe showing evidence of oil, tar, or grease

shall be permanently marked and removed from the job; this pipe shall not again be brought on the job until it has been cleaned to the satisfaction of the Engineer.

Laying of pipe and jointing of pipe shall be done according to manufacturer's recommendations with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint or a "push on" type joint is employed.

Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe. Under no circumstances shall pipe be allowed to be laid in water.

Pipe cutting for inserting valves, fitting, or closure places shall be done in a neat and workmanlike manner without damage to the pipe. Cutting pipe by the use of cleavers or similar tools liable to cause damage to the pipe lining will not be permitted.

It is essential that each gasket is in proper position when the pipe is "shoved home". A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered after pipe has been laid, shall be repaired by and at the expense of the contractor by a method acceptable to and approved by the Engineer.

Bell ends will face direction of laying unless otherwise directed by the Engineer for lines on the appreciable slope, the Engineer may require that bell ends face upgrade.

Pipe gaskets and accessories shall be stored in a clean dry location not subject to vandalism. Gaskets shall be cleaned and installed immediately prior to installation of the pipe into the trench. The bell end of the pipe should be prepared per the manufacturer's specifications prior to gasket installation.

Maximum deflections of pipe shall be as follows for an 18 ft. joint of pipe:

MAXIMUM DEFLECTION IN INCHES			
Pipe Size	(B & S)	(MJ)	Push-on Joint
6"	17"	27"	19"
8"	15"	20"	19"
10"	14"	20"	19"
12"	12"	20"	19"
14"	10"	13"	11"
16"	9"	13"	11"
18"	8"	11"	11"
20"	7"	11"	11"
24"	6"	9"	11"
30"	5"	9"	--
36"	4"	8"	--
42"	4"	7"	--
48"	3"	7"	--

Railroad crossings shall be made following all precautionary construction measures required by the railroad official, and no extra compensation will be allowed by the Engineer unless otherwise provided in the Special Provisions.

Where conditions are, in the opinion of the Engineer unsuitable for laying pipe because of weather or trench conditions, the Contractor shall be required to cease work until permission is given by the Engineer for work to commence again.

REACTION BLOCKING

All fittings, or components subject to hydrostatic thrust shall be securely anchored by use of concrete thrust blocks poured in place, unless otherwise directed by the Engineer. The reaction blocks shall be installed by the contractor in accordance with the plans and/or detail sheet. Where concrete must be reinforced, the contractor shall furnish such reinforcing as required.

Material for reaction blocking shall be transit-mixed concrete. This concrete shall have a twenty-eight (28) day compressive strength of 2500 psi. Any metal used to resist thrust that is not encased in concrete shall be galvanized or otherwise rust proof treated or shall be painted as directed by the Engineer.

SETTING BLOW-OFFS

Blow-offs and drainage branches shall not be connected to any sewer or submerged in any stream or be installed in any manner that will permit siphonage into the distribution system. They shall be located as shown on the plans or as directed by the Engineer.

SETTING FITTINGS

Fittings shall be set at locations shown on the plans with care being taken to properly "bell-up" joints and support body of fitting. All dead-end lines shall be plugged with a plug in bell ends or a cap on spigot ends.

SETTING HYDRANTS

Specific directions are required for the setting of all hydrants. In streets where paving is proposed in the near future, the contractor will be given line and grade stakes for hydrants. It is mandatory for the contractor to preserve these stakes for the inspector to verify that the hydrant was set correctly. Once the contractor has set a hydrant correctly and had this fact verified by the inspector, he will not be required to alter line or grade on his hydrant without extra compensation; however, the one year of warranty on materials and workmanship applies. In areas where paving is not anticipated in the near future, hydrants shall be set according to the inspector's direction, in general hydrants shall be located in a manner to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians. Until the water main is accepted by the City, all Fire Hydrants shall be bagged. All Fire Hydrants that have yet to be approved for use shall be covered and identified as being "NOT IN SERVICE". Bags shall be made of 27"x42"x4 mil polypropylene material, and in bold print, clearly shown in very large, easy to read print the words "NOT IN SERVICE". Bags shall be firmly secured to Fire Hydrant with a strap.

Hydrants set in impervious soil shall have a drainage pit two feet in diameter and two feet deep excavated below the bowl. This pit shall be filled with coarse stone to a point six (6") inches above

the waste opening. No hydrant drainage pit shall be connected to a sewer. Wherever hydrants are placed in pervious soil, coarse stone shall be placed around the bowl to a point twelve (12") inches above the waste opening and at least one (1') foot laterally in all directions.

Each hydrant shall be set plumb and shall have a concrete reaction block poured in place. The bearing area required for this block shall be taken from the schedule included herein. Where the use of a reaction block is not practicable, appropriate coated straps shall be used at no additional cost to the City. Hydrants will be acceptable only if the reaction blocking or strapping is placed along the projection of the reaction thrust line. Blocking placed above the thrust line will not be acceptable. Cleaning shall take place before a hydrant is set, and all dirt and foreign matter shall be removed from the hydrant.

SETTING VALVES, VALVE BOXES AND MANHOLES

Butterfly and Gate Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the gate valve. Where pavement is existing, valve box covers shall be set flush with pavement. In streets where no paving exists, valve box covers shall be set flush with the existing grade. All geared valves, and such other valves as may be designated, shall be set in a manhole with operating nuts readily accessible for operation through the manhole opening. Butterfly and horizontal gate valves shall be installed with the operating nut away from the center line of the street. By-pass valves shall be closet to the centerline of the street. The contractor shall at no extra cost to the City follow guidelines set up by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor for confined space entry. Manholes shall be constructed in a manner that will allow valve repairs and afford protection to the pipe from impact where it passes through the manhole walls. Protection from impact shall be provided with a layer of 1/2-inch expansion material between the pipe or valve and the brick wall. The brick wall over the pipe shall be so constructed as to provide arch action.

All tapping sleeves and valves shall be air or water tested as directed by the Engineer before the tap is made.

TESTING OF WATER LINES (PRESSURE)

In general, the pressure test and the leakage test will be performed in the manner set forth in Section 13 of AWWA Standard C-600, except that the contractor will furnish his own pressure gauges. The pressure test and the leakage test will be performed by the Contractor at no cost to the City except that the City will provide the necessary water.

After each section of line is completed between cut-off valves, the Contractor shall subject that section to hydrostatic tests. Each section to be tested shall be slowly filled with water, care being taken to expel all air. The pipe shall be tapped at all high points with corporation stops, as determined by the Engineer or his representative, at the expense of the contractor, to vent the air. A pressure of 150 pounds per square inch shall be applied to the line through a corporation stop located at the lowest elevation of the section being tested and test pressure shall be maintained for a minimum period of two consecutive hours. During the test, all pipe, fittings, valves, hydrants, and joints shall be examined for defects. Leaking joints shall be made tight. No pipe installation will be

accepted unless and until the leakage (evaluated on the pressure test of 150 psi for two (2) hours) is approved by the Engineer.

TESTING OF WATER LINES (DISINFECTION)

All water mains shall be disinfected by the contractor in accordance with AWWA C651. The contractor shall furnish qualified men to do the work and they shall be experienced with chlorine and disinfecting agents. The contractor shall see that the pipe is thoroughly clean when installed and should give the new mains a high velocity flushing (minimum of 2.5 feet/second) through fire hydrants or other approved blow-offs. The flushing shall continue until the Engineer determines that the lines are free from all foreign matter and are ready to be disinfected.

Before being placed in service, the entire line shall be chlorinated. Chlorine may be applied by the following methods: Liquid chlorine gas-water mixture or calcium hypochlorite (70% available chlorine) and water mixture. The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant, or other connection insuring treatment of the entire line. Water shall be fed slowly into the new line with chlorine applied in such amounts as to produce a dosage of 50 parts per million. Lines previously filled shall be treated to a concentrated dosage at intervals along the line.

A twenty-four (24) hour residual of ten (10) parts per million shall be produced in all parts of the line. During the chlorination process all valves, hydrants and accessories shall be operated. After chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal bacteriologically to those of the permanent source of supply and shall conform otherwise in all respects to the requirements of the State Board of Health, as determined by samples collected by the City Water Plant Chemist.

Calcium Hypochlorite needed to produce 50 ppm available chlorine per 1000 feet of pipe		
Diameter (inches)	Pipe Volume per 1000 feet of pipe (gallons)	Pounds Required
2	163	0.1
3	367	0.2
4	653	0.4
6	1,469	0.9
8	2,611	1.6
10	4,080	2.4
12	5,875	3.5
16	10,444	6.2
20	16,335	9.7
24	23,499	14.0
30	36,717	21.9

If test results are unsatisfactory, the contractor shall immediately rechlorinate the lines and proceed with such measures as are necessary to secure sterile lines. Corporation cocks used only for testing shall be removed and replaced with a brass plug.

Following chlorination all treated water shall be thoroughly flushed from the newly laid pipeline. Discharge of chlorinated water shall conform to all local, state and federal regulations. Dechlorination shall be performed at the Contractor's expense.

Contractor shall clear the flow path of all loose debris surface contaminants and/or hazardous materials that could be carried into the storm drains or surface waters during flushing operations. Prevent erosion of the flow path in unpaved or vegetated areas. Dechlorinate the flow path at the point of discharge using a dechlorinating agent. Monitor and record results downstream to ensure compliance with local, state and federal discharge regulations. Upon completion of flushing operation, ensure the flow path is free of all temporary erosion prevention materials and that any sediment or silted areas are cleared, seeded and mulched.

VALVE OPERATIONS

No valve in the existing system shall be operated without following the procedure outlined below. Failure to comply with these requirements shall be grounds for suspension of pipe laying operations until written assurances can be obtained from a company official that such noncompliance will not again occur. The Contractor should be aware that the City regards violations of these requirements as justifying extreme and costly punitive measures.

Notification procedures are as follows:

- (a) The contractor shall notify the Engineering Department prior to operating any valve. In areas where a comparatively large number of consumers are affected, at least four (4) hours notice should be given to the Water and Sewer Pipe Maintenance Division and at least four (4) hours notice must be given to each consumer.
- (b) If there is no reason why a valve or series of valves cannot be operated, the Engineering Division will give permission for the valve or valves to be operated.
- (c) At such time as the valves are actually operated, the Contractor shall call the Water and Sewer Pipe Maintenance Division and give the following information:
 - 1) Name of person calling
 - 2) Name of Company
 - 3) Name of person responsible for operating valve
 - 4) Location of Valve
 - 5) Reason for operating and number of turns valve opened and closed
 - 6) Time valve opened and closed
- (d) At such time as the valves are returned to their initial state, the contractor shall again call and give the same information as in paragraph (c) above relative to the second operation of the valves. In the event that this sequence of operations involves a period of time greater

than twenty-four (24) hours, the Contractor shall revert to paragraph (c) above and again secure permission, following the steps outlined.

- (e) A card file is kept on these valve operations, and the valves are systematically checked.
- (f) System valves shall be defined as any valve that has main pressure against either gate face. Newly installed tapping valves and control valves to networks not yet accepted for service are considered as system valves. Valves within a network still under construction are not considered as system valves.

In the case of an emergency, the contractor shall be allowed to take such steps with valves and hydrants as are necessary for the protection of life and property. Notification may be made after valve operations are completed. An emergency shall be defined as a break in a six (6") inch or larger water main, or where ruptured smaller lines are causing property damage.

4. FINAL PREPARATIONS

UTILITY ADJUSTMENTS

Upon completion of the installation of the utility line, the contractor shall adjust all manholes and valve boxes to the street or shoulder grade or to the elevation shown on the plan. All adjustments within the pavement shall be adjusted by placing a concrete collar (Class A, 3000 psi concrete), 6" thick, extending a minimum of 12" from the outside circumference of the structure. The elevation of the top of the concrete collar shall be at the same elevation as the bottom of the surface course of pavement to be placed. Where water valves are located outside the pavement, then the elevation of the top of the concrete collar shall be at the same grade as the shoulder. All collars on the shoulder shall be poured in place and trowelled to a smooth finish.

RESTORATION OF STREETS, CURB AND GUTTER, DRIVEWAYS, SIDEWALKS, ETC.

The contractor shall maintain all trenches without hazard to vehicular or pedestrian traffic until the street, curb and gutter, driveway, sidewalk, etc. can be replaced or until a final inspection is conducted by the Engineer.

A. Pavement Replacement

Wherever bituminous type pavement has been ordered by the Engineer or the Owner to be cut and replaced, it shall be replaced with 3" Type H Binder and 1" thick Type I-2 bituminous concrete surface course in conformance with North Carolina Department of Transportation "Standard Specifications for Roads and Structures", most recent edition. Any tack coat used shall conform to the same standards. Pavement cuts in heavily traveled areas shall be patched the same day as cut; all others shall be patched within a twenty-four hour period from completion of the work, unless directed by the Engineer.

Wherever concrete type pavement has been ordered by the Engineer or Owner to be cut and replaced, it shall be replaced with Class A concrete poured eight (8") inches thick (See Standard Detail).

Wherever concrete driveway has been ordered by the Engineer or the Owner to be cut and replaced, it shall be replaced with Class A concrete poured to match existing or to a minimum depth of six (6") inches.

B. Concrete Curb and Gutter, Driveways and Sidewalk Replacement

All curb and gutter, driveways and sidewalks which have been damaged or removed during construction shall be repaired with Class "A" concrete and in accordance with City of Burlington Standard Detail Drawings and Specifications or NCDOT Standards. The contractor shall use a masonry saw to make a neat cut a minimum of 2" deep where tying into the existing concrete. The Engineer shall determine where the saw cuts will be made.

SEEDBED PREPARATION

The contractor shall cut grass, weeds and other unacceptable growth and dispose of satisfactorily. Areas to be seeded shall be brought to the proper line, grade and cross-section as shown on the plans or as previously constructed or as required by the Engineer. Minor shaping and smoothing of uneven and rough areas outside the area disturbed during installation of the utility shall be worked as directed by the Engineer in order to provide for more effective drainage, control of erosion and for ease of subsequent mowing operations.

The soil shall be scarified or otherwise loosened to a depth of not less than five (5") inches. Seedbed preparation within two (2') feet of the edge of pavement shall be limited to a depth of 2" to 3". Clods shall be broken and the top 2" to 3" of soil shall be worked into an acceptable seedbed by discing or the use of soil pulverizers, drags, harrows or other methods approved by the Engineer. Where Type I seeding (lawns) is specified on the plans or required by the Engineer, then all rocks, gravel, stone and other debris shall be removed from the seedbed. In addition, the seedbed shall be handraked as directed by the Engineer. Where Type II seeding (general) is specified on the plans or required by the Engineer, then all rocks and debris over 2" in diameter shall be removed from the seedbed.

However, stockpiles of stone and gravel shall not be permitted to spread out in the seedbed. The preparation of the seedbed shall not be done when the soil is frozen, extremely wet or otherwise in an unfavorable working condition.

The seedbed preparation shall be inspected and approved by the Engineer prior to the contractor applying any seed, fertilizer, lime or mulch to the seedbed. It shall be the contractor's responsibility to schedule a meeting with the Engineer at least 24 hours in advance of the requested inspection. Failure to have the seedbed approved by the Engineer prior to seeding and mulching shall result in the contractor not being compensated for the unproved work.

SEEDING AND MULCHING

A. **Applying Limestone and Fertilizer:** After the seedbed has been approved by the Engineer, the contractor shall apply at a uniform rate dolomitic limestone (4,000 lbs. per acre) and fertilizer (1,000 lbs. per acre of 10-10-10) within 24 hours after the seedbed has been prepared. The method of applying the limestone and fertilizer to the soil shall be approved by the Engineer.

- B. **Type I Seeding (Lawns):** Immediately after the limestone and fertilizer have been applied to the soil, the contractor shall uniformly apply the seed in accordance with the following schedule:

DATE	SEED TYPE	APPLICATION RATE
Aug.15 - Oct. 31	Kentucky 31 Tall Fescue	225 Lbs/Ac.
Nov. 1 - Jan. 31	Kentucky 31 Tall Fescue	225 Lbs/Ac.
	Rye Grain	40 Lbs/Ac.
Feb. 1 - Aug. 14	Kentucky 31 Tall Fescue	225 Lbs/Ac.

- C. **Type II Seeding (General):** Immediately after the limestone and fertilizer have been applied to the soil, the contractor shall uniformly apply the seed in accordance with the following schedule:

DATE	SEED TYPE	APPLICATION RATE
Aug. 15 - Oct. 31	Kentucky 31 Tall Fescue	120 Lbs/Ac.
Nov. 1 - Jan. 31	Kentucky 31 Tall Fescue	120 Lbs/Ac.
	Rye Grain	40 Lbs/Ac.
Feb.1- April 30	Kentucky 31 Tall Fescue	120 Lbs/Ac.
May 1- June 30	Tall Fescue	120 Lbs/Ac.
	German Millet	40 Lbs/Ac.
July 1 - Aug. 14	Tall Fescue	120 Lbs/Ac.
	Sudangrass	20 Lbs/Ac.

- D. **Mulching:** Immediately after the limestone, fertilizer and seed has been applied to the soil, the seedbed shall be harrowed, dragged, raked or otherwise worked so as to cover the seed with a layer of soil.

Mulch shall consist of grain straw or other equally satisfactory material approved by the Engineer. Mulch shall be spread uniformly over the area by hand or mechanical spreader. The mulch will be applied at a rate that will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion and conserve moisture (approximately 65 bales per acre).

Mulch shall be held in place by crimping the grain straw or by spraying emulsified asphalt to the mulch at a rate of 3.5 gallons per 1,000 square feet. Adequate precautions shall be taken to prevent spraying asphalt emulsion on cars, fire hydrants, driveways, sidewalks, or other structures. The contractor shall clean any cars, fire hydrants, driveways, sidewalks or other structures that have been sprayed. Spraying of asphalt emulsion in Type I seeding will not be allowed except as permitted by the Engineer.

The date of certification of all seed must be within eight months of the date of the sowing.

REPAIR SEEDING

Repair seeding shall consist of repairing areas which have been previously seeded and mulched in accordance with the above specifications but which have failed to successfully establish an adequate stand of grass. Where the area has failed because the contractor did not fully comply with the specifications or due to negligence on the part of the contractor, the area shall be repaired by the contractor at his expense.

Repair seeding shall include minor seedbed preparation as directed by the Engineer; furnishing, placing and covering of limestone, fertilizer and seed, and the furnishing and placing of mulch as required.

MATTING FOR EROSION CONTROL

Matting for erosion control shall consist of furnishing, placing and securing either, excelsior matting, jute matting, netting or other approved matting on previously shaped and seeded drainage channels, slopes or other areas at locations shown on the plans or as directed by the Engineer.

Placing of matting shall be done immediately following seeding. The earth surface shall be smooth and free from stones, clods, leaves, or debris that will prevent the contact of the matting with the soil. Care shall be taken to preserve the required line, grade and cross section of the area covered.

Matting shall be unrolled in the direction of flow of water and shall be applied without stretching so that it will lie smoothly but loosely on the soil surface. The up-channel or top of slope end of each piece of matting shall be buried in a narrow trench at least 6 inches deep covered with soil and tamped firmly. Where one roll of matting ends and a second roll begins, the upper end of the second net shall be anchored in a trench 6" deep and the lower end of the first roll shall overlap the second roll at least 18". Where two or more widths of matting are laid side by side, the overlap shall be at least 4".

The matting shall be stapled in accordance with the manufacturer's specifications but at least every 12 inches across the top of the matting and just below each anchor. The outer edges and down the center of each strip of matting shall be stapled every 3 feet apart. Lapped edges shall be stapled every 2 feet apart.

CLEANUP

All surplus or spoil material and all tools and temporary structures shall be removed from the site by the contractor. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump provided by the contractor and the construction site left clean to the satisfaction of the Engineer. In every instance, the contractor shall be responsible for leaving the site in as good or better shape than prior to the initiation of the construction. It shall be up to the Engineer to determine when the cleanup operation is finished and acceptable to the City.

Any excavation from trenches which has been placed on roadway surfaces and driveways will be completely removed from such surfaces as soon as practical, but in no case will excavation material be left on pavement at the end of a work day. Necessary equipment for removal of such material will be available at all times to preclude the development of traffic hazards from dust and/or slick areas caused by rainfall on clay material. The contractor shall maintain personnel on the site until

all cleanup activities are satisfactorily completed. All final cleanup activities including grassing will be completed within 15 days after completion of the main line in that area (i.e., no area will remain without grassing longer than fifteen (15) days).

All salvageable materials from the City's water or sewer system belong to the City of Burlington and must be turned over to the Water and Sewer Pipe Maintenance Division.

FINAL INSPECTION

The contractor is instructed to request a final inspection, only after the contractor or his appointed agent has checked the work and a punchlist has been generated. The contractor shall repair all defects on the contractor-generated punchlist prior to requesting a final inspection by the Engineer. The contractor at his expense shall repair all defects observed by the Engineer during the final inspection. After the contractor satisfactorily corrects all defects and the project is deemed acceptable by the Engineer, written notice will be given to the contractor stating that the City has accepted the new facilities for maintenance. Said notice will also include the date of expiration of the one (1) year warranty.

GUARANTEE

The contractor shall guarantee that if any materials, equipment or workmanship covered by these specifications and the accompanying drawings proves defective within one (1) year after final acceptance, such defects shall be made good by him without cost to the City.

SECTION C - SUPPLEMENTAL STANDARDS - WATER SYSTEM IMPROVEMENTS

SIZE OF THE WATER MAINS

Water distribution mains shall be sized to provide a minimum pressure at all points within the distribution system of not less than 20 pounds per square inch (gauge) during periods of peak demand (fire flow), but in any case water mains shall not be less than two-inch standard nominal diameter. Fire hydrants shall not be installed on water mains of less than six inches diameter or on water mains or water systems not designed to carry fire protection flows. Systems not designed for fire flows shall have the capacity to maintain pressure of at least 30 pounds per square inch (gauge) throughout the system during periods of peak flow. Multi-phase projects shall be designed and constructed in a planned manner to reduce the number of in line valves needed due solely to phasing.

NUMBER OF RESIDENCES ON A WATER MAIN

- (A) No more than twenty (20), or the equivalent of twenty (20) residences shall be connected to a two-inch (2") diameter water line, unless the main is looped or otherwise supplied from two connections with mains of adequate capacities.
- (B) A looped two-inch (2") main shall serve no more than forty (40) residences, or the equivalent water demand of forty (40) residences. A two-inch diameter main shall not exceed 1000 feet in length.

DEAD-END WATER MAINS

Where installation of dead-end water mains cannot be avoided, a hydrant or a valve of adequate size for flushing shall be installed at the terminal end of the line. The flush valves shall have an above-ground discharge and shall be protected from contamination.

RELATION OF WATER MAINS TO SEWERS

- (A) Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least ten (10') feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a ten (10') foot lateral separation, in which case:
 - (1) The water main is laid in a separate trench, with the elevation of the bottom of the water main at least eighteen (18") inches above the top of the sewer; or
 - (2) The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least eighteen (18") inches above the top of the sewer.
- (B) Crossing a Water Main Over a Sewer. Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen (18") inches above the top of the sewer, unless local conditions or barriers prevent an eighteen (18") inch vertical separation, in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing.

- (C) Crossing a Water Main Under a Sewer. Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

VALVES

- (A) Valves should be installed on all branches from feeder mains and between mains and hydrants according to the following schedule:

- (1) three valves at X's (crosses),
- (2) two valves at T's (tees) and
- (3) one valve on single hydrant branch.

Multi-phase subdivision projects shall be designed and constructed in a planned manner to reduce the number of in line valves required due solely to phasing.

- (B) All valves installed in water distribution systems should meet appropriate AWWA Standards C 500-71 (adopted in 1971) C 504-74 (adopted in 1974) and C 507-73 (adopted in 1973) of the American Water Works Association, Inc., or approved equal standards

BACKFLOW PREVENTION DEVICES

- (A) Residential Customers With Irrigation Systems. When installing an irrigation system, residential customers are required to install and maintain a backflow prevention assembly on their water line to ensure the safety of the surrounding community. All irrigation systems shall have an above grade reduced pressure principle backflow preventer with enclosure. The backflow prevention assembly must be tested by a Utilities-approved and certified tester upon installation and annually thereafter.

For a recent list of certified testers or other information about backflow, contact Water & Sewer Maintenance by calling 336/222-5140.

- (B) Industrial and Commercial Construction Projects. All industrial and commercial customers shall install and maintain backflow prevention devices at every water service connection. This includes domestic, irrigation, fire line services, and swimming pool meters.
 - (1) Before beginning any construction project, industrial and commercial customers must submit construction plans to City of Burlington. The City of Burlington will evaluate your plans and inform you of the backflow requirements.
 - (2) Depending on the type of backflow installation required, the installer must comply with certain construction specifications. These address materials, clearances, enclosures, drainage and inspections.
 - (3) When the backflow prevention device is installed, contact the City of Burlington to request an inspection. A City of Burlington approved and certified tester must test the device upon installation and annually thereafter.

SECTION D - SUPPLEMENTAL STANDARDS -SEWER SYSTEM IMPROVEMENTS

RELATION OF SEWER MAINS TO WATER MAINS

- A. Lateral Separation of Sewer and Water Mains. Sewer lines shall be laid at least ten (10') feet laterally from existing or proposed water mains, unless local conditions or barriers prevent a ten (10') foot lateral separation in which case:
- (1) The sewer is laid in a separate trench, with the elevation of the top of the sewer at least eighteen (18") inches below the bottom of the water main; or
 - (2) The sewer is laid in the same trench as the water main with the water main located at one side of a bench of undisturbed earth, and with the elevation of the bottom of the water main at least eighteen (18") inches above the top of the sewer.
- B. Crossing of a Sewer under a Water Main. Whenever it is necessary for a sewer to cross under a water main, the sewer shall be laid at such an elevation that the top of the sewer is at least eighteen (18") inches below the bottom of the water main, unless local conditions or barriers prevent an eighteen (18") inch vertical separation in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing.
- C. Crossing of Sewer over a Water Main. Whenever, it is necessary for a sewer to cross over a water main, both the sewer and water main shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of ten (10') feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

RIGHT-OF-WAY

Public sewer lines designated as sanitary sewer outfalls to be constructed upon private property shall have a minimum easement of thirty (30') feet in width.

BUFFER ZONE FOR WELLS

Sanitary sewer lines shall be located a minimum distance of 100 feet from the center of any well used as a community or private water supply. This buffer may be reduced to 50 feet provided that the sanitary sewer lines are constructed of materials and joints that are equivalent to water main standards.

MAXIMUM LENGTH BETWEEN MANHOLES

The maximum length of sewer line which shall be constructed between manholes shall be four hundred (400') feet.

RELATIONSHIP BETWEEN SEWER SYSTEM AND FLOOD PLAINS

Sewer manholes located within the 100-year flood plain shall be constructed in accordance with drawing detail SS-7 of the "Standard Specification Drawings" for water tight manholes, or sewer manholes located within the 100-year flood plain shall have a minimum height of two (2') feet above the 100-year flood elevation. The 100-year flood elevation shall be determined from

elevations provided by the U.S. Army Corp. of Engineers in the "Flood Insurance Study" for the City of Burlington and published by the Federal Emergency Management Agency on December 22, 1998.

RELATIONSHIP BETWEEN SEWER SYSTEM AND CREEK CROSSINGS

The elevation of all sewer lines at creek crossings shall be set such that the top of the pipe is at or below the elevation of the stream bed or for crossings above water level, the bottom of the pipe should be located above the 25-year flood elevation.

MINIMUM COVER

Whenever it is determined that the depth of cover above the sewer main is three feet or less, the sewer main shall be constructed of ductile iron materials.

MINIMUM DIAMETER - PUBLIC SEWER LINES

All public sewer mains shall be eight (8") inches or more in diameter.

MINIMUM SEPARATION FROM STORM SEWER

All sewer mains shall be constructed such that the minimum clearance between the installed sewer line and an adjacent storm sewer is twelve (12") inches.

WASTEWATER FLOW-DESIGN CONSIDERATIONS

All sewer mains shall be designed such that the design loading on the sewer line will result in the sewer flowing half full. Minimum design velocity for gravity sewers shall be two (2') feet per second.

FORCE MAINS

All force mains shall be tested and approved to water main standards. Hydrostatic thrust shall be considered in the design of all reaction blocking and fittings.

SECTION E - METHOD OF MEASUREMENT AND BASIS FOR PAYMENT

GENERAL

The bid items shown on the proposal form have been created solely for the purpose of comparison of bids and for the use in the preparation of monthly construction estimates. Quantities shown thereon must be considered as approximate only. All work shown on the plans, herein specified, required, or implied in any way in the drawings or specifications shall be done regardless of whether or not the work specifically defined in any bid item.

All measurements for payment will be based on completed work performed in strict accordance with the drawings and specifications. All work completed under the contract shall be measured by the Engineer or his representative.

Payment for the accepted quantities completed under this contract will be made at the lump sum or unit price bid, which prices shall include furnishing all labor, tools, equipment and materials required to construct the improvements in the manner specified including clearing and grubbing, all types of excavation, trenching, shoring, pumping, pipe installation, testing, backfilling, repairs, surface restoration and all other items necessary to complete the work as specified.

TRAFFIC CONTROL

Payment for traffic control will be paid for at the contract lump sum price for "Traffic Control" and will be full compensation for all work described in the technical specifications.

CLEARING AND GRUBBING

Payment for clearing and grubbing will be paid for at the contract lump sum price for "Clearing and Grubbing" and will be full compensation for all work described within the technical specifications.

DUCTILE IRON WATER MAINS

Water mains shall be measured from beginning of a run through valves and fittings to the end. Where tapping sleeves and valves are used, measurements will begin from center of tapping valve and run through to the end of the line.

Payment for ductile iron water mains will be paid for at the contract unit price per linear foot for each linear foot of pipe installed and incorporated into the work for each of the various sizes listed in the proposal.

VALVES

Payment for the installation of tapping sleeves and valves, gate valves, butterfly valves, air release valves will be paid for at the contract unit price for each valve incorporated and accepted into the work and shall be full compensation for all work required to install the valve. No additional payment will be made to adjust valves to grade and to place the concrete collar around all valve boxes.

FIRE HYDRANTS

Payment for installation of fire hydrants and extensions will be paid for at the contract unit price for each size fire hydrant incorporated and accepted into the work. Extensions will be paid for at the contract unit price per vertical foot for each vertical foot of extension incorporated and accepted into the work. No additional payment will be made for Hydrant bags.

FITTINGS & REACTION BLOCKING

Payment for installation of ductile iron or gray iron fittings and reaction blocking will be paid for at the contract unit price for each fitting incorporated and accepted into the work.

MECHANICAL JOINT RESTRAINT

Payment for installation of mechanical joint restraint glands will be paid for at the contract unit price for each size of mechanical joint restraint gland incorporated and accepted into the work.

STEEL ENCASEMENT

Payment for installation of steel encasement pipe will be paid for at the contract unit price per linear foot for each linear foot of steel encasement pipe incorporated and accepted into the work. Installation of casing spacers shall be considered incidental to the encasement pipe and no additional payment will be made for casing spacers.

CARRIER PIPE

Payment for the installation of carrier pipe will be paid for at the contract unit price per linear foot and based on the actual number of linear feet (measured to the nearest foot) for each size of "carrier pipe" incorporated and accepted into the work.

SEWER MAINS

Sewer mains will be measured by the linear foot from centerline of manhole to centerline of manhole to the nearest 0.1 ft. minus the inside diameter of the manhole.

Payment for the installation of sanitary sewer mains will be paid for at the contract unit price for each size, material type and depth of invert below centerline grade incorporated and accepted into the work.

MANHOLES

Measurement for manholes will be taken as the actual number of vertical feet from the invert of the center of the manhole to the top of frame and cover measured to the nearest 0.1 ft.

Payment for installation of manholes will be paid for at the contract unit price for each manhole installed. Where the depth of a manhole exceeds 6 feet, the contractor will be paid for extra depth manholes at the contract unit price for "Extra Depth Manhole" for the depth which exceeds 6.0 feet.

Payment for connection to existing manholes will be at the contract unit price for each connection incorporated and accepted into the work.

DROP MANHOLES

Measurement for drop manholes will be taken as the actual number of vertical feet from the invert at the center of the manhole to the invert of the influent pipe measured to the nearest 0.1 ft.

Payment for the installation of drop manholes will be paid for at the contract unit price for each drop manhole incorporated and accepted into the work.

ROCK EXCAVATION

Where rock excavation is encountered (as defined in the specifications) payment will be made for the yardage of rock excavated within the following limits:

Width: 12-inches on each side of the outside diameter of the pipe and 12-inches beyond the outside face of manhole walls. When a trench box or sloped trench sides are used to facilitate excavation under the provisions of all appropriate OSHA safety regulations, the width of the trench used for payment calculations shall be the greater of the width determined above or a width of 48 inches.

Depth: 6-inches below the grade line of the pipe to the average top of rock between points of measurement. Rock excavation for manholes shall be measured from the bottom of the manhole base to the average top of rock within the excavated area.

No payment for rock excavation will be made for rock excavated outside of these limits. The unit price for rock excavation includes the cost of rock excavation and disposal, as well as furnishing and placing suitable backfill material within the above described limits.

STONE

Payment for installation of incidental stone, stabilization stone and stone screenings will be paid for at the contract unit price per ton for the various types of stone used. Payment will be based on the actual number of tons delivered to the job site from the quarry incorporated and accepted into the work. Quarry tickets shall be given to the inspector at the time of delivery. Stone tickets not given to the inspector will not be paid for. Any excess stone not incorporated into the work or where the contractor is in the opinion of the Engineer wasting stone, then the amount of stone not incorporated into the work will be deducted from the tickets.

RIP RAP

Payment for installation of rip rap will be paid for at the contract unit price per ton for "Rip Rap" incorporated and accepted into the work. Payment will be based on the actual number of tons based on quarry tickets. Quarry tickets shall be given to the inspector at the time of delivery. Rip rap tickets not given to the inspector will not be paid for. Any excess rip rap not incorporated into the work or where the contractor is in the opinion of the Engineer wasting rip rap, then the amount of rip rap will be deducted from the tickets.

REINFORCED CONCRETE PIPE

No direct payment will be made for the replacement, installation of existing storm sewer pipe which in the opinion of the Engineer is determined to be suitable to be reused, since the work is considered incidental to the installation of the water and sewer mains. Where the Engineer has determined the existing storm sewer is unsuitable for reuse or the contractor is directed to install new storm sewer pipe, then payment for the installation of reinforced concrete pipe will be paid for at the various contract unit prices for the various sizes of reinforced concrete pipe per linear foot for each linear foot of reinforced concrete pipe incorporated and accepted into the work.

STORM SEWER LINES

Storm sewer lines will be measured by the linear foot from centerline of drainage structure to centerline of drainage structure or end of pipe to the nearest 0.1 ft. minus the inside dimension of the drainage structure.

Payment for the installation of storm sewer lines will be paid for at the contract unit price for each size, material type and depth of invert below centerline grade incorporated and accepted into the work.

SILT FENCE

Payment for the installation of silt fence will be paid for at the contract unit price per linear foot for "Silt Fence" and will be based on the actual number of linear feet of silt fence incorporated and accepted into the work. Payment for clean stone used to anchor the silt fence and filter the sediment, will be paid for at the contract unit price per ton for "Filter Stone for Erosion, No. 5". No direct payment will be made for the removal of silt fence since the work is considered incidental to the work being paid for at the contract unit price for "Silt Fence".

SILT FENCE OUTLET

Payment for the installation of silt fence outlet will be paid for at the contract unit price per linear foot for "Silt Fence Outlet" and will be based on the actual number of linear feet of silt fence outlet incorporated and accepted into the work. Payment for clean stone used to filter the sediment, will be paid for at the contract unit price per ton for "Filter Stone for Erosion Control No. 5". No direct payment will be made for the removal of silt fence outlet since the work is considered incidental to the work being paid for at the contract unit price for "Silt Fence Outlet".

STONE FOR EROSION CONTROL, CLASS A

Payment for the installation of rip rap used to construct various erosion control devices will be paid for at the contract unit price per ton for "Stone for Erosion Control, Class A".

FILTER STONE FOR EROSION CONTROL, NO. 5 OR NO. 57

Payment for the installation of filter stone used to filter sediment for the various erosion control devices will be paid for at the contract unit price per ton for "Filter Stone for Erosion Control, No. 5 or No. 57".

EXCAVATION FOR EROSION CONTROL

The quantity of excavation to be paid for will be the volume in cubic yards for the actual amount of volume excavated within the limits established by the plans or as directed by the Engineer. Payment for the excavation and removal of material required for the installation and maintenance of erosion control devices will be paid for at the contract unit price per cubic yard for "Excavation for Erosion Control".

TEMPORARY SEEDING

Payment for temporary seeding will be paid for at the contract unit price per acre for "Temporary Seeding" and will be based on the actual number of acres (measured to the nearest 0.1 acre) incorporated and accepted into the work.

FENCE MAINTENANCE, REMOVAL AND REPLACEMENT

Payment for fence maintenance, removal and replacement will be paid for at the contract lump sum price for "Fence Maintenance, Removal and Replacement".

FILTER FABRIC

Filter fabric will be paid for at the contract unit price per square yard of filter fabric used for the installation of rip rap and shall be based on the actual number of square yards of filter fabric incorporated and accepted into the work, measured to the nearest 0.1 square yard.

EROSION CONTROL MATTING

Erosion control matting will be paid for at the contract unit price per square yard of matting, and shall be based on the actual number of square yards of matting incorporated and accepted into the work, measured to the nearest 0.1 square yard.

STREET IMPROVEMENT SPECIFICATIONS

DIVISION I – EARTHWORK

CLEARING AND GRUBBING

The work of clearing and grubbing shall consist of the cutting, removal and satisfactory disposal of all vegetation and surface debris to the limits established on the drawings.

Clearing and grubbing operations shall be completed sufficiently in advance of grading operations as may be necessary to prevent any of the debris from the clearing and grubbing operations from interfering with the excavation or embankment operations.

All work shall be performed in a manner that will cause a minimum of soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

The Contractor shall conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. When any such injuries unavoidably occur, all rough edges of scarred areas shall first be made reasonably smooth in accordance with generally accepted horticultural practice, and the scars then thoroughly covered with an asphaltum base tree paint. Any such plants that are damaged by any construction operations to such an extent as to destroy their value for shade or other landscape purposes, shall be cut and disposed of by the Contractor, without extra compensation, when so directed by the Engineer.

Payment for clearing and grubbing will be paid for at the contract lump sum price for "Clearing and Grubbing" and will be full compensation for all work described within this section.

DISPOSITION OF TIMBER

The disposal of timber on this project shall include vegetative material, brush, roots, stumps, tree tops and timber and shall be disposed of by the Contractor off-site of the right-of-way. It shall be the Contractor's responsibility to provide for all disposal sites utilized for this purpose.

No direct payment will be made for the disposition of timber since the work is considered incidental to the work being paid for at the contract lump sum price for "Clearing and Grubbing".

EXCAVATION

A. General

The work of roadway excavation shall consist of excavation, placement, and compaction or satisfactory disposal of all materials encountered within the limits of the work necessary for the construction of the roadway. All work shall be in conformity with the lines, grades and cross sections shown on the plans or established by the Engineer.

B. Unclassified Excavation

This item shall consist of removal and satisfactory disposal of materials necessary for street improvements and shall include the construction of embankments wherein excavated material from a cut area within the project is transferred to a fill area within the project. [The method of construction of embankment fill areas shall be as described in Section (F) below.] Materials to be removed include but are not limited to sidewalks, driveways, retaining walls, embankment slopes, rock columns, pipes, and underground tanks. All unsuitable materials that are excavated from the site of the project shall be disposed of at disposal sites. It shall be the Contractor's responsibility to provide for these permanent disposal sites.

All suitable material that is excavated from within the limits of the project site shall be stockpiled by the Contractor and made available for use in replacing unsuitable material or stabilizing unsuitable subgrade material. It shall be the responsibility of the Contractor to provide necessary off-site locations for excavated suitable material from within the limits of the project. No materials will be removed from stockpiles except upon authorization of the Engineer. In the event the Contractor fails to stockpile sufficient suitable material excavated from within the limits of the project, the Contractor will be required to provide suitable material approved by the Engineer from sources of his own procurement at no cost to the owner.

The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the plans or as directed by the Engineer.

Where it is necessary for utility poles or guy wires to remain in their original location, and where such poles are within the project construction limits, the Contractor shall conduct his earthwork operations in a manner which will not disturb these facilities.

Payment for unclassified excavation will be paid for at the contract lump sum price for "Unclassified Excavation".

C. Undercut Excavation

This item shall consist of the excavation of unsuitable materials which are below the top of the roadway subgrade line as shown on the plans including placement and compaction of suitable materials and satisfactory disposal of unsuitable materials. Rock encountered during this excavation shall be removed as noted in Section (D) below.

Payment for undercut excavation will be paid for at the contract unit price per cubic yard for "Undercut Excavation" and based on measurements taken by the Engineer.

D. Rock Excavation:

This item shall consist of the excavation of solid materials which cannot be excavated except by drilling and blasting, or boulders greater than one-half (1/2) cubic yard volume. Disintegrated rock capable of being excavated with power shovels with ripper attachments, and not previously blasted or broken rock, shall not be classified as rock excavation.

Payment for rock excavation will be paid for at the contract unit price per cubic yard for "Rock Excavation" and based on measurements taken by the Engineer.

E. Borrow Excavation

This item shall consist of excavation of approved material, loaded and transported from stockpiles or borrow pits previously approved by the Engineer to locations within the project site.

Payment for borrow material will be paid for at the contract unit price per cubic yard for "Borrow Excavation" and based on measurements taken or cross section volumes computed by the Engineer.

F. Construction of Embankments

Prior to construction of embankments, all unsuitable material such as organic material and topsoil, shall be removed from the natural ground within the limits of the fill. Only suitable material approved by the Engineer shall be used in the formation of embankments. No brush, roots, rubbish, sod, weeds, limbs, logs, stumps, heavy vegetation, or other unsuitable material shall be incorporated or placed in the embankments.

Where embankments are made on hillsides or slopes more than thirty (30) degrees with the horizontal, the slopes of the original subgrade shall be loosened to a minimum depth of six (6") inches.

All portions of the surface of an existing street upon which an embankment is to be placed shall be thoroughly scarified before placing the embankment where directed by the Engineer. The Engineer, at his discretion, may require old pavements upon which an embankment is to be placed, to be completely removed.

Embankment materials shall be deposited and spread in successive, uniform, horizontal layers of not more than six (6") inches in depth, loose measurement, for the full width of the cross section, and shall be kept level by the use of blade graders. Each layer shall be thoroughly compacted by rolling with approved equipment before starting the next layer. Hauling shall be distributed over the full width of the embankment. Deep ruts will not be allowed to form during the construction of the embankment.

A reasonable amount of side or end dumping will be allowed in marshy areas, hills, and ravines, to form a satisfactory base for the construction equipment.

G. Drainage

During Compaction: During earthwork, the surface shall be kept shaped and drained at all times. Drains and ditches to insure proper drainage shall be installed as required.

H. Ditch Excavation

This item shall consist of the excavation and satisfactory disposal of all materials excavated in the construction of drainage ditches as shown on the plans or as directed by the Engineer. Drainage

ditches will be defined as inlet and outlet ditches for pipe culverts, structures and changes in the alignment of stream channels.

Payment for ditch excavation will be paid for at the contract unit price per linear foot for "Ditch Excavation" and based on the actual number of linear feet incorporated into the work.

I. Proof Rolling

Prior to placement of stone base, the subgrade shall be brought to grade and proper section, thoroughly compacted by rolling with an approved rubber tired roller, weighing twelve (12) to fifteen (15) tons. The subgrade shall be proof-rolled in the presence of the Engineer, using equipment acceptable to the Engineer, but in no case less than a H-10 Highway Load. All soft and yielding material, or any other unsuitable material in the subgrade shall be removed and replaced, at the applicable bid prices, with suitable borrow material or crusher run stone as directed and to the satisfaction of the Engineer.

J. Compaction Testing

Field testing of soil compaction shall be performed, as required by the Engineer by an independent testing laboratory to be engaged by the City. During the course of fill operations, field testing shall be done in accordance with AASHTO T-99. Tests shall show characteristics of fill material used, degree of compaction and location of tests. If any test fails to meet specified requirements, the area from the point of test to the adjacent satisfactory tests shall be reworked and retested until the results indicate that the specifications have been met. The cost of all failed tests and any required retesting shall be borne by the contractor; the City shall bear the cost of original tests that show acceptable conditions.

K. Removal of Existing Pavement

This item shall consist of removal and satisfactory disposal of the Portland cement concrete or bituminous components of an existing roadway pavement structure, within the limits shown on the plans, or as directed by the Engineer.

The contractor shall provide a straight neat cut through the entire thickness. Where concrete pavement is to be removed, the Contractor shall provide a neat edge along the pavement being retained by sawing the pavement approximately two (2") inches deep before breaking the adjacent pavement.

Payment for removal of existing pavement will be determined by the actual surface measurement prior to its removal and will be paid for at the contract unit price per square yard for "Pavement Removal".

DIVISION 2 - STORM DRAINAGE

PIPE INSTALLATION

Pipe installation shall consist of all excavation, bedding, laying pipe, jointing and coupling pipe sections, and backfilling necessary to install the pipe, flared end sections, and fittings required to complete the project.

Suitable excavated materials shall be utilized as backfill or in the formation of embankments, subgrades, shoulders or as directed by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. The Engineer will designate excavated materials that are unsuitable. The Contractor will furnish disposal areas for the unsuitable materials.

Where traffic is to be maintained, the installation of pipe shall be done in sections so that half the width of the roadway will be available and open to traffic. Minimum cover on all paved drives shall be 12 inches.

Storm drainage pipe shall be reinforced concrete pipe (RCP) meeting the requirements of AASHTO M-170 for Class III RCP or High Density Polyethylene (HDPE) Pipe meeting the requirements of AASHTO M-294 for pipe with smooth interior, Type "S" or Type "D" with a minimum cover for (HDPE) Pipe of 18 inches of suitable material. RCP joint material shall be flexible plastic and meet the requirements of AASHTO M-198 for Type B flexible plastic gaskets. HDPE joint shall be bell and spigot type joint with "O"-ring gasket meeting the requirements of ASTM F-477 placed on the spigot end; a minimum of two (2) corrugations of the spigot end must insert in the bell end of the pipe. Pipe bands and fittings for HDPE pipe shall meet the requirements of AASHTO M-294. HDPE pipe shall require the approval of the City Engineer prior to installation.

All pipe shall be unloaded and handled with reasonable care. When any joint or section of pipe is damaged during unloading or handling, the undamaged portions of the joint or section may be used where partial lengths are needed or, if damaged sufficiently, the Engineer will reject the joint or section and the Contractor shall remove such rejected pipe from the project. Minor damage to pipe may be repaired by the Contractor when permitted by the Engineer.

Pipe shall have full bearing for its full length. RCP bell or groove-end shall be up-grade with spigot or tongue-end fully entered into the adjacent section. HDPE pipe shall be laid with the bell end up-grade and the spigot fully entered into the bell end.

Where the foundation material is determined to have poor supporting characteristics or composed of rock, the Engineer may require undercutting of the existing foundation material and backfilling with either a suitable local material or No. 78-M clean stone.

Backfilling around the pipe shall be placed in 6-inch layers, loose and compacted to 95% density in accordance with AASHTO T-99 as modified. All backfill material shall be approved by the Engineer.

Payment for pipe installation will be paid for at the contract unit price per linear foot for the various sizes of RCP. Payment for flared end sections and pipe fittings will be paid for at the contract unit price for each flared end section pipe fitting incorporated into the work.

PIPE REMOVAL

Existing pipe shall be removed when so designated on the plans or directed by the Engineer. Removal shall be in such a manner that any nearby facilities will not be damaged.

Where traffic is to be maintained, the removal of pipe shall be done in sections so that half the width of the roadway will be available and open to traffic.

Any additional backfill material that is required will be provided by the Contractor at his expense and considered incidental to the work being paid for at the contract unit price per linear foot for "Pipe Removal".

Salvaged pipe shall become the property of the City unless otherwise indicated by the Special Provisions.

Payment for pipe removal will be based on the actual number of linear feet of pipe removed and paid for at the contract unit price per linear foot for "Pipe Removal".

PIPE PLUGS AND PIPE COLLARS

Pipe plugs and collars shall be constructed in accordance with the details shown on the plans or as directed by the Engineer. Pipe plugs shall be constructed of either brick masonry or Portland Cement Concrete, Class B. Pipe collars shall be constructed of Portland Cement Concrete, Class A.

Payment shall be based on the number of cubic yards utilized, computed from the dimensions shown on the plans or from revised dimensions authorized by the Engineer, and paid for at the contract unit price per cubic yard for "Pipe Plugs" and "Pipe Collars".

STORM DRAINAGE STRUCTURES

Storm drainage structures being curb inlets, catch basins, storm drain manholes and junction boxes shall be constructed of solid clay brick, solid concrete block masonry or precast concrete together with all necessary precast concrete tops, metal grates, covers, frames and other hardware in accordance with the requirements shown on the plans. The contractor shall at no extra cost to the City follow guidelines set up by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor for confined space entry.

Clay brick shall meet the requirements of ASTM C-62 for Grade SW, shall be new and have straight parallel edges with square corners. In lieu of clay brick, concrete brick may be used and shall meet the requirements of ASTM C-55 for Grade S-II.

Concrete block shall meet the requirements of ASTM C-90 for Grade U-II and shall be substantially free from chips and cracks.

Mortar for brick masonry drainage structures shall be one (1) part Portland Cement, one-fourth (1/4) part hydrated lime and three-fourths (3/4) parts mortar sand (maximum) and no more water than necessary to make a workable mixture. Cement shall meet the requirements of AASHTO M-85 for types I, II and III, hydrated lime shall meet the requirements of ASTM C-207 for type N.

Precast drainage structures shall be solid wall, not waffled wall, and meet the requirements of ASTM C-913, with reinforcing conforming to the requirements of ASTM C-890 and shall utilize grade 60 re-bars conforming to the requirements of ASTM A-615 or WWF conforming to the requirements of ASTM A-185 or both. Additional re-bars shall be placed diagonally around all openings. Concrete compressive strength shall be a minimum of 4,000 psi. Structure shall be designed for an H20-44 loading. Steps shall be required for structures over 3'-6" in depth. Where fittings enter the structure, they shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned. Pipe connections shall be made so that the pipe does not project beyond the inside wall of the drainage structure, and shall be grouted as necessary to make smooth and uniform surfaces on the inside of the structure. Joints are to be sealed with butyl rubber joint sealant conforming to the requirements of ASTM C-990. Inverts shall be grouted to drain to the discharge outlet invert.

Deformed steel bar reinforcement shall conform to the requirements of ASTM A-615 for Grade 60 and fabrication shall be in accordance with the "Manual of Standard Practice" published by the Concrete Reinforcing Steel Institute. Bars shall be cold bent to the details shown on the plans.

Steps for drainage structures shall be the composite plastic-steel construction type and installed vertically on 15-inch centers.

Where the foundation is found to be of poor supporting character or of rock, the existing material shall be removed by undercutting to the depth directed by the Engineer and backfilled with suitable local material or No. 78-M clean stone.

After the drainage structure has been completed, the excavation shall be backfilled with approved material compacted to 95% density in accordance with AASHTO T-99 as modified. Backfilling will not be done until the structure has cured for at least seven (7) curing days, unless otherwise permitted by the Engineer.

Payment for drainage structures will be based on the actual number of drainage structures completed and incorporated into the work and paid for at the contract unit price for each "Drainage Structure". In addition, that portion of a drainage structure exceeding a depth of five (5.0') feet will be measured and paid for on a linear foot basis. Undercutting of the foundation material or additional backfill material will be considered incidental to the work being paid for at the actual unit price for each "Drainage Structure". Payment for frame assemblies with grates and covers and precast concrete tops will be based on the actual number of frame assemblies with grates and covers or precast concrete tops completed and incorporated into the work and paid for at the contract unit price.

DRAINS

Standard cast iron soil pipe or polyvinyl chloride pipe (PVC), Schedule 80, of four (4") inches diameter shall be used from property line to street where gutter drains are present. Cast iron soil pipe shall meet the requirements of ASTM A-74 for service weight pipe. Polyvinyl Chloride (PVC) pipe shall meet the requirements of ASTM C-3034. This standard four (4") inch pipe will be used under the direction of the Engineer to prevent minor drainage problems. The pipe shall be laid to match invert of gutter and shall be smoothly and neatly incorporated into the curb with mortar. Where possible, drains shall be tied into storm sewer by cutting a neat hole through the storm sewer pipe near the top and patching in back with mortar.

Payment for drains will be paid for at the contract unit price per linear foot for "Drains" and based on the actual number of linear feet incorporated into the work. Tie-ins will be completed by the Contractor and considered incidental to the work being paid for at the contract unit price for "Drains".

BRICK MASONRY ENDWALLS

Brick masonry endwalls shall be constructed in accordance with details shown on plans or as directed by the Engineer. Endwalls shall be constructed of brick masonry and Portland cement concrete. Payment shall be based on the number of cubic yards utilized, computed from dimensions shown on the plans or from revised dimensions authorized by the Engineer, and paid for at the contract unit price per cubic yard for brick masonry endwalls.

DIVISION 3 - SUBGRADE, BASES AND SHOULDERS

SUBGRADE

The work covered by this section shall consist of the preparation, shaping and compaction of that portion of the site upon which base or pavement is to be placed.

The subgrade shall be sloped to the lines, grades, and typical sections shown on the plans. All unsuitable material, boulders, and vegetative matter shall be removed and replaced with suitable material.

Material excavated in preparing the subgrade shall be stored or stockpiled in such a manner as to not interfere with proper drainage or any of the subsequent operations of placing base or pavement.

When tested, all material to a depth of 6-inches below the finished surface of the subgrade shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T-99 as modified.

The subgrade shall be compacted at or near the optimum moisture content to produce the maximum density. The Contractor shall dry or add moisture to the subgrade when required to provide a uniformly compacted subgrade.

No direct payment will be made for subgrade since the work is considered incidental to the work being paid for at the contract unit price for "Unclassified Excavation", "Borrow Excavation" and "Aggregate Base Course".

AGGREGATE BASE COURSE

The work covered by this section shall consist of the construction of a base composed of an approved aggregate material hauled to the site, placed on the site, compacted and shaped to conform to the lines, grades, depths, and typical sections shown on the plans as established by the Engineer.

All stone used as base course on the project shall be clean, tough, durable, and free of excessive amounts of flat elongated pieces. Toughness tests shall show wear of not more than fifty-five (55%) percent in accordance with AASHTO Specifications T 96-77. If subjected to five (5) sodium sulfate alterations in accordance with AASHTO Specifications T 104-77, the weighted loss shall be no greater than fifteen (15%) percent by weight.

Moisture Content. Moisture, by weight, shall be from four (4) to five (5) percent. ABC shall be relative to North Carolina Department of Transportation Specifications, Section 520 for ABC.

Grading requirements of ABC.	
Sieve Designation	Percent by Weight Passing
1-1/2 inch	100
1 inch	75 - 97
1/2 inch	55 - 79
No. 4	35 - 55
No. 10	25 - 45
No. 40	14 - 30
No. 200	4 - 12

Material passing No. 200 sieve shall not be more than two thirds (2/3) the percent passing No. 40 sieve.

Material passing No. 10 sieve shall meet grading requirements using AASHTO Method T-88-57, or most recent revision thereof, as follows:

Grading requirements of ABC passing No. 10 Sieve	
Sieve Designation	Percent by Weight Passing
No. 10	100
No. 40	40 - 84
No. 200	11 - 3

The aggregate material shall be spread on the subgrade in a uniform layer and without segregation. Where the required completed thickness of base is 8-inches or less, the material may be spread and compacted in one layer. Where the required compacted thickness of base is more than 8-inches, the material shall be spread and compacted in two (2) equal layers.

No base material shall be placed on frozen subgrade or base. Any rutting, weaving, soft areas or other defects which may develop in the completed base course or any damage caused by construction traffic shall be repaired as directed by the Engineer.

Aggregate which is contaminated with foreign materials to the extent the base course will not adequately serve its intended use shall be removed and replaced by the Contractor.

Each layer of the base shall be compacted to a density equal to at least 100% in accordance with AASHTO T-180 as modified. The base material shall be compacted at or near the optimum moisture content to produce the maximum density. The Contractor shall dry or add moisture to the material when required to provide a uniformly compacted base. When completed the base course shall be smooth, hard, dense, unyielding and well bonded.

Payment for aggregate base course will be paid for at the contract unit price per ton for "Aggregate Base Course" and based on the actual number of tons incorporated into the work.

CONDITIONING EXISTING BASE

The work covered by this section consists of the conditioning of an existing base placed by others in preparation for the placement of additional layers of base material or pavement. Conditioning shall consist of scarifying, shaping and compacting the base to conform to the lines, grades, depths and typical sections established by the plans or Engineer.

The base shall be compacted to a degree satisfactory to the Engineer. The Contractor shall dry or add moisture to the material when required to provide a uniformly compacted base. Conditioning shall not be done when the existing base contains excess moisture or is frozen.

Payment for conditioning existing base will be paid for at the contract unit price per 1,000 square yards for "Conditioning Existing Base" and based on the actual number of square yards incorporated into the work.

STONE SCREENINGS

Stone screenings shall conform to section 1012-1 (c) 3 of the NCDOT Standard Specifications for Roads and Structures.

Stone screenings shall be placed on the road surface to prevent excavated material from adhering to the road surface.

Payment for stone screenings will be paid for at the contract unit price per ton for "Stone Screenings" and based on actual number of tons incorporated into the work.

INCIDENTAL STONE BASE

The work covered by this section shall consist of furnishing, placing and shaping a graded stone material for use in driveways, temporary maintenance of traffic, adjacent to mailboxes, and at any other locations directed by the Engineer.

The graded stone material shall be in accordance with the North Carolina Department of Transportation Standards for the following classifications:

Classification	Use
No. 67	Water Control
No. 78-M	Bedding – incidental structures
ABC	Roadway, Driveway and shoulder stabilization

The stone material shall be uniformly spread over the area required, shaped and dressed to the satisfaction of the Engineer.

Payment for incidental stone base will be paid for at the contract unit price per ton for "Incidental Stone Base" and based on the actual number of tons incorporated into the work.

SHOULDER CONSTRUCTION

The work covered by this section shall consist of the construction of roadway shoulders with approved earth material to the lines and grades as shown on the plans.

The material used to construct earth shoulders shall be suitable material from roadway excavation or obtained from borrow sources. The shoulders shall be constructed in proper sequence and in such a manner as to provide proper drainage at all times. The Contractor shall provide adequate equipment to perform the work. No equipment that will damage the curb and gutter or pavement shall be used to construct the shoulders.

No direct payment will be made for shoulder construction since the work is considered incidental to the work being paid for at the contract unit price for "Unclassified Excavation" and "Borrow Excavation".

DIVISION 4 - BITUMINOUS BASES AND PAVEMENTS

TACK COAT

The work covered by this section shall consist of tacking an existing bituminous or concrete surface with bituminous material. Tack coat shall be applied beneath each layer of bituminous plant mix base or pavement.

The tack coat shall be CRS-1 and meet the requirements of AASHTO M-208 for Grade CRS-1, as revised. Tack coat shall be applied only when the surface to be treated is sufficiently dry and when the atmospheric temperature is 35 degrees or above. The existing surface to which tack coat is to be applied shall be cleaned of all dust and foreign material prior to placing the tack coat.

The tack coat shall be uniformly applied at a rate from 0.03 to 0.10 gallons per square yard. The exact rate of application will be established by the Engineer. The temperature of the material at the time of application shall be between 90 degrees Fahrenheit and 150 degrees Fahrenheit.

No direct payment will be made for the tack coat since the work is considered incidental to the work being paid for at the contract unit price per ton for the various "Bituminous Concrete Pavements".

BITUMINOUS PLANT MIX PAVEMENTS, GENERAL

The work covered by this section shall consist of the production, delivery and placement of all types of bituminous plant mixed bases and surface courses; and in reasonably close conformity with the lines, grades, thickness and typical sections shown on the plans or established by the Engineer.

The production and delivery of bituminous plant mixed pavements shall be in accordance with the North Carolina Department of Transportation Standard Specifications Section 610-5 through 610-9. Bituminous materials shall not be placed during foggy or wet weather, when the subgrade or base course is frozen, or when the moisture on the surface to be paved would prevent proper bond.

Bituminous materials shall not be placed when the air temperature, measured in the shade, is less than 35 degrees Fahrenheit for a layer having a thickness of 1-1/2 inches or greater or 40 degrees Fahrenheit for a layer having a thickness of less than 1-1/2 inches. In addition, surface course material that is to be the final layer of pavement shall not be placed between the dates of December 15 and March 16.

The bituminous material shall be spread and struck off to the required grades, cross sections, and thicknesses by self contained, power propelled pavers. Equipment shall be regulated so as not to pull or tear bituminous material and shall be in accordance with Section 610-10 of the North Carolina Department of Transportation Standard Specifications.

Immediately after the bituminous material has been spread, it shall be thoroughly and uniformly compacted. A minimum of two (2) steel wheel tandem rollers weighing from 8 to 12 tons and equipped with wetting devices shall be used to compact all surface courses. In addition, a pneumatic

tired roller capable of transmitting 60 to 90 psi per tire shall be used to compact black base and/or binder courses.

When the laying of the material is to be suspended long enough to become chilled or at the end of each day's operation, the Contractor shall construct a transverse joint. The Contractor shall construct a sloped wedge ahead of the end of the full depth pavement to provide for proper compaction and protection of the full depth pavement. Before paving operations are resumed, the Contractor shall remove the sloped wedge to a point of full pavement depth. The exposed edge of the pavement shall then be lightly coated with a tack coat.

Longitudinal joints in the surface course shall be constructed to fall between travel lanes, where possible. When multilane multilayer construction is required, the longitudinal joint in each layer shall offset that in the layer immediately below by approximately six (6") inches. Longitudinal joints shall be formed by allowing the paver to deposit the material adjacent to the joint to such depth that maximum compaction can be obtained along the joint. The joint shall be pinched by rolling immediately behind the paver.

No direct payment will be made for bituminous plant mix pavements general since the work is considered incidental to the work being paid for at the contract unit price per ton for the various "Bituminous Concrete Pavements".

BITUMINOUS CONCRETE

The work covered by this section shall consist of the construction of a bituminous plant mix base course, binder course, or surface course composed of a mixture of coarse and fine aggregates, asphalt cement, and mineral filler, properly laid upon a prepared surface, in accordance with the lines, grades, thicknesses and typical sections shown on the plans.

Coarse and fine aggregates, mineral filler, and stone screenings shall meet the requirements of Section 912-1 of the North Carolina Department of Transportation Standard Specifications. Asphalt Cement, Grade AC-20 shall meet the requirements of Section 920-1 of said specifications.

At least one-half of the fraction of material passing the No. 200 sieve shall be mineral filler or stone screenings. The total natural sand or sands in the mixture will be tested in accordance with AASHTO T-11 to determine the amount of material that can be washed through the No. 200 sieve. The total amount of such washed material shall not exceed 8% by weight of the total aggregate in the mixture.

Mixes:

BLACK BASE, TYPE HB	
Sieve Designation	Total Percent Passing
2 inch	100
1-1/2 inch	90 - 100
3/4 inch	60 -85
No. 4	25 -50
No. 8	25 -40
No. 200	0 - 6
Asphalt Cement Content Range 3.0% - 6.0%	
Temperature Range 250 degrees F. to 300 degrees F.	

BINDER COURSE, TYPE H	
Sieve Designation	Total Percent Passing
1 inch	100
3/4 inch	90 - 100
1/2 inch	67 - 88
No.8	25 - 45
No. 200	1 - 7
Asphalt Cement Content Range 3.5% - 6.5%	
Temperature Range 250 degrees F. to 300 degrees F.	

SURFACE COURSE, TYPE I-2	
Sieve Designation	Total Percent Passing
3/4 inch	100
1/2 inch	96 - 100
3/8 inch	90 - 100
No. 4	70 - 95
No. 8	55 - 75
No. 40	15 - 45
No. 80	7 - 22
No. 200	3 - 9
Asphalt Cement Content Range 4.5% - 8.5%	
Temperature Range 250 degrees F. to 300 degrees F.	

The actual bitumen content will be established during construction by the Engineer within the limits established in the above specifications.

Each of the mixtures shown above shall be compacted to the density as indicated.

- A. Bituminous Concrete Base Course - ninety (90%) percent of maximum theoretical density.
- B. Bituminous Concrete Binder - ninety-four (94%) percent of laboratory density as determined by the Marshall method of test.
- C. Bituminous Concrete Surface Course - ninety-five (95%) percent of laboratory density as determined by the Marshall method of test.

Payment for bituminous concrete black base, binder and surface courses will be paid for at the contract unit price per ton for "Bituminous Concrete Black Base", "Bituminous Concrete Binder" or "Bituminous Concrete Surface" and based on the actual number of tons incorporated into the work.

BITUMINOUS PLANT MIX, PAVEMENT REPAIR

The work covered by this section shall consist of repairs to existing pavement and shall include but not limited to the cutting of the existing pavement to a neat uniform and vertical joint; the removal and disposal of pavement, base, and subgrade materials as directed by the Engineer; the coating of the area to be repaired with a tack coat; and the replacement of the removed material with bituminous plant mix materials. The repairs shall be made in accordance with the plans, or as directed by the Engineer.

All bituminous plant mix materials shall meet the requirements of the preceding section.

All pavement repairs shall be made such that traffic can be maintained in at least one direction.

Payment for bituminous plant mix, pavement repair will be made at the contract unit price per ton for "Pavement Repair" and based on the actual number of tons incorporated into the work.

BITUMINOUS SURFACE TREATMENT

The work covered by this section shall consist of the construction of a bituminous surface treatment consisting of one or more applications of a liquid bituminous material and one or more applications of aggregate cover coat material on a prepared surface.

Liquid asphalt, Grade CRS-2 shall be used for both the mat and seal coats and shall meet the requirements of North Carolina Department of Transportation Standard Specifications, Section 1020-7. Aggregate for mat and seal coats shall meet the requirements of Section 1012-2 of said specifications and shall be size No. 6 and No. 78-M respectively.

Bituminous material shall be applied only when the surface to be treated is dry, cleaned of all dust, dirt, grass or other deleterious matter, and when the atmospheric temperature is above 60 degrees Fahrenheit unless otherwise approved by the Engineer.

Liquid asphalt and aggregate shall be applied in accordance with the following table for both the mat and seal coats:

Type of Asphalt Coat	Application Rate Gal./Sq. Yd.	Application Temperature.	Aggregate Size	Aggregate Rate Lb./Sq. Yd.
Mat	0.42 - 0.47	150 F. to 175 F	No. 6	30-35
Seal	0.27 - 0.34	150 F. to 175 F	No. 78-M	15-20

Rolling shall be done immediately after the aggregate has been uniformly spread and consists of one complete coverage with a steel wheel roller after which pneumatic tired rollers shall be used until the aggregate is thoroughly keyed into the bitumen. Excessive crushing of the aggregate will not be permitted.

Payment for bituminous surface treatment will be paid for at the contract unit price per square yard for "Bituminous Surface Treatment, Mat Coat" or "Bituminous Surface Treatment, Seal Coat" and based on the actual number of square yards incorporated into the work.

DIVISION 5 - INCIDENTALS

MOBILIZATION

The work covered by this section consists of preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, and other facilities necessary for work on the project; and for all other costs incurred prior to beginning work on the various items on the project site.

All work covered by this section will be paid for at the contract lump sum price for "Mobilization".

Partial payments for the item of "Mobilization" will be made with the first and second partial pay estimates paid on the contract, and will be made at the rate of 50% of the lump sum price for "Mobilization" on each of these partial pay estimates, provided the amount of this bid item does not exceed 5% of the total amount bid for the project. Where the amount bid for "Mobilization" exceeds 5% of the total amount bid, 2-1/2% of the total amount bid will be paid on each of the first two partial pay estimates, and that portion exceeding 5% will be paid on the final pay estimate.

CONCRETE CONSTRUCTION GENERAL

The work covered by this section shall consist of the construction of all incidental concrete including but not limited to the following: Concrete curb and gutter, sidewalks, driveways and paved ditches and constructed in accordance with the dimensions and details as shown on the drawings.

A. Materials

Portland cement shall be used in all concrete construction.

The following AASHTO Specifications, or most recent revision thereof, shall govern the making of Portland Cement:

- M 85 - Portland Cement (Type I and II)
- M 6 - Fine Aggregate for P.C.C.
- M 80 - Course Aggregate for P.C.C.
- T 96 - Resistance to abrasion (water of less than fifty (50%) percent)

B. Aggregate Grading

Unless otherwise specified, number fifty-seven (57) size clean stone shall be used for P.C.C.

Gradation	
Sieve Designation	Percent by Weight Passing
1-1/2 inch	100
1 inch	95 - 100
1/2 inch	25 - 60
No. 4	0 - 10
No. 8	0 - 5

C. Water

Water used in making concrete shall be clean and free from deleterious amounts of acids, alkalis, or organic materials (public water supply).

D. Concrete Classification

Class	Minimum 28 day Compressive Strength PSI	Consistency Slump Range (inches)	
		Vibrated	Non-Vibrated
A	3,000	1 - 2-1/2	3 - 5
B	2,500	3/4 - 1-1/2	2 - 4
C	2,000	3/4 - 1-1/2	2 - 4
D	1,500	3/4 - 1-1/2	2 - 4

E. Forms

Forms shall be set and maintained true to the required lines, grades, and dimensions. Forms shall be constructed with material of such strength and with sufficient rigidity to prevent any appreciable deflection between supports. Forms shall be mortar-tight and shall be filleted at sharp corners when indicated on the plans. Clamps, pins, metal spacers, anchorages or other connecting devices shall be designed to hold the forms rigidly together.

The shape, strength, rigidity, and surface smoothness of forms that are to be reused shall be maintained at all times. Forms shall be thoroughly cleaned of all dirt, mortar, and foreign material before being used. Flexible forms shall be used on all radius sections of two (2') feet or less.

Before concrete is placed, all inside form surfaces shall be thoroughly coated with commercial quality form oil or other equivalent coating.

F. Cold Weather

Concreting operations shall not be undertaken or continued when any of the following conditions exist, unless otherwise approved by the Engineer.

1. When atmospheric temperature during the preceding twenty-four (24) hours has not risen above 40 degrees Fahrenheit.
2. When atmospheric temperature has not reached 40 degrees Fahrenheit by 10:00 A.M.
3. When the subgrade is frozen.
4. When the aggregate, either course or fine, contains frozen particles.
5. When atmospheric temperature is falling and reaches 40 degrees Fahrenheit.
6. When local weather reports or conditions indicate the possibility of temperature of 32 degrees Fahrenheit or lower within the ensuing twenty-four (24) hours. Concrete less than twenty-four (24) hours old that may be subjected to temperatures of less than 32 degrees Fahrenheit shall be protected by the customary curing method and in addition a thermal insulation acceptable to the Engineer shall be placed on the concrete and retained in place.

until the required curing period is completed. Calcium chloride, or other admixtures, may be used only as directed by the Engineer.

7. No more concrete shall be laid than can be properly finished and covered during daylight.

G. Subgrade

Soft and yielding material or other unsuitable material is to be removed and replaced with suitable material, and then compacted and finished to a firm smooth surface.

H. Placement

Debris and foreign materials shall be removed from placement area. Subgrade to be thoroughly wetted prior to pouring; no puddles will be acceptable. Handling of concrete shall be continuous to ensure a plastic mix, and shall be placed as near to final position as possible to avoid segregation due to rehandling or flowing. Concrete partially hardened or contaminated shall not be placed. Concrete shall not be placed on frozen or muddy subgrade and shall be thoroughly tamped where edges or corners are encountered. Honeycombs will not be acceptable. Concrete shall be deposited within forty-five (45) minutes after mixing.

I. Joints

Joints shall coincide when partial or complete slabs are constructed. All joints shall be perpendicular to surface. Expansion joint filler to be one-half (1/2") inch thick, and extend full depth of joint with top being one-quarter (1/4") inch below finished surface. Joints shall be edged to one-quarter (1/4") continuous radius. Excess concrete to be removed from joint.

J. Expansion Joints

Expansion joint material shall be nonextruding premoulded bituminous fiber filler and shall conform with the requirements of AASHTO Specifications M-153, for Type III Filler.

K. Finish

Concrete shall be tamped and struck off with approved template to grade. Approved bridge shall be required where work is too wide to be finished from each side. Workmen with mud or other foreign substance on footwear shall not walk in green concrete. All edges of slabs to be finished with an approved edging tool of one-quarter (1/4") inch radius.

Forms are not to be removed prior to a sufficient set, then without injury to concrete. Structures other than sidewalks, drives, and curb and gutter shall be rubbed down to a smooth uniform finish unless otherwise excused by the Engineer.

Concrete with honeycombs shall be removed and replaced without additional compensation to the Contractor.

L. Non-Slip Broom Finish

Apply non-slip broom finish to all curb, curb and gutter, sidewalk and drive entrances unless otherwise specified. Immediately after float finishing, roughen the concrete surface by brooming in the direction perpendicular to the main traffic route.

M. Curing and Protection

Immediately following finishing operations, the entire exposed surface shall be protected and curing compound applied. Edges shall have curing compound applied immediately after from removal.

Vehicular traffic is to remain off concrete for ten (10) and seven (7) days respectively if Type I and III cement is used. Pedestrian traffic is to remain off for three (3) days.

Liquid membrane-forming curing compounds shall be used unless otherwise specified by the Engineer. Curing compound is to conform to AASHTO M-148, or most recent revision thereof, and shall be Type II white pigmented. Curing compound shall be mechanically applied in one (1) uniform operation at a rate of not less than one (1) gallon per each two hundred (200) square feet.

No direct payment will be made for concrete construction-general since the work is considered incidental to the work being paid for at the contract unit prices for the various items directly applicable to the work being constructed.

CONCRETE CURB AND CURB AND GUTTER

The work covered by this section consists of the construction of Portland cement concrete curb and concrete curb and gutter in accordance with the requirements shown on the plans and the provisions of these specifications.

Concrete shall be constructed in accordance with the requirements of concrete construction-general provided above. Concrete for curb, or curb and gutter may be placed by a machine.

Contraction joints for curb, or curb and gutter will be spaced at fifteen (15') foot intervals with expansion joints spaced at ninety (90') foot intervals.

No earth backfill or pavement shall be placed adjacent to the curb, or curb and gutter until at least three (3) curing days have elapsed. However, earth backfill shall be placed no later than four (4) calendar days after the curing period unless otherwise approved by the Engineer. The quantity and degree of compaction at the backfill shall be satisfactory to the Engineer.

Payment for concrete curb, and concrete curb and gutter will be paid for at the contract unit price per linear foot for "Concrete Curb" and "Concrete Curb and Gutter" and based on the actual number of linear feet incorporated into the work.

CONCRETE SIDEWALKS AND DRIVEWAYS

The work covered by this section shall consist of the construction of Portland cement concrete sidewalks and driveways in accordance with the plans and specifications.

Concrete for sidewalks and driveways shall be constructed in accordance with the requirements of concrete construction-general provided above.

Full depth expansion joints shall be provided at intervals not exceeding forty (40') feet, and to separate sidewalks from other sidewalks, driveways, curbs, adjacent buildings, adjacent retaining walls, catch basins, fire hydrants, utility poles, grates, and other structures as required.

Longitudinal and transverse contraction joints shall be produced by cutting joints in the concrete after floating operations with an approved tool so that the joint will be at least one (1") inch in depth. The joint shall not be less than one-quarter (1/4") inch nor more than one-half (1/2") inch in width. Contraction joints shall be placed at intervals of five (5') feet.

No backfill shall be placed adjacent to the sidewalk or driveway until at least three (3) curing days have elapsed. However, backfill shall be placed no later than four (4) calendar days after the curing period unless otherwise approved by the Engineer. Backfill shall be completed to a degree comparable to the adjacent undisturbed material.

Payment for concrete sidewalks and driveways will be paid for at the contract unit price per square yard for "Sidewalks" and "Driveways" and based on the actual number of square yards incorporated into the work.

CONCRETE PAVED DITCH

The work covered by this section shall consist of the construction of Portland cement concrete paved ditches in accordance with the requirements shown on the plans and these specifications.

Concrete for paved ditches shall be constructed in accordance with the requirements of concrete construction-general provided above.

Full depth expansion joints shall be provided at intervals not exceeding thirty (30') feet and at all other points where proposed ditches abut rigid objects. Place contraction joints one (1") inch in depth at ten (10') foot intervals between expansion joints.

No backfill shall be placed adjacent to the paved ditch until at least three (3) curing days have elapsed. However, backfill shall be placed no later than four (4) calendar days after the curing period unless otherwise approved by the Engineer. Backfill shall be compacted to a degree comparable to the adjacent undisturbed material.

Payment for concrete paved ditches will be paid for at the contract unit price per square yard for "Concrete Paved Ditches" and based on the actual number of square yards incorporated into the work.

MASONRY CONSTRUCTION - GENERAL

The work covered by this section shall consist of the construction of all brick masonry construction including but not limited to the following: steps, gravity retaining walls, masonry drainage structures, and adjustments of catch basins, manholes and drop inlets and constructed in accordance with the dimensions and details as shown on the drawings.

Materials: All materials shall meet the following requirements:

Brick shall be clay or shale brick and conform to ASTM C62 for Grade SW, shall be new and have straight parallel edges with square corners.

Concrete building block shall meet the requirements of ASTM C90 for Grade U-II and shall be gray in color and substantially free from chips and cracks.

Portland cement shall meet the requirements of AASHTO M85.

Hydrated Lime shall meet the requirements of ASTM C207 for Type N.

Mortar Sand shall meet the requirements of AASHTO M45.

Water shall be clean and practically free from oil, salt, acid, alkali, organic matter or other substances (public water supply).

Mortar used in all brick and block masonry shall be one (1) part Portland cement, one quarter (1/4) part hydrated lime and three (3) parts mortar sand. No more water shall be added than is necessary to make a workable mixture.

Masonry walls shall be built plumb and true to the required dimensions. Horizontal and vertical joints shall be full of mortar, straight, level or plumb and neat at intersection. Exposed joints shall be finished with a concave joiner. All other joints shall be flush cut.

No masonry shall be placed when the temperature is below 35 degrees Fahrenheit. Masonry that is less than three (3) days old shall be protected from freezing by methods approved by the Engineer.

No backfill shall be placed adjacent to the structure until at least three (3) curing days have elapsed. However, backfill shall be placed no later than four (4) calendar days after the curing period unless otherwise approved by the Engineer. Backfill shall be compacted to a degree comparable to the adjacent undisturbed material.

No direct payment will be made for masonry construction-general since the work is considered incidental to the work being paid for at the contract unit prices for the various items directly applicable to the work being constructed.

STEPS

The work covered by this section shall consist of the construction of reinforced concrete or brick masonry steps in accordance with the dimensions and details shown on the plans and these specifications.

All materials and construction methods shall conform to the requirements of concrete construction-general or masonry construction-general provided above.

Payment for steps will be paid for at the contract unit price per cubic yard for "steps" and based on the actual number of cubic yards incorporated into the work.

GRAVITY RETAINING WALLS

The work covered by this section shall consist of the construction of concrete, brick or block masonry gravity retaining walls in accordance with the dimensions and details shown on the plans and specifications.

All materials and construction methods shall conform to the requirements of concrete construction-general or masonry construction-general provided above.

Payment for gravity retaining walls will be paid for at the contract unit price per cubic yard for "gravity retaining walls" and based on the actual number of cubic yards incorporated into the work.

ADJUSTMENT OF CATCH BASINS, MANHOLES, DROP INLETS, METER BOXES AND VALVE BOXES

The work covered by this section shall consist of the raising or lowering of existing catch basins, manholes, drop inlets, meter boxes and valve boxes encountered within the limits of the project to match the adjacent finished work.

All materials and construction methods shall conform to the requirements of concrete construction-general or masonry construction-general as specified above.

Adjustment of catch basins, manholes, drop inlets, meter boxes, and valve boxes shall be defined as the work required to place items at new line and grade raised or lowered two (2') vertical feet or less in elevation.

Structures required within the pavement shall conform to grade and crown for a smooth riding surface. Castings shall be embedded in mortar spread on top of solid masonry. Shims causing small bearing areas will not be tolerated. True bond between unlike materials shall be obtained.

Existing forms, grates, manhole covers, rings, meter and valve boxes shall be salvaged and reused in the adjustment.

Each manhole and catch basin shall be protected in a manner that will trap and prevent the entry of debris into the system. Manholes and inverts shall be cleaned prior to paving. Stoppages and damages caused by not cleaning manholes and catch basins will be accessed to the prime contractor.

Payment for adjustment of catch basins, manholes, drop inlets, meter boxes and valve boxes will be paid for at the contract unit price per each adjustment and based on the actual number of adjustments incorporated into the work.

CONVERTING EXISTING CATCH BASINS AND DROP INLETS

The work covered by this section shall consist of the converting of existing catch basins and drop inlets to either drop inlets or junction boxes as required by the plans including all necessary construction and reconstruction together with all necessary metal grates, covers, frames, and other hardware in accordance with the plans and specifications.

All materials and construction methods shall conform to the requirements of concrete construction-general or masonry construction-general as specified above.

Structures required within the pavement shall conform to grade and crown for a smooth riding surface. Castings shall be embedded in mortar spread on top of solid masonry. Shims causing bearing areas will not be tolerated. True bond between unlike materials shall be obtained.

Payment for converting existing catch basins and drop inlets will be paid for at the contract unit price per each conversion and based on the actual number of conversions incorporated into the work.

RIP RAP

The work covered by this section shall consist of the construction of plain rip rap in accordance with the dimensions and details as shown on the plans or as directed by the Engineer.

Plain rip rap shall consist of quarry run stone and shall be classified by size into either class 1, class 2, class A or class B. The class and thickness to be used shall be called for on the plans.

The rip rap shall be graded so that the smaller stones are uniformly distributed throughout the mass. The completed rip rap shall be at least the thickness indicated on the plans. The contractor may place the stone by mechanical methods, augmented by hand placing, provided that when the rip rap is complete it forms a properly graded, dense, neat layer of stone.

At locations where rip rap is required at the outlets of pipe culverts, the rip rap shall be placed immediately after completion of the pipe culvert installation.

Payment for rip rap will be paid for at the contract unit price per ton for "Rip Rap" and based on the actual number of tons incorporated into the work.

SEEDING AND MULCHING

The work covered by this section consists of preparing seed beds; furnishing, placing and covering limestone, fertilizer and seed, compacting seed beds; furnishing, placing and securing mulch and other operations necessary for the permanent establishment of vegetation from seed on shoulders, slopes, ditches and all other disturbed areas in accordance with the plans and specifications.

The work of seeding and mulching shall be performed on a section by section basis immediately upon completion of earthwork sections, but in no instance shall any disturbed areas not be seeded within thirty (30) working days after completion of the grading phase.

The entire disturbed areas shall be finely tilled by harrowing as directed by the Engineer. Clods shall be broken and worked into the seed bed. All rock and debris three (3") inches or larger shall be removed prior to the application of seed and fertilizer.

Where soil conditions are unfavorable for successful establishment of cover, available topsoil shall be spread. Dolomitic Limestone shall be applied at the rate of 4,000 pounds per acre and a 10-10-10 commercial fertilizer mix shall be applied at the rate of 1,000 pounds per acre to the disturbed area.

It shall be worked into the soil to a depth of three to four inches. Seed shall be uniformly applied to disturbed area according to the following schedule by broadcasting with a cyclone seeder or other methods that will assure uniform application. Seed shall be lightly covered and soil firmed. Straw mulch shall be applied to the seeded area at the rate of 1-1/2 bales per 1,000 square feet and tacked.

SCHEDULE FOR PROVIDING PERMANENT VEGETATIVE COVER

APPLICATION RATES		
PLANTING DATES	PLANTS AND MIXTURES	LBS/ACRE
November through January	Tall Fescue	100
	and Rye	50
February through April	Tall Fescue	120
May through July	Tall Fescue	70
	and Weeping Lovegrass	20
August through October	Tall Fescue	100
	and Sorghum-Sudan Hybrids	50

The Contractor shall be responsible for repairing any damaged areas or reseeding where an acceptable stand of grass has failed to be successfully established. No direct payment will be made for repairs since the work is considered incidental to the work being paid for at the contract unit price per acre for "seeding and mulching".

Payment for seeding and mulching will be paid for at the contract unit price per acre for "Seeding and Mulching" and based on the actual number of acres incorporated into the work.

Payment for jute matting and/or excelsior matting will be paid for at the contract unit price per square yard for "Jute Matting" and/or "Excelsior Matting" and based on the actual number of square yards incorporated into the work.

ROCK CHECK DAMS

The work covered by this section shall consist of the construction, maintenance and removal of rock check dams in ditches or swales to reduce water velocity and trap sediment as shown on the plans or as directed by the Engineer.

Materials for rock check dams shall consist of either Class 1 or Class 2 rip rap and conform to the requirements specified under the section for Rip Rap. All other materials necessary to construct the rock check dam shall be approved by the Engineer.

The Contractor shall construct all rock check dams in accordance with the details shown on the plans and at locations shown on the plans or as directed by the Engineer. The Contractor shall maintain all rock check dams and remove and dispose of silt accumulations when so directed by the Engineer. The Contractor shall remove all rock check dams as the project nears completion and these disturbed areas shall be seeded and mulched in accordance with these specifications when so directed by the Engineer.

Payment for rock check dams will be paid for at the contract unit price for each "Rock Check Dam" incorporated into the work.

TEMPORARY SILT FENCE

The work covered by this section shall consist of furnishing, installing, maintaining and removing a water permeable filter type fence for the purpose of controlling siltation as shown on the plans or as directed by the Engineer.

Either wood posts or steel posts may be used. Wood posts shall be a minimum of six (6') feet long, at least three (3") inches in diameter and straight enough to provide a fence without noticeable misalignment. Steel posts shall be five (5') feet long, one and three-fourths (1-3/4") inches wide and have projections for fastening the wire to the fence.

Wire fence fabric shall be at least thirty-two (32") inches high and shall have at least six (6) horizontal wires. Vertical wires shall be spaced twelve (12") inches apart. The top and bottom wires shall be at least 10 gage. All other wires shall be of at least 12-1/2 gage.

Burlap shall weigh at least 6.7 ounces per square yard and shall have a minimum width of thirty-six (36") inches.

Synthetic fabric shall be composed of strong rot-proof synthetic fibers formed into either a woven or a non-woven fabric. The fabric shall have a minimum width of thirty-two (32") inches and conform to the requirements of Section 956-2 of the North Carolina Department of Transportation "Standard Specifications".

When a synthetic filter fabric is used, the woven wire fence fabric backing may be eliminated subject to the following conditions:

- 1) Post spacing is reduced to a maximum of 6 feet.
- 2) Fence posts shall be inclined toward the runoff source at an angle of not more than 20 degrees from vertical.
- 3) The proposed fabric has been approved by the Engineer as being suitable for use without the woven wire fence fabric backing.

The Contractor shall install temporary silt fence in accordance with the details and at the locations shown on the plans or as directed by the Engineer. The Contractor shall maintain the silt fence until the project is completed or until the fence is removed, and shall remove and dispose of silt accumulated at the silt fence when so directed by the Engineer. Filter fabric shall be removed and replaced whenever it has deteriorated to such extent that it reduces the effectiveness of the silt fence. The silt fence shall remain in place until the project nears completion or the Engineer directs that it be removed. Upon removal of the silt fence, the Contractor shall seed and mulch the area in accordance with the specifications for seeding and mulching.

Payment for silt fence will be paid for at the contract unit price per linear foot for "temporary silt fence" and based on the actual number of linear feet incorporated into the work.

TEMPORARY SILT DIKE (Geotextile-Encased Check Dam)

This work shall consist of furnishing, installing, maintaining, and, when required, removal of the "temporary silt dike". The dikes shall be used as a continuous line barrier at the toe of slope or R/W line to contain sediment or as a ditch barrier placed perpendicular to the flow of water in a defined drainage ditch to minimize erosion and contain sediment. These dikes shall be installed and located as shown on the plan or as directed by the Engineer.

"Temporary silt dikes" shall be triangular-shaped, having a height of at least eight to ten inches (8" - 10") in the center with equal sides and a sixteen- to twenty-inch (16" - 20") base. The triangular-shaped inner material shall be urethane foam. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle two to three (2' - 3') feet. Standard length of each dike will be seven feet (7') unless otherwise indicated on the plans. The dikes shall be attached to the ground with Wire Staples. The staples shall be No. 11 gauge wire and be at least six to eight (6" - 8") inches long. Staples shall be placed as indicated on the installation detail.

When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled. Check dams shall be placed perpendicular to the flow of water. The leading edge must be secured in a key slot and staples.

The Contractor shall inspect all dikes after each rainfall event of at least 0.5 inches or greater. The Contractor shall repair any deficiencies or damage. Accumulated silt or debris shall be removed and relocated as directed by the Engineer. If the dikes are damaged or inadvertently moved during the silt removal process, the contractor shall immediately replace dikes after damage occurs.

Accepted "temporary silt dike" will be measured by the 'linear foot' in place as directed by the Engineer, will be paid for at the contract unit price bid for "temporary silt dike". Price bid will include the cost of furnishing the dikes, installation, maintenance, and removal when directed by the Engineer.