

Water Specifications
for
City of Hendersonville
Water & Sewer

January 2018

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01500.1 LIMITS OF CONSTRUCTION

The Contractor shall confine all operations and personnel to the limits of construction as shown on the plans. There shall be no disturbance whatsoever of any areas outside the limits of construction.

01500.2 CLEANLINESS

The Contractor shall maintain the work and project grounds free from rubbish, debris and waste materials during all phases of the work.

Immediately upon completion of the work but prior to final acceptance, the Contractor shall remove all rubbish, debris, temporary structures, equipment, excess or waste materials and shall leave the work and project grounds in a neat and orderly condition that is satisfactory to the Engineer and Owner.

01500.3 CONSTRUCTION SURVEYING

All work shall be constructed in accordance with the lines, grades and elevations shown on the plans or as given by the Engineer in the field. The Contractor shall be fully responsible for maintaining alignment and grade. Principal controlling points and base lines for locating the principal components of the work together with a suitable number of benchmarks adjacent to the work will be provided by the Engineer. From this information, the Contractor shall verify benchmarks and develop and make all detailed surveys needed for construction. The Contractor shall protect and safeguard all points, stakes, grade marks, monuments and benchmarks at the site of the work and shall re-establish, at his own expense, any marks which are removed or destroyed due to his construction operations.

01500.4 EQUIPMENT AND MATERIAL STORAGE

The Contractor shall plan his activities so that all materials and equipment can be stored within the limits of construction.

01500.5 CONTROL OF EROSION, SILTATION AND POLLUTION

- A. The Contractor shall take whatever measures necessary to minimize soil erosion and siltation, water and air pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control.

The Contractor shall keep himself fully informed of all such regulations which in any way affect the conduct of the work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

The Engineer will limit the area over which clearing and grubbing, excavation, borrow, and embankment operations are performed whenever the Contractor's operations do not make effective use of construction practices and temporary measures which will minimize erosion, or whenever construction operations have not been coordinated to effectively minimize erosion, or whenever permanent erosion control features are not being completed as soon as permitted by construction operations.

- B. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material pits, and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

01500.6 TRAFFIC CONTROL

The Contractor shall provide, erect, and maintain all necessary devices to control traffic and protect the public, the work and workers. All traffic control shall be provided as established in The Manual of Uniform Traffic Control Devices and any and all supplements of the North Carolina Department of Transportation.

In special cases, additional traffic control may be required as directed by the Engineer or by the North Carolina Department of Transportation.

01500.7 ENCROACHMENT/EASEMENT AGREEMENTS

It shall be the responsibility of the contractor to abide by any and all conditions of any and all easements and/or encroachments which are necessary for the accommodation of the work.

01500.8 PAYMENT

The contract prices shall include full compensation for all costs incurred under this section.

02100.1 **SCOPE**

Clearing and grubbing shall consist of the removal and satisfactory disposal of all trees, brush, stumps, logs, grass, weeds, roots, decayed vegetative matter, posts, fences, stubs, rubbish and all other objectionable matter resting on or protruding through the original ground surface and occurring within the construction limits or right-of-way of any excavation, borrow area, or embankment.

02100.2 **GENERAL**

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 under this section shall be performed in a manner which will cause minimum 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.

02100.3 **CLEARING**

The work of clearing shall be performed within the limits established by the plans, specifications, or the Engineer. Clearing shall consist of the cutting, removal, and satisfactory disposal of all wooded vegetation and debris.

Individual trees, groups of trees, and vegetation to be left standing will be clearly marked on the plans or in the field by the engineer. Individual trees and groups of trees designated to be left standing within cleared areas shall be trimmed of all branches to necessary to prevent interference with construction operations. All limbs and branches required to be trimmed shall be neatly cut close to the trunk of the tree or to main branches. When oaks or elms are trimmed during a critical time of year (usually spring for oaks, or throughout the growing season for elms) some type of wound dressing should be applied to the cut. Individual trees, groups of trees, and other vegetation, to be left standing shall be thoroughly protected from damage incidental to construction operations by the erection of barriers or by such other means as the circumstances may require.

Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. When such damages occur, all damaged areas shall be repaired, removed or otherwise resolved utilizing generally accepted practices at the Contractor's expense.

02100.4 **GRUBBING**

The work of grubbing shall be performed within the limits established by the plans, specifications, or the Engineer. Grubbing shall consist of the complete removal and satisfactory disposal of all grassy vegetative matter, root mat, ball and root, soil material high in organic content and surface debris.

Perform the following as part of the work of grubbing:

1. Remove and dispose of crops, weeds, and other annual growth.
2. Remove and dispose of surface debris such as fences, steps, walls, chimneys, column footings, other footings, foundation slabs, basements, other foundation components, signs, junked vehicles, and other rubble and debris.
3. Fill holes and depressions.
4. Cut off and plug at the right of way or construction limits any private water or sewer line intercepted during the construction of the project.
5. Cut off and remove from the right of way or construction area any septic tank or portion thereof intercepted within the right of way or construction area during the construction of the project.

02100.5 **DISPOSAL OF CLEARED AND GRUBBED MATERIAL**

Remove from the project and properly dispose of all vegetation, roots, stumps, tree laps, and timber remaining on the project by a satisfactory method.

When vegetation is disposed of by burning, burn in such a manner as to prevent injury to property within or outside of the right of way. Comply with all local, state, and federal laws, ordinances, and regulations when burning. Secure all necessary burning permits. Perform all burning under the constant care of a competent watchmen. Do not allow smoldering or dense smoke to occur during burning.

02100.6 **PAYMENT**

The contract prices shall include full compensation for all costs incurred under this section.

02200.1 **DESCRIPTION**

The work covered by this section consists of the disposal of waste and debris in accordance with the requirements of these specifications. Waste will be considered to be all excavated, grubbed or removed materials which are not utilized in the construction of the project.

02200.2 **GENERAL REQUIREMENTS**

Waste shall be disposed of in areas that are outside of the project area and provided by the Contractor, unless otherwise required by the plans or special provisions or unless disposal within the project area is permitted by the Engineer.

The Contractor shall maintain the earth surfaces of all waste areas, both during the work and until the completion of all seeding and mulching or other erosion control measures specified, in a manner which will effectively control erosion and siltation.

The following requirements shall also be applicable to all waste or disposal areas other than active public waste or disposal areas:

1. Rock waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practical, and shall be covered with a minimum six (6) inch thick layer of earth material either from project waste or from borrow.
2. Earth waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practicable, but in no case will slopes steeper than 2:1 be permitted.
3. Construction debris, grubbed debris and all broken pavement and masonry shall be covered with a minimum six (6) inch thick layer of earth waste material from the project or borrow. The completed waste area shall be shaped as required above for disposal of earth waste.
4. Seeding and mulching shall be performed over all earth or earth covered waste areas.
5. Where the Engineer has granted permission to dispose of waste and debris within the project area, the Engineer's approval of said disposal will be necessary to insure the satisfactory appearance of the completed project.

Disposal of waste or debris in active public waste or disposal areas will not be permitted without prior approval by the Engineer. Such disposal will not be permitted when, in the opinion of the Engineer, it will result in excessive siltation or pollution.

02200.3 **PAYMENT**

The contract prices shall include full compensation for all costs incurred under this section.

02800.1 **SCOPE**

This section covers the furnishing of all labor, equipment and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations which are not specifically scheduled or specified for topsoil and seeding, paving, landscaping or other surfacing.

02800.2 **GENERAL**

In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, curb and gutter.

Any damage to existing structures shall be repaired using materials and workmanship equal to those of original construction.

02800.3 **SEEDING ALONG PIPELINES**

All ground surfaces along pipelines, which are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with Section 1060 of the NCDOT Standard Specifications for Roads and Structures. Large rocks, clumps of earth and excessive spoil material shall be removed from the area prior to seeding.

Shoulders of all roads shall be restored as specified in section 02800.8 for lawns and landscaped areas.

Wooded areas, not classified as lawns shall be restored to as near their original condition as possible.

02800.4 **CONCRETE SIDEWALKS**

Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Sidewalks are to be constructed in accordance with NCDOT requirements.

02800.5 **DRIVEWAYS****UNPAVED DRIVEWAYS**

For unpaved driveways, the Contractor shall furnish all materials and labor to construct a six (6) inch thick compacted cinder or gravel driveway or roadway. The

aggregate placed shall be Compacted Aggregate Base Course material in accordance with NCDOT Specifications, Item 1008. Driveways shall be left better than their original condition.

CONCRETE DRIVEWAYS

Concrete replacement for driveways shall be reinforced to match the existing concrete driveway reinforcement and shall be six (6) inches thick. Existing concrete driveways that are not reinforced shall be replaced with fiberglass reinforced, six (6) inch thick concrete. Concrete driveways shall be constructed in accordance with NCDOT Specifications, Item 848. Pads that are damaged shall be taken out in their entirety to include approaches to match existing spacing, finish and color as directed by the Engineer.

ASPHALT DRIVEWAYS

Asphalt for driveways shall be placed in accordance with NCDOT Specifications – one (1) inch Asphalt Concrete Surface Course, Type SF 9.5A over two (2) inch Asphalt Binder Grade PG 64-22 over six (6) inch Compacted Aggregate Base Course. The final one (1) inch thickness of Asphalt Concrete Surface Course pavement shall be constructed at the same time that the adjacent street is paved. Patching asphalt approaches is prohibited.

02800.6 **ROADWAY REPLACEMENT**

Asphalt pavement shall be replaced meeting the requirements and specifications of NCDOT.

Concrete Roadways are to be constructed in accordance with Section 848 of the NCDOT Standard Specifications for Roads and Structures. Portland cement concrete roadways shall be replaced with Class B Concrete and shall have equal thickness and reinforcing steel as the original roadway. An aggregate of 6 inches shall be placed prior to the placing of concrete.

Differential settlement of restored pavements shall be corrected immediately.

02800.7 **DITCHES**

Ditches shall be reestablished to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work, unless shown otherwise on plans.

02800.8 **LAWNS AND LANDSCAPED AREAS**

Lawns and landscaped areas shall be regraded and replaced as follows:

- A. Contours shall be restored to preconstruction grades.

- B. Lawn replacement shall be in accordance with the Section 1660 of the NCDOT Standard Specifications for Roads and Structures. Topsoil areas shall be replaced with topsoil of equal quality and quantity.
- C. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

02800.9 **CURB AND GUTTER**

Curb and gutter removed with, or damaged as a result of construction operations, injured or disturbed by the Contractor, his agents, or employees, shall be replaced with new construction in accordance with section 846 of the NCDOT Standard Specifications for Roads and Structures latest edition.

02800.10 **DAMAGE TO STRUCTURES**

Any damage to existing structures shall be repaired by using materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or which cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the Engineer. Replacement costs shall be responsibility of the Contractor.

02800.11 **PAYMENT**

The contract prices shall include full compensation for all costs incurred under this section.

03450.1 **DESCRIPTION**

The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, waterlines, manholes, catch basins, hydrants, gate valves, sewer services, water taps, drainage structures, drainage ditches and other unclassified excavation as may be deemed necessary by the Engineer.

03450.2 **GENERAL**

In general, construct all portions of the excavations so that the safe slope of the earth is not exceeded. Comply with all OSHA requirements and provide a competent person on site to supervise the excavation at all times. Properly and adequately protect any part of the excavation from caving or slipping by the use of sheeting, bracing, or shoring as required. Install all shoring in trench excavations so that it may be withdrawn in stages on both sides of the trenches to prevent lateral movement of the pipe as the backfilling progresses, except where the Engineer permits the shoring to be left in place at the contractor's request. Cut off any sheeting left in place at least twenty-four inches (609.6 mm) below finished grade wherever directed. Remove and properly dispose of the cut off material. Wherever necessary, in quicksand, soft or wet ground, or for the protection of surrounding structures and property, drive sheeting to such depth below the bottom of the excavation as may be necessary. The Contractor may use well points or other methods in lieu of sheeting to stabilize the banks or for protection at the discretion of the Contractor. Take all measures necessary to keep surface water out of the foundations and trenches by diking, ditching, or otherwise avoiding it. Use approved methods for surface drainage.

Keep all excavations free of water while the work is in progress. Water may be removed by pumps or the use of underdrains, whichever will produce the above results. Deposit all excavated material in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Leave hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls unobstructed and accessible at all times. Keep gutters clear or use other satisfactory provisions for street drainage. Do not obstruct natural watercourses. Take whatever measures necessary to control erosion and keep silt runoff from contaminating adjoining property. Do not lay pipe upon a foundation into which frost has penetrated, or at any time, that in the opinion of the Engineer, there is danger of the formation of ice or frost at the bottom of the excavation. The Engineer may at his discretion allow construction

of the pipeline to continue under freezing conditions provided the Contractor promptly backfills the trench as directed. Carefully lower pipe and accessories into the trench with suitable equipment. Do not drop or dump any of the materials into the trench under any circumstances.

Take care to avoid abrasion of the pipe coating. Use wooden poles as levers for removing skids across trenches which have broad flat faces to prevent damage to the pipe or pipe coating.

03450.3 **EXCAVATED MATERIALS**

Excavated materials to be used for backfill will be approved by the Engineer. Where stockpiling of excavated material is required, the Contractor shall take whatever measures necessary to control erosion and prevent silt runoff.

03450.4 **PAYMENT**

The contract prices shall include full compensation for all costs incurred under this section.

05050.1 **SCOPE**

The work covered by this section consists of repairs to existing pavement which are necessary in order to provide a safe, passable, and convenient condition for traffic, or to replace pavement which has been removed in order to remove or to place pipe lines.

Repairing of existing pavement shall include but not be limited to the saw cutting of the existing pavement to a neat vertical joint and uniform line; the removal and disposal of pavement, base, and subgrade material as approved or directed by the Engineer; the coating of the area to be repaired with a tack coat; and the replacement of the removed material with asphalt plant mix.

05050.2 **GENERAL**

Construction of the subgrade, base course and paving shall be undertaken immediately after completion of all underground piping and structures, all curbs and gutters, all yard piping, conduits and other facilities passing beneath paved areas, and all structural slabs and foundations required within or adjacent to the paved areas.

The repairs shall be made in accordance with the plans, or as approved or directed by the Engineer.

05050.3 **WEATHER LIMITATIONS**

Bituminous mixtures shall not be placed during rainy weather, when the subgrade or base course is frozen or shows any evidence of excess moisture nor when the moisture on the surface to be paved would prevent proper bond nor when the air temperature is less than 40 degrees F. in the shade away from artificial heat.

05050.4 **CONSTRUCTION METHODS.**

Repair of existing pavement shall be done as approved or directed by the Engineer. The work shall be coordinated with all other work and operations.

Where traffic is to be maintained, the removal or installation of pipe shall be done in sections so that half the width of the roadway will be available to traffic. Immediately upon completion of the pipeline crossing the paved area, the pavement repair shall be made.

05050.5 **TESTS**

All of the above work will be subject to thickness and compaction tests as deemed necessary by the Engineer. Such tests will be at the Expense of the Contractor.

05050.6 **PAYMENT**

The contract prices shall include full compensation for all costs incurred under this section.

05100.1 SCOPE

The work covered by this section consists 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 or established by the Engineer.

05100.2 MATERIALS

- A. Aggregate base course materials shall consist of crushed stone or uncrushed gravel, or other similar material having hard, strong, durable particles free of adherent coatings.

The Contractor shall furnish aggregate base course material produced in accordance with the requirements indicated herein for Type A, aggregate unless otherwise specified in the special provisions.

All aggregates shall be from approved sources. Sources will not be approved unless the material has satisfactory soundness and satisfactory resistance to abrasion. Satisfactory soundness will be considered to be a weighted average loss of not greater than 15 percent when subject to 5 alternations of the sodium sulfate soundness test in accordance with AASHTO T104. Satisfactory resistance to abrasion will be considered to be a percentage of wear of not greater than 55 percent when tested in accordance with AASHTO T96.

- B. Aggregates shall be handled in such a manner as to minimize segregation.

Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the ground surface shall be firm, smooth, and well drained. A cover of at least 3 inches of aggregate shall be maintained over the ground surface in order to avoid the inclusion of soil or foreign material. Stockpiles shall be built in such a manner as to minimize segregation. When it is necessary to operate trucks or other equipment on a stockpile in the process of building the stockpile, it shall be done in a manner approved by the Engineer.

Stockpiles of different types or sizes of aggregates shall be spaced far enough apart, or else separated by suitable walls or partitions, to prevent the mixing of the aggregates.

Any method of stockpiling aggregates which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by

sieve tests of samples taken from any portion of the stockpile over which equipment has been operated, and failure of such samples to meet all grading requirements for the aggregate will be considered cause for discontinuance of such stockpiling procedure.

- C. Gradation: All standard sizes of aggregates shall meet the gradation requirements when tested in accordance with AASHTO T27.

05100.3 HAULING AND PLACING AGGREGATE BASE MATERIALS

The aggregate material shall be spread on the subgrade to a uniform loose depth and without segregation.

Where the required compacted thickness of base is 8 inches or less the base material may be spread and compacted in 1 layer. Where the required compacted thickness of base is more than 8 inches, the base material shall be spread and compacted in 2 or more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4 inches.

Each layer of material shall have approved by the engineer prior to placing succeeding layers of base material or pavement. Each layer is subject to being sampled, and tested at the engineer's request. The contractor shall pay for failed tests.

No base material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment.

The maximum speed of trucks hauling or traveling over any part of the subgrade or base shall be 5 miles per hour.

The Contractor shall utilize methods of handling, hauling, and placing which will minimize segregation and contamination. If segregation occurs, the Engineer may require that changes be made in the Contractor's methods to minimize segregation, and may also require mixing on the road which may be necessary to correct any segregated material. No additional compensation will be allowed for the work of road mixing as may be required under this provision. 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 at no additional cost to the Owner. The above requirements will be applicable regardless of the type of aggregate placed and regardless of prior acceptance.

05100.4 SHAPING AND COMPACTION

Immediately after the placing of a layer of the base, the Contractor shall begin machining and compacting the layer. Each layer shall be maintained to the required cross section during compaction and each layer shall be compacted to the required density prior to placing the next layer.

Each layer of the base shall be compacted to a density equal to at least 100 percent of that obtained by compacting a sample of the material in accordance with AASHTO T180. Copies of these modified testing procedures are available upon request from the NCDOT Materials and Tests Unit.

The base material shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test methods. The Contractor shall dry or add moisture to the material when required to provide a uniformly compacted and acceptable base.

The final layer of the base material shall be shaped to conform to the lines, grades, and typical sections shown on the plans or established by the Engineer. When completed the base course shall be smooth, hard, dense, unyielding, and well bonded.

05100.5 TOLERANCES

After final shaping and compacting the base, the Engineer will check the surface of the base for conformance to grade and typical section and will determine the base thickness.

The thickness of the base shall be within a tolerance of plus or minus 1/2 inch of the base thickness required by the plans.

05100.6 PAYMENT

The contract prices shall include full compensation for all costs incurred under this section.

06100.1 **SCOPE**

These specifications shall apply to the materials to be furnished and installed to complete the water line installations in accordance with the plans. All pipe and appurtenances shall be of the class and type as indicated on the plans, within the approved materials list and designated herein.

6100.2 **GENERAL**

No unapproved materials will be delivered to the job site.

All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

All pipe, fittings, valves, hydrants, pipe clamps, restraints, flanges, castings, rebar, hatches, inlets, meter and valve boxes, and any other iron and steel products shall be produced in the United States.

Specifications cited shall refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

06900.3 **HANDLING AND STORING MATERIALS**

The Contractor shall use care unloading materials to avoid damage. Material shall not be rolled or dragged over gravel or rock during handling. The Contractor shall store the fittings, valves and appurtenances on sills above storm drainage level and deliver for installation after the trench is excavated. All valves shall be drained and so stored as to protect them from freezing. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

If any defective material is discovered after installation, it shall be removed and replaced with sound material or shall be repaired by the Contractor in an approved manner at his own expense.

06100.4 PIPE

A. Ductile Iron Pipe

Ductile Iron Pipe shall be manufactured in accordance with ANSI Specification A 21.51. All Ductile Iron Pipe shall be Class 350 unless otherwise specified and shall be lined with cement mortar not less than 1/16 inch thick conforming to ANSI Specification A21.4.

1. Flanged Joints

Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

Ductile Iron Flanged joint pipe shall be thickness Class 53 minimum and shall have Ductile Iron flanges conforming to ANSI B 16.1, 125 pound template. Pipe shall be ordered in lengths needed as no pipe shall be cut, threaded or flanged in the field.

In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required. Steel or tap bolts shall be cadmium plated, with good and sound, well fitting threads, so that the nuts may be turned freely by hand. Cadmium plating shall be by an approved process with a plate thickness of 0.0001 to 0.0005 inches

2. Mechanical Joints

All mechanical joints shall be manufactured in accordance with ANSI Specification A21.11. All bolts shall be torqued to manufacturer's specifications. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Slip Joints

Slip or push-on joints shall be manufactured in accordance with ANSI Specification A21.11.

Bells of "slip" joint pipe shall be contoured to receive a bulb shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer.

B. Steel Casing Pipe

See Section 7400.

06100.5 Fittings

Cast Iron and Ductile Iron Fittings

All cast iron and ductile iron pipe fittings shall be mechanical joint in accordance with ANSI Specification A21.10 for underground piping. All ductile iron and cast iron pipe fittings shall be flanged in accordance with ANSI Specification B 16.1 for exposed piping.

All fittings shall be lined with cement mortar not less than 1/16 inch thick in conformance with ANSI Specification A21.4 and suitable for a minimum of 250 psi working pressure unless otherwise specified.

All mechanical joints shall be manufactured in accordance with ANSI Specification A21.11.

06100.6 Gate Valves

All gate valves shall be designed for a working pressure of 200 psi unless otherwise specified and shall have a clear waterway equal to the full nominal diameter of the pipe and shall be opened by turning counterclockwise. Each valve shall have the initials of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by hand wheel or operating nut as herein specified and shall have an arrow cast in the metal indicating the direction of opening. Valves to be installed underground shall be non-rising stem type while valves installed above ground or in buildings and structures shall have rising stems.

A. Gate Valves Up To 2 Inches

Gates valves up to 2 inches shall be all brass, conforming to AWWA C-800.

Each valve shall have a tee handle or hand wheel, whichever is applicable, for valve operation.

B. Gate Valves 3 Inches and Larger

Gate valves 3 inches and larger shall be iron body, resilient-seated meeting the requirements set forth in AWWA Specification C-509.

06100.7 Butterfly Valves

Butterfly valves shall be Mueller Lineseal III valves, self-adjusting, disk seal, Class 150B. Butterfly valves shall conform to AWWA C504 designed for minimum operating pressure of 150 psi with higher pressure valves as needed for each location. Both ends shall be mechanical joint in compliance with AWWA C111 and ANSI A21.11. Valves shall be at least the same class of pipe with which they are used.

06100.8 FIRE HYDRANTS

Fire hydrants shall be Mueller Centurion with 5¼" nozzles, which is the City standard. Refer to the detail **FIRE HYDRANT INSTALLATION** shown on the plans.

06100.9 BLOW OFF VALVES

Blow off valves shall be as shown on the detail **BLOW OFF VALVE** shown on the plans.

06100.10 AIR RELEASE VALVE

Air release valves shall be as shown on the detail **TYPICAL AIR RELEASE VALVE** as shown on the plans.

06100.11 TAPPING SLEEVE

Tapping saddle shall be Mueller #H-615 or approved equal. See detail TAPPING SLEEVE on the plans.

06100.12 MEASUREMENT

Measurement for the contract item Pipe of the various types and sizes will be by the linear foot installed.

Measurement for the contract items Valve, Tapping Saddle of the various types and sizes, Fire Hydrant Assembly, Air Release Valve and Blow Off Valve will be each.

06100.13

PAYMENT

The contract prices will be paid for PIPE of the various types and sizes; VALVE of the various types and sizes;; FIRE HYDRANT ASSEMBLY; AND AIR RELEASE VALVE; which prices shall include full compensation for all costs incurred under this section.

06200.1 APPLICABLE AWWA STANDARDS

C600: Installation of Ductile-Iron Water Mains and Their Appurtenances

C651: Disinfecting Water Mains (Preventive and Corrective Measures During Construction)

06200.2 TRENCH DEPTH AND COVER

The minimum allowable soil cover over a water main must be 3’.

06200.3 SAW CUTTING ASPHALT

Refer to NCDOT specifications and requirements.

06200.4 PREPARATION OF PIPE FOUNDATION

The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the plans for the type of pipe being installed.

The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustment will require the approval of the Engineer.

A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint.

Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than six (6) inches. A suitably tamped and shaped foundation of approved material shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustments in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned according to the undercut detail as shown on the plans or as directed by the Engineer. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

The Contractor shall remove all water by pumping or bailing. No pipe shall be laid until the water has been removed from the trench. Water removed from the trench must be disposed of in such a manner as not to cause damage to work completed or in progress. All necessary measures will be taken to prevent erosion due to the dewatering process.

06200.5 LAYING PIPE

All pipe and appurtenances are to be installed in strict accordance with the manufacturer's specifications and the contract material specifications. No pipe shall be laid except in the presence of the Engineer or his inspector or with special permission from the Engineer.

Water lines shall have thrust blocks constructed at all tees, "Y's", bends, and valves as shown on the plans.

Proper tools, implements and facilities satisfactory to the Engineer shall be provided and used for the safe and proper laying of the pipe. The pipe interior, sealing surfaces, fittings and other accessories shall be kept clean. All pipe and appurtenances will be lowered into the trench piece by piece in such a manner as to provide safe working conditions. The pipe shall be laid on the prepared foundation providing a uniform flow line along the pipe. Pipe shall be removed if broken, damaged or displaced during the laying of pipe or backfilling the trench.

When cutting short lengths of pipe, a pipe cutter as approved by the Engineer will be used and care will be taken to make the cut at right angles to the center line of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or coarse file to match the manufactured taper.

The maximum deflection per joint of flexible joint pipe shall meet manufacturer's specifications. No deflection shall be allowed in galvanized steel pipe joints or concrete pressure pipe joints.

The interiors of pipes, fittings, and valves shall be protected from contamination. Pipe delivered for construction shall be strung to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

06200.6 RELATIONSHIP OF WATER AND SEWER SYSTEMS

The contractor is required to comply with the North Carolina Administrative Code, Rules Governing Public Water Systems.

Lateral separation of water and sewer lines shall be a minimum of 10 feet unless existing conditions prevent a 10 foot lateral separation in which case:

1. The water line is laid in a separate trench, with the elevation of the bottom of the water line at least 18 inches above the top of the sewer line.
2. The water line is laid in the same trench, with the water line located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water line at least 18 inches above the top of the sewer line.

When the water line crosses over a sewer line, the water line shall be laid with the bottom of the water line at least 18 inches above the top of the sewer line. When existing conditions prevent an 18 inch minimum separation both the water and sewer lines shall be ferrous material for a distance of 10 feet on both sides of the point of crossing.

When the water line crosses under a sewer line both the water and sewer lines shall be ferrous material for a distance of 10 feet on both sides of the point of crossing. The water line shall be laid in such a manner as to maximize the distance between the crossing point and any joints.

06200.7 BACKFILLING

Methods of backfilling shall be in strict accordance with the Standard Details.

06200.8 PAYMENT

The contract prices shall include full compensation for all costs incurred under this section.

06900.1 **SCOPE**

This section covers the installation of all necessary fittings, valves and appurtenances for the water distribution system as shown on the plans and specified herein, testing and chlorination.

06900.2 **THRUST BLOCKS**

All plugs, caps, tees, bends, and other fittings shall be provided with adequate joint restraint as shown in the latest set of Standard Details.

If thrust blocks are approved for use by the Engineer, they shall be constructed to the minimum dimensions shown on the drawings or as directed. Thrust blocks shall be made of concrete having a compressive strength of twenty-eight (28) days of 3000 psi when tested in accordance with ASTM Specification C39 or C42 and shall bear directly against the undisturbed trench wall. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three (3) days after installation of the concrete thrust blocks unless otherwise approved by the Engineer. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized. Sakrete or any similar material will not be permitted under any circumstances.

06900.3 **GATE VALVE INSTALLATION**

Before setting each valve the Contractor shall make sure the interior is clean and test opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the plans, and at the exact locations shown. Trench backfill shall be tamped thoroughly for a distance of three (3) feet on each side of valve boxes.

06900.4 **GATE VALVE BOX INSTALLATION**

A valve box shall be installed over each underground valve. All boxes shall be set plumb with their top flush with finished grade.

06900.6 FIRE HYDRANT INSTALLATION

Fire hydrants shall be located as shown. Each hydrant shall be connected to the main with a six (6) inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than eighteen (18) inches above the finished grade. Hydrants shall be thoroughly blocked with concrete or shall be rodded to the six (6) inch branch tee. Unless otherwise specified, the backfill around hydrants shall be thoroughly compacted to the final grade immediately after installation in order to put the hydrant into service as soon as practicable. Not less than seven (7) cubic feet of clean crushed stone shall be placed around the base of the hydrant to insure drainage of the hydrant barrel. A cap block shall be set under the fire hydrant foot for a solid bottom.

06900.7 LINE FLUSHING

Reference is made to AWWA C651. Prior to testing of any sections of water main, the Contractor, using an approved water source, shall completely flush out all lines at a minimum velocity of 2.5 feet per second to clean out any sediment or debris.

06900.8 TESTING

After the pipeline has been satisfactorily constructed complete with the required fire hydrants, services, and all other appurtenances, and the trench backfilled satisfactorily, and after line flushing and approval by the Engineer, the newly constructed pipeline and valved sections shall be subjected to a hydrostatic pressure leakage test. The Contractor shall notify the Engineer when the work is ready for testing with all testing done in the presence of the Engineer. All labor, equipment, water and materials, including meters and gauges shall be furnished by the Contractor at his own expense.

Ductile iron pipe will be tested in accordance with AWWA C600.

Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the tests, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 200 pounds per square inch for a period of two (2) hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

The rate of leakage shall be determined at fifteen (15) minute intervals by means of volumetric measurement of the water added during the test until the rate has stabilized at the constant value for three (3) consecutive fifteen (15) minute periods.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per twenty-four (24) hours.

No leakage will be allowed under the above tests for piping in buildings and structures.

Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury.

Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings.

06900.9 **DISINFECTION**

All piping used for potable water service shall be chlorinated in accordance with the requirements for the State of North Carolina, Department of Environmental Quality, and in accordance with AWWA C651.

Pipe interiors, fittings, and valves shall be protected from contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign matter. When pipe laying is not in progress for more than one hour, all openings in the pipeline shall be closed by watertight plugs. Joint of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plug shall remain in place until the trench is dry.

If dirt enters the pipe that, in the opinion of the Engineer, will not be removed by flushing operations, the interior of the pipe shall be cleaned and swabbed as necessary, with a 5% hypochlorite disinfecting solution.

The Contractor shall provide sampling taps. Generally, sampling taps shall be provided on the water main every 1,000' and at the end of **each** main and at the end of **each** branch, in order to afford representative water testing and sample collection.

Additional sampling taps shall be provided if the main length exceeds ½ mile, at intervals of ½ mile. Taps shall be located and constructed so samples may be easily collected without danger to personnel or likelihood of sample contamination.

Sampling taps may be used as blow-offs. The number and locations of the taps/blow-offs must be approved by the Engineer. Hydrants may not be used for bacteriological sampling.

When long transmission mains are constructed, without side connections, the distance between each tap shall be no more than one-half mile.

The Contractor shall construct taps so that bacteriological samples can be easily collected without danger to personnel or likelihood of sample contamination. The Contractor shall legibly mark each sample tap with identifying letters or numbers for sample reference purposes. The Contractor shall not designate hydrants as taps for bacteriological sampling purposes. If the service or corporation taps are installed before the laboratory tests are completed, each tap will be tested for coliform bacterial.

Before being placed in service, all new mains and existing piping disturbed in any manner by the work shall be disinfected. Draining the water from existing piping or even lowering the water pressure more than one-half will constitute disturbance of the piping.

The disinfecting of water mains, valves and other appurtenances incorporated into the main construction shall be done by means of a chlorinating measuring apparatus, with proper devices for regulating the flow and providing an effective diffusion into the water within the main being disinfected and by application of a chlorine-bearing compound bearing a high-test calcium hypochlorite (65-70% available chlorine). In the preparation of the solution, the powder shall first be made into a paste and then gradually thinned with water to approximately 1% chlorine solution (10,000 parts per pound of powder). This will require about 7.50 gallons of water to each one pound of powder. Solution shall be applied to the main through a rubber hose by gravity, siphonage, injection or by suitable pump feeder.

The point of chlorine application shall be at the beginning of the water main construction and/or any valve section thereof, through corporation cock installed close to and on the downstream side of the regulating gate valve controlling the flow of such proportion to the rate of water flow entering the main that the chlorine applied shall produce fifty (50) parts per million (420 pounds per million gallons) chlorine concentration in the water within the main.

During the disinfecting operation, valves, hydrants, and other mechanical devices controlling the flow of water shall be operated to permit full effectiveness of the

chlorine. Valves shall be manipulated so that the strong solution within the main being sterilized will not flow back into the supply line nor flow into mains already in service. A chlorine concentration test shall be made, in turn, at each of the hydrants and/or taps provided for that purpose.

The tablet method of disinfection may be utilized for disinfection provided the total length of potable water main to be laid is less than 2,000 linear feet of pipe less than 12" in diameter. This method will be suitable only, if in the opinion of the Engineer, the pipeline has been maintained suitable free from foreign matter and any other contaminants during construction.

Final Flushing Tests

After the required period of retention has elapsed, the heavily chlorinated water shall be flushed out in a dry ditch or an area deemed suitable by the Engineers or Inspector. The location at which the heavily chlorinated water is discharged shall be at least 1000 feet from the nearest tributary stream or body of water and care shall be taken to discharge the water in a manner which will not endanger plant or animal life, or cause an erosion problem.

After the required period of retention has elapsed, the heavily chlorinated water shall be flushed out completely to waste by the above mentioned method by the Contractor until the replacement water throughout the length of the main shall, upon test, be proven comparable in quality to the water supply source and meet all state and local requirements.

After the disinfecting operation has been completed and upon test, proved satisfactory, the heavily chlorinated water shall be retained in the main long enough to destroy all nonspore forming bacteria. This period shall be at least twenty-four (24) hours. At the completion of the retention period, the chlorine concentration of the water within the main shall be at least ten (10) parts per million of chlorine. No bacteriological samples shall be collected at points where the free chlorine residual exceeds the ambient distribution system free chlorine by more than 0.5 mg/l.

The Contractor shall request bacteriological sampling on the same day the lines are flushed. Bacteriological sampling shall be performed by a NCDEQ certified laboratory, Monday through Thursday prior to 2:00 PM. The Contractor shall notify the laboratory at least one hour before the bacteriological sampling is required. Samples shall not be collected on Fridays or the day prior to a scheduled holiday. Under no circumstances shall such samples be collected from hydrants or unsterilized hose connections. Should the results of the bacteriological examination prove satisfactory, the main shall remain in service. Should the initial disinfecting fail to result in approval, the disinfecting procedure shall be repeated until satisfactory results are obtained.

07412.1 **DESCRIPTION OF WORK**

The work under this section consists of furnishing all materials, labor, equipment and services required for the complete installation of encasement pipe and carrier pipes under highways and railroads by boring and jacking as shown on the drawings and specified herein.

All work in connection with constructing encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad Agencies. The Contractor shall be familiar with these requirements.

The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

07412.2 **ENCASEMENT MATERIALS**

Encasement pipe shall be smooth wall welded steel conforming to ASTM A139, Grade B. The outside of the pipe shall be coated in accordance with AWWA Standard C203. Minimum pipe wall thickness shall be as follows:

Pipe Nominal Diameter (Inches)	Wall Thickness (Inches)
12%	0.188
14 to 24	0.250
30	0.312
36	0.375

Casing pipe shall have the following minimum sizes:

Carrier Pipe Size (Inches)	Casing Pipe Size (Inches)
4	12%
6	12%
8	14
12	20
16	24

07412.3 INSTALLATION OF ENCASEMENT

Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor's responsibility to notify the Engineer immediately if conditions do not permit a jack and bore installation. The encasement pipe shall be of the diameter indicated for the carrier pipe as shown on the drawing.

Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, sheeting, shoring and bracing for embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously.

Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.

The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Engineer.

The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by the Engineer. The Engineer will direct that this space be filled if the space is large enough to cause any earth settling.

Before the pipe is installed in the casing, pressure creosoted wood blocks shall be rigidly fastened to the barrel of the pipe. After completion of the casing, the Contractor shall insert the pipeline in pre-jointed segments. No contact will be permitted between the casing and the carrier pipeline.

The boring machine shall be accurately aligned before the boring is commenced and the Contractor shall take such necessary steps as are required to accurately place the casing with respect to line and grade.

The leading edge of the steel casing shall be kept as close to the auger head as possible and shall be advanced at the same speed as the earth auger in order to minimize any unsupported holes in the earth.

07412.4 PAYMENT

The contract prices shall include full compensation for all costs incurred under this section.