WATER SYSTEM

OVERVIEW OF CONTENTS

A. **SCOPE** Furnish all material, equipment, and labor required to install water piping, fittings, valves and appurtenances as specified, as shown on the Plans, and as directed by the Engineer.

B. **GENERAL** The Contractor shall construct the water lines, valves, fire hydrants, and appurtenances as shown on the Plans and as specified below. Clearing, grubbing, trench excavation, shoring, backfill, restoration and other related items shall be as specified elsewhere herein. Pipe and accessories shall be new as specified herein or as specifically approved by the Engineer. All pipes, fittings, packing, joint materials, valves and fire hydrants shall conform to the latest edition Section C of the American Water Works Association (AWWA) Standards as a minimum. Other standards referenced in this specification (e.g.; ASTM) are applicable as far as the material or installation conforms to AWWA Section C. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61, Drinking Water System Components-Health Effects. The certifying party shall be accredited by the American National Standards Institute. There shall be no connection between the water distribution system and any pipe, pumps, tanks vessels, hydrants or any other structure whereby unsafe water or other contaminated materials may be discharged or drawn into the water system.

C. CHAPTER 1 - PIPE MATERIALS

The following pipe materials are approved for use within the City of North Augusta water system, however **all water lines 12-inches in diameter and larger shall be ductile iron pipe**. All pipe material shall be as shown on the Plans or as directed by the Engineer. The pressure rating, pressure class, pipe weight, length of pipe, specification reference, and name of manufacturer shall be clearly marked on each length of pipe.

All pipe material, solder and flux shall be lead free (less than 0.2% lead solder and flux less than 8.0% lead in pipe and fittings). At this time the only acceptable pipe materials to be used for potable water conveyance are as follows:

Section 1.0 - Ductile Iron Pipe

Ductile Iron Pipe shall conform to the requirements with ANSI A-21.50 (AWWA C150 & C-151) and ANSI A-21.10 (AWWA C-100). Ductile iron pipe shall be coated and lined as specified in AWWA C-104.

1.00 Ductile Iron Pipe 12-Inch in diameter and smaller shall be pressure Class 350. Unless otherwise shown on the plans or directed by the City Engineer.

1.01 Ductile Iron Pipe 16-Inch in diameter and larger shall be pressure Class 250. Unless otherwise shown on the plans or directed by the City Engineer.

1.02 DI pipe shall have a cement lining meeting the requirements of ANSI 21.4 (AWWAC-104).

1.03 A minimum of 1 mil thick bituminous coating shall be on the outside surface of all DI pipe.

1.04 Pipe shall be clearly marked with manufacturer's name, D.I. or ductile, weight and class.

1.05 Joints shall be either push-on or mechanical joint configuration.

1.06 Ductile Iron Pipe materials shall be new. Pipe that has been previously used for conveying potable water is prohibited.

1.07 Ductile Iron Pipe shall be used for any line where rock is encountered.

Section 1.1 - Polyvinyl Chloride (PVC) Pipe

Polyvinyl (PVC) Pipe shall conform to requirements with ASTM D2241 and AWWA C-900 PVC. All PVC Pipe shall be SDR Class 200.

1.10 PVC Pipe 4- inch through 12-inch diameter pipe shall be ASTM D2241 C-900 SDR 21, Class 200. ***Solvent – weld PVC pipe and fittings shall not be used in water mains four (4) inches and larger.***

1.11 PVC Pipe 2-inch shall comply with ASTM D-2241, SDR 21, and Class 200.

1.12 PVC Pipe material shall be new. Pipe that has been previously used for conveying potable water is prohibited.

1.13 PVC Pipe with a diameter larger than 12-inch shall be prohibited for use in the water system. Ductile Iron shall be used for 12-inch and larger diameter pipe. (See Ductile Iron Section item # 2. for details)

1.14 The storing and handling of the pipe shall be done in a manner acceptable to North Augusta Utilities. All pipe shall be supported within 5' of each end; in between the end supports, there shall be another additional support. The pipe shall be stored away from heat or direct sunlight.

1.15 Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

a. Nominal size
b. Type of material
c. SDR or class
d. Manufacturer
e. NSF Seal of Approval

Section 1.2 - Steel Pipe

When installed as approved by the City Engineer shall conform to AWWA C200 and one of these: ASTM A53 or A120 (Black and hot-dipped Zinc Coated).

Section 1.3 - Non-Approved Materials

The following materials are not allowed in any installation within the City of North Augusta Water System.

a. Asbestos Cement Pipe

b. Thermoplastic Pipe

c. Natural rubber or other material which will support microbiological growth; this includes material that may be used for gaskets, O-rings, or other products for jointing pipes, setting meters or valves, or other appurtenances and which may be exposed to water.

d. Slip-on joint lubricant which will support microbiological growth; this includes the use of vegetable shortening.

e. The installation of used materials of any type is not permitted.

D. CHAPTER 2 - PIPE JOINTING

Section 2.1 - Push-On Joints

Push-on type joints shall be assembled by inserting a continuous, molded, synthetic rubber compound ring gasket in an annular recess in the pipe socket and forcing the spigot end of the entering pipe into the socket, thereby compressing the gasket radically to the pipe to form a positive seal.

The design and shape of the gasket and the annular recess shall be such that the gasket is locked in place against displacement as the joint is assembled. Details of the joint design shall be in accordance with the manufacturer's standard practice.

The size and shape of the gasket shall be suitable to provide adequate compressive force between the spigot and the socket after assembly to affect a positive seal under all combinations of joints and gasket tolerances.

Ductile iron push on joints shall conform to AWWA C-111. PVC push on joints shall conform to AWWA C-900 for 6, 8, and 12-inch pipe and to ASTM D-3139 for 2-inch PVC.

Lubricant for push-on joints shall be non-toxic, shall not support bacteria growth (no vegetable shortening allowed), and shall have no deteriorating effect on the gasket material.

Section 2.2 - Mechanical Joints

Mechanical Joints shall conform to AWWA C-111 and shall have gaskets smooth and free form any porosity or imperfections. Gaskets shall be made of vulcanized synthetic rubber. Bolts for mechanical joints shall be standard, high-strength, heat-treated cast iron tee-head bolts and hexagon nuts meeting the requirements of AWWA C-111.

2.20 The last 8 inches of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned and approved lubricant applied.

2,21 The cast-iron gland shall then be slipped on the spigot end of the pipe. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.

2.22 The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell, being careful to have the gasket evenly positioned around the entire joint.

2.23 The cast-iron gland shall be moved into position for bolting, all bolts inserted, with the nuts finger tight. Bolts shall be tightened alternately to produce an equal pressure on all parts of the gland. A suitable torque-limiting wrench shall be

used with maximum torque as recommended by the manufacturer.

Section 2.3 - Rod Retainer, Bolts and Nuts

2.30 Bolts, nuts, and all-thread rod shall be made of either high-strength cast iron containing a minimum of 0.50 percent copper, or medium carbon steel ASTM A 449 specifications for carbon steel externally threaded standard fasteners, Grade B, having minimum yield strength of 74,000 psi.

2.31 Stainless steel materials shall be Type 316 stainless or better.

2.32 Materials shall be clean, and coated with a rust resistant lubricant.

2.33 Threads shall be in accordance with ANSI B1.1

2.34 Threads shall conform to the coarse thread series with Class 2A internal threads, and Class 2B external threads.

2.35 Bolts three-quarter (3/4") inch and smaller shall be furnished with heavy hex h heads conforming to ANSI B18.2.1.

2.36 Bolts larger than three-quarter (3/4") inch may have either standard or heavy hex heads conforming to ANSI B18.2.1.

E. CHAPTER 3 - PIPE JOINT FITTINGS

3.00 Fittings: Ductile and gray cast iron fittings shall conform to the requirements of the American Standard Specifications, ANSI A21.10/AWWA C110, Ductile-iron and Gray-iron Fittings, 3-inch Through 48-inch for Water and Other Liquids. Standard mechanical joint fittings shall be used. The gaskets shall be the proper kind for attachment with the type of pipe being used.

3. 10 Exterior Protective Coatings: All ductile and gray cast iron fittings shall be given an outside bituminous coating, as stipulated in the ANSI A21.10 and shall be coated with the pipe manufacturer's standard (10 to 20mils dry film thickness) outside coating, coal tar, or asphalt base material per AWWA C151 or fusion-bonded epoxy in accordance with ANSI A21.16 (AWWA C116).

3.11 Interior Protective Coatings: Fittings shall be lined with Enameling or a thin cement lining in accordance with American National Standard ANSI A21.4/AWWA C104, Cement-mortar lining for Ductile Iron Pipe and Fittings. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining accordance with the pipe manufacturer’s standard A21.4 AWWA C104.

3.12 Underground piping shall have mechanical or push-on joints. Above ground and interior piping shall have flanged joints.

F. CHAPTER 4 - PIPE INSTALLATION

Section 4.0 - Inspection of Materials

A careful field inspection shall be made of all material before installation. Materials and accessories shall be handled with care to insure delivery and installation in a sound, undamaged condition. Particular care shall be taken to protect the linings and coatings from damage. Pipe and accessories shall be examined for defects and tapped with a light hammer to detect cracks prior to installation. All damaged, defective or unsound materials as determined by the Engineer shall be removed from the job site.

Section 4.1 - Alignment and Grade

4.10 All pipes shall be laid and maintained to the required lines and grades. Fittings, valves, and hydrants shall be at the required locations and with joints centered, and all valves, hydrant and stems plumb.

4.11 Temporary support and adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the contractor.

4.12 Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the contractor in cooperation with owners of such utility structures.

4.13 All pipe shall be laid to the depth shown on the contract drawings or as required by the Engineer in writing. The depth shall be measured from the established street grade or the surface of the permanent improvement to the top of the pipe barrel. This depth shall not be less than thirty inches (30”).

Section 4.2- Excavation of Trench

4.20 The trench shall be dug to the required alignment and depth shown on the drawings and/or as specified above only so far in advance of pipe laying as North Augusta Utilities shall permit. The trench shall be braced and drained when necessary so that workmen may work therein safely and efficiently.

4.21 The trench width at the ground surface may vary with, and depend upon, its depth and the nature of the ground encountered. The minimum clear width of un-sheeted or sheeted trench measured at the horizontal diameter of the pipe shall be 18-inches, or one foot greater than the outside diameter of the barrel of the pipe, whichever is greater. The maximum clear width of trench at the top of the pipe shall be not more than the outside diameter of the barrel of the pipe plus two feet.

4.22 The pipe shall be laid on firm soil, cut true and even to afford bearing for the full length of the barrel of the pipe, or on earth mounds.

4.23 Any part of the trench excavated below grade shall be corrected with thoroughly compacted material approved by the City of North Augusta Engineering Department.

4.24 When an unstable subgrade condition is encountered, an additional depth shall be excavated and refilled to pipe foundation grade with crushed stone or other suitable material as required to achieve a satisfactory trench bottom.

4.25 Ledge rock, boulders, and large stones shall be removed to provide clearance to each side of, and below, all pipe and accessories. This clearance for pipe and accessories shall be six inches.

4.26 Excavations below subgrade in rock or in boulders shall be refilled to subgrade with material approved and thoroughly compacted.

4.27 Wherever necessary to prevent craving, trench excavations in soils such as sand, gravel, and sandy soil shall be adequately sheeted and braced. Where sheeting and bracing are used, the trench width shall not be less than that specified above. As backfill is placed, if sheeting is to be withdrawn, it shall be withdrawn in increments not to exceed one foot, and the void left by the withdraw sheeting shall be filled and compacted.

4.28 All excavated materials shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

4.29 The use of trench-digging machinery will be permitted except where its operations will cause damage to trees, buildings, or existing structures above or below the ground. At

such locations, methods by hand shall be employed to avoid such damage.

4.29.1 To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, warning lights and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic use. Whenever required, watchmen shall be provided to prevent accidents. Rules and regulations of the local authorities regarding safety provisions shall be observed.

4.29.2 Excavations for pipe laying operations shall be conducted to cause the least interruption to traffic: Hydrants under pressure, valve-pit covers, valve boxes, curb-stop boxes, fire or police call boxes, or other utility controls shall be unobstructed and accessible during the construction period.

4.29.3 Adequate provisions shall be made for the flow in sewers, drains, and water courses encountered during construction. The structures which may have been disturbed shall be satisfactorily restored.

Section 4.3 Preparation of Trench Bottom

Pipe shall be laid directly on a trench bottom containing coupling holes so as to provide continuous contact with the pipe between coupling holes.

4.30 Coupling Holes: Prior to lowering pipe into the trench, a coupling hole shall be dug in the trench bottom having a length, width, and depth to allow assembly and to maintain a minimum clearance of two inches (2”) between coupling and undisturbed trench bottom.

4.31 Shaping Trench Bottom: Prior to lowering pipe into the trench, the trench bottom between coupling holes shall be made flat and cut true and even to grade so as to provide continuous contact of the trench bottom with the pipe.

Section 4.4 - Lowering Pipe and Accessories into Trench

4.40 All pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench using suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

4.41 The pipe and accessories shall be inspected for defects prior to lowering into trench. Any defective, damaged, or unsound material shall be repaired or replaced.

4.42 All foreign matter or dirt shall be removed from the interior of pipe before lowering into position in the trench. Pipe shall be kept clean.

Section 4.5 Installation of Pipe

Installation of water mains and appurtenances shall be conducted in accordance with Section C of the American Waterworks Association (AWWA) Standards and/or manufacturers recommended installation procedures.

4.50 Pipe Bedding -- continuous uniform bedding shall be provided in the trench for all buried pipe. After a length of pipe has been placed in the trench with the spigot end forced home in the bell of the adjacent pipe, it shall be brought to the correct line and grade, and secured in place by tamping in layers to a sufficient height above the pipe to adequately support and protect the pipe. Backfill must be of an approved material. Stones other than crushed bedding shall not come into contact with the pipe and shall not be within six (6) inches of the pipe.

4. 51 Whenever pipe laying is not in progress, the open ends of pipe shall be closed either with a watertight plug or by other approved. means. If there is water in a trench, this seal shall be left in place until the trench has been pumped completely dry.

4.52 The pipe shall be cut so that valves, fittings, or closure pieces can be inserted in a neat and workmanlike manner and without any damage to the pipe. After cutting, all burrs and sharp edges shall be removed and the exterior of the spigot end suitably beveled to facilitate assembly.

4.53 Properly restrained bends shall be used for all major alignment changes. Joint deflections shall only be used for minor alignment changes necessary to avoid obstructions. Long radius curves by joint deflection shall only be used if approved by the Engineer. In any event, joint deflectors shall not exceed manufacturer's recommendations, or that necessary for the joint to be satisfactorily made.

4.54 All pipe shall be joined in the exact manner specified by the manufacturer of the pipe and jointing materials.

4.55 Pipe shall be laid with the bell facing in the direction of laying. No blocking of the pipe barrel above the trench bottom will be permitted.

4.56 All mains shall be detectable within three and one-half (3-1/2) feet with electronic locating equipment.

4.57 Where the minimum cover of thirty (36) inches cannot be provided, pipe shall be ductile iron, or other approved material and method approved by SCDHEC, and, when necessary, insulated to prevent freezing.

4.58 All water mains shall be located out of all contaminated areas. If the main must run through a contaminated site, the main material must protect the water system from being contaminated (e.g. Ductile Iron Pipe with chemical resistant gaskets). Rerouting the water line if possible.

G. CHAPTER 5- SEPARATION OF WATER MAINS AND SEWERS

5.10 Water Mains and Sewers shall be separated in accordance with South Department of Health and Environmental Control's State Primary Drinking Water Regulation R.61-58.4.D.(12)(a)-(f).

5.11 Water lines will be permitted to cross perpendicular over sanitary sewer lines when a vertical separation of 18-inches can be maintained and the water line will be located above the sewer line. Where a water line crosses over a sanitary sewer, a full length of pipe shall be used with its joints straddling the sewer.

5.12 Where a water line is to be parallel to a sanitary or storm sewer, it shall be laid at least 10 ft from the sewer, Where approved when supported by date from the design engineer, water lines may be permitted closer than this on a case-by case basis, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on the one side of the sewer. The elevation of the bottom of the water main must be at least 18-inches above the top of the sewer.

5.13 Special Conditions: When it is impossible to obtain the distances specified in Section 5.10 (State Primary Drinking Water Regulation), the City may allow an alternative design. Any alternative design shall:

1. Maximize distances between the water main and sewer line and the joints of each;

2. Use materials which meet the requirements R.61-58.4(D)(1) for the sewer line; and,

3. Allow enough distance to make repairs to one of the lines without damaging the other.

5.14 Drain-fields and Spray-fields: Potable water lines shall not be laid less than twenty-five (25) feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by SCDHEC.

5.15 No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no other practical alternative, provided that ductile iron is used, no joints of the water line are within the storm sewer or catch basin and the joints are located as far as possible from the storm sewer or catch basin.

5.16 Force Mains: There shall be at least a ten (10) foot horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen (18) inch vertical separation at crossing in all cases whether the water main is

either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line.

5.17 Chamber, pits or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

H. CHAPTER 6 - WATER SURFACE CROSSINGS

Section 6.0 Above and Underwater Water Crossing

6.00 Underwater Crossings: A minimum cover of two (2) feet shall be provided over the pipe. When crossing water courses which are greater than fifteen (15) feet in width. The following shall be provided:

6.01 The pipe shall be protected from damage, freezing, anchored, supported and accessible for repairs or replacement.

6.02 The pipe material and joints shall be designed appropriately.

6.03 Valves shall be located so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding.

6.04 A blow-off shall be provided on the side opposite the supply service, sized in accordance with R.61-58.4(D)(7) SCDHEC State Primary Drinking Water Regulations. Blow-offs shall not be directed toward creeks or other water bodies without proper precaution being taken to de-chlorinate prior to discharge.

6.05 The pipe material shall be Ductile Iron Mechanical Joint and designed appropriately.

I. CHAPTER 7 - INSTALLING PIPE BY JACKING AND BORING

Where water mains are to be installed within paved streets, roadways, sidewalks, etc., and it is undesirable to install pipe under this surface by means of an open cut trench, the contractor will install this pipe by jacking and boring.

Section 7.0 - Steel Casing for Highway Crossings

7.00 Only ASTM A 139, Grade B steel pipes, recently primed and coated with hot coal tar enamel to a dry film thickness of 100 mils minimum shall be used.

7.01 The casing pipe shall have a minimum inside diameter and a minimum wall thickness as specified by the Engineer. The Engineer shall be responsible for determining if the minimum sizes and thickness shown on the approved drawings are adequate for placing the casing under the highway and for installing the carrier pipe.

7.02 Only ductile iron pipe shall be used inside steel casings unless specifically approved otherwise by the City of North Augusta Engineering Division.

7.03 Ductile iron pipe shall be supported by 360 degree stainless steel carrier spacers.

J. CHAPTER 8 - IDENTIFICATION TAPE AND DETECTION WIRE

8.00 A copper wire or metallic identification tape shall be installed over the pipe and within one foot of finished grade.

8.01 The wire or tape shall be stubbed up at each valve location and left accessible inside the valve box. The wire shall form a continuous loop in the water system. Insulation shall be stripped from each wire where spliced together. Bare copper wires shall be covered with a water proofing tape to prevent corrosion.

K. CHAPTER 9 - VALVES

Valves shall be furnished and installed as shown on the plans, as specified, or as directed by the Engineer. Unless otherwise noted, valves shall be furnished with mechanical joint connections for buried service and flanged joints for non-buried service. All valves shall be opened by turning counterclockwise and shall have an arrow cast into the metal of the operating nut or in the handle to indicate direction of opening. Each valve shall have the manufacturer's name, year made, and pressure rating cast on the body.

Section 9.0 - Gate Valves

9.00 Gate valves shall have a full opening equal to the size of the pipe on which they are installed and shall open by turning counterclockwise.

9.01 Gate valves shall be iron body, bronze mounted, double disc parallel seat valves with hub, mechanical joint, or flanged ends, as called for on the plans or in the proposal form. Mechanical joints shall be used unless other configuration specified in plans.

9.02 All valves installed below ground shall be non-rising stem type with two-inch square operating nut, marked to indicate the direction of opening. All valves installed above ground shall be outside stem and yoke (OS&Y) type equipped with hand wheel for manual operation, marked to indicate the direction of opening.

9.03 Gate valves shall meet the requirements of A.W.W.A. C509, specifications for gate valves for ordinary water service. Valves shall be tested at a minimum pressure of 300 pounds per square inch hydrostatic pressure for working pressures up to 150 pounds per square inch, and 400 pounds per square inch for working pressures of over 150 pounds per square inch.

9.04 Valves shall be furnished with double "O" ring seal, and stuffing boxes shall be bronze bushed, providing complete bronze sealing surface for "O" rings. Valves shall be M & H Valves or Mueller No. A02370-20 or approved equal. Two-inch gate valves shall be Mueller # A-2360-8 or equal with square operating nut.

Section 9.1 - Tapping Valves

Tapping valves and mechanical joint sleeves shall be furnished and installed at the locations shown on the plans. The tapping valve shall conform in all respects to Section 9.0 as specified. The Contractor shall verify the material and size of the pipeline

to be tapped. Valves and sleeves shall be manufactured by the Mueller Company, or approved equal.

Section 9.2 - Butterfly Valves

Butterfly valves shall conform to AWWA Standard C504, for Class 150B, unless otherwise specified.

9.20 Suitable for two way flow.

9.21 Valve body to be cast iron ASTM A126, Class B or cast iron ASTM A48, Class 40 or ductile iron per ASTM A536, Grade 65-44-12.

9.22 Body ends to be flanged, ANSI B16.1, Class 125, for all exposed locations and all valves larger than 48 inch.

9.23 Provide mechanical joint ends, AWWA C-111, for buried valve 48-inch and smaller.

9.24 Furnish disc of Ni-Resist (ASTM A436 Type I) or ductile iron (ASTM A536). Disc to be offset design, providing 360 uninterrupted seating, with 90 operations from full closed to full open position.

9.25 Resilient seats to be synthetic rubber (BUNA-N).Seat may be located in the valve body or attached to the disc. Mating material for resilient seat to be 18-8 Type 304 stainless steel. Seats to be field adjustable around the full 360 circumference and field replaceable.

9.26 Shafts to be turned, ground and polished, constructed of 18-8 Type 304 stainless steel. Shafts may be of one piece or two piece stub design.

9.27 Valve bearings shall be of Teflon or other self-lubricating material designed for a bearing pressure not to exceed 1/5 of the compressive strength of the bearing material.

Section 9.3 - Air Relief Valves

Air relief valves shall be provided in accordance with sound engineering practices at high points in water mains as required.

9.30 Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

9.31 The open end of an air relief valve from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

Section 9.4 - Valve Boxes

All underground valves shall be installed with cast iron valve boxes having a suitable base and shaft extension sections to cover and protect the valve and permit easy access and operation. Box assemblies shall be Clow F-2450, Grinnell, Mueller, or an approved equal.

9.40 Extension sections shall be furnished with the boxes when required for valves installed at depth below the minimum required depth for main installation.

9.41 The word WATER shall be cast on covers for valve boxes on potable waterlines only. A 24" X 24" X 4" concrete pad shall be placed around all valve boxes not located in paved areas.

Section 9.5 - Valve and Box Installation

9.50 Valves and valve boxes shall be installed throughout the water system as shown on the Plans or as directed by the Engineer.

9.51 Valves and valve boxes shall be plumb and valve boxes shall be centered directly over the valve operating nut.

9.52 Earth fill shall be carefully tamped around valve box to 3 feet on all sides or to the undisturbed face of the trench, if less than that distance.

9.53 Stuffing boxes shall be tightened and the valve shall be inspected in both opened and closed positions to see that all parts are working.

9.54 All piping and valves shall be properly and adequately supported to prevent movement or undue strain on the piping and equipment.

L. CHAPTER 10 - FIRE HYDRANTS

Fire hydrants shall be Mueller Centurion 200 (Red in Color).

The Contractor shall furnish and install fire hydrants as shown on the plans or as directed by the Engineer. Fire hydrants shall be three-way, cast iron body, of the dry head, breakable traffic type with breakable safety flange at the ground line, and shall meet AWWA C502 Specifications for Fire Hydrants, or latest revision. Rated working pressure shall be 250 p.s.i.g.

Section 10.0 Setting Fire Hydrants

10.0 The interior of the hydrant shall be thoroughly cleaned of all foreign matter prior to installation. Hydrant drains shall not be connected to or located within ten (10) feet of sanitary sewers.

10.1 Hydrants shall be jointed to the main with a six-inch (6”) pipe branch controlled by an independent six-inch (6”) gate valve.

10.2 Hydrants shall be set plumb with the bury line at the ground surface and at such elevations that the connecting pipe shall have at least 36 inches cover over pipe. Furnish and install hydrant extensions as necessary to ensure proper elevation.

10.3 Whenever hydrants are set in soil classified as impervious, a drainage pit two feet in diameter and two feet deep shall be excavated below each hydrant. The pit shall be filled compactly with course gravel or broken stone mixed with course sand, under and around the bowl of the hydrant to a level six inches (6”) above the waste opening. No hydrant drainage pit shall be connected to a sewer.

10.4 Earth suitable for backfill shall be carefully placed in six-inch layers and carefully tamped.

10.5 A reaction or thrust backing shall be provided at the bowl of each hydrant and shall be so placed as not to obstruct the drainage outlet of the hydrant, or the bowl of the hydrant.

10.6 Where conditions are such that the bearing value of the trench wall will not provide satisfactory support, the Contractor will be required to furnish and install mechanical joint restraint or and tie rod harnesses to hold the fittings and pipe line in place.

10.7 Not less than seven cubic feet of crushed or broken stone shall be placed around the base of the hydrant to insure drainage.

10.8 After installation, each hydrant and valve shall be inspected in both opened and closed positions to assure that all parts are in satisfactory working condition.

10.9 Immediately following installation, all fire hydrants shall be securely covered with a polyethylene bag bearing the words “Hydrant Out of Service”, or some other indication that the fire hydrant is not active. Plastic "garbage" bags are not acceptable

10.10 The hydrant bag shall remain in place until a SCDHEC Permit to Operate is issued.

M. CHAPTER 11 - SERVICE CONNECTIONS

A separate tap shall be made for each residence and/or business. The tap to the main shall be made with a tapping saddle of cast-iron or double stainless steel strapping construction. Unless otherwise noted on drawings, all taps, fittings, and service tubing shall be ¾" diameter.

11.0 All tapping of mains shall be done in the upper half of the pipe and approximately at 45° angle from the vertical.

11.1 Tapping saddles shall be of cast-iron or double stainless steel strapping construction.

11.2 Service tubing shall be type K copper. that meets ASTM B-88 specifications. Tubing shall be sized the same as with compression fittings installed by properly bending and not crimping the tube. Tubing shall be continuous without splices unless required length exceeds 100 feet. No polyethylene, plastic, steel, or any other tubing material will be allowed.

11.3 Corporation stops and curb stops shall be ¾" Ford, Ford angle meter valve #KV43332W compression fitting with locking wing, or approved equal. All curb stops and angle valves shall be made of brass.

11.4 All services shall be located at the center of the lot or unit unless otherwise noted in drawings. The concrete curb shall be stamped with a “W” while the concrete is wet, to designate the tap location. The stamp shall be provided by the City of North Augusta.

N. CHAPTER 12 - METER BOXES AND VAULTS

Meter boxes shall be either concrete or cast iron of the proper and necessary dimensions to accommodate the particular size meter to be housed. The box shall be large enough so that the particular size meter housed by it can be removed without disturbing the box.

12.0 The cover for the box shall be of cast iron Brooks or equal and such that it can be easily removed by one man for purposes of providing easy access to the complete meter assembly and cut off.

12.1 Service connections 3/4" through 1” (inch) meter box bases shall be made of heavy gage polybutelene plastic.

12.2 Service connections 1-1/2” (one – and - one- half inch) through 2” meter box bases shall be made of cast iron.

12.3 Service connections 3” and larger bases shall be made of concrete and the lid shall be made of stainless steel cast into concrete.

12.4 The box shall have a depth of not less than fifteen inches (15”).

Meter Boxes, pits, vaults or manholes containing valves, blow-off, meters, air release valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

O. CHAPTER 13 - REACTION SUPPORT

All ductile iron and cast iron material associated with the installation of all below-grade hydrant barrels and risers, valves, fittings, restraint couplings and pipe shall be poly-wrapped in accordance with ANSI A21.5 (AWWA C105) Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids Thickness: 8 Mils

13.0 Concrete mix used for thrust blocking shall have a 28-day compressive strength of no less than 3,000 pounds per square inch.

13.1 Place blocking between the undisturbed ground and the fitting to be anchored. Place the blocking so that the pipe and fitting joints will be accessible for repairs, unless otherwise shown.

13.2 Thrust blocking is required on all water lines greater than two and one-half (2.5") inches in diameter.

13.3 Thrust blocking must also be installed on all lines two and one-half (2.5") inches and smaller if the joints are of the slip-joint type.

13.4 Sufficient thrust block bearing shall be installed to distribute the thrust onto undisturbed earth at a rate not exceeding the allowable soil bearing value.

13.5 Where conditions are such that the bearing value of the trench wall will not provide satisfactory support, the Contractor will be required to furnish and install mechanical joint restraint or and tie rod harnesses to hold the fittings and pipe line in place.

13.6 Mega lug retainer glands or equivalent shall be used for all mechanical joints three (3") inches and larger. Where appropriate and as designated by the City Engineer. Mega lug retainer glands shall be used in combination with blocking.

P. CHAPTER 14 - CROSS-CONNECTION CONTROL DEVICES

Section 14.0 Cross-Connection Control

14.00 All fire lines for sprinkler systems , except those in the high hazard category, as well as irrigation lines shall be protected by an approved testable double check valve. Facilities involved with medical treatment or food processing, for example, will also require a backflow prevention device. Any water supply project involving the use of a reduced pressure backflow prevention device or double check valve assembly will not be given final approval for operation until the backflow prevention devices have been tested by a SCDHEC certified tester and test results submitted to the City of North Augusta Building Standards Division. Backflow prevention devices must be on the SC DHEC approved list. The person testing backflow prevention devices must be a SCDHEC certified tester.

14.01 No piping systems which by-pass an installed backflow prevention device (or preventer) shall be allowed under any circumstances, unless the bypass is also equipped with an equal, approved back-flow prevention device.

14.02 High hazard category cross-connections shall require an air gap separation or an approved reduced pressure back-flow preventer.

14.03 Reduced pressure principal back-flow prevention assemblies may not be installed in any location subject to possible flooding. This includes pits or vaults, which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be two (2x) times the size of the line entering the back-flow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.

14.04 All piping up to the inlet of the back-flow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

14.05 Backflow preventers must be on the SCDHEC list of approved backflow prevention devices, and shall be installed in a manner approved by the City of North Augusta and in accordance with local plumbing codes and all applicable requirements of the SCDHEC State Primary Drinking Water Regulations 26.

For residential protection, the Utilities Division will install Residential Dual Check Valve for the customer. The customer shall be aware that the installations of a residential dual check valve results in a potentially closed plumbing system within the residence. As such, the owner may need to provide for thermal

expansion within their closed system, i.e., pressure relief valves and/or the installation of thermal expansion devices.

There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.

14.08 Testing of backflow preventer is required immediately after installation, repairs or replacement.

Q. CHAPTER 15 - BLOW OFFS

Blow-offs shall be located in a box or structure that facilitates proper use. The orifice shall be provided on fixed piping, in the valve box.

Blow-offs shall not be directed towards roads or so that the water will flow into creek etc. At stream crossings direct away from streams, over ground.

No flushing device shall be directly connected to any sewer.

Blow-off Orifice Sizes

Pipe Diameter	Minimum (GPM) Flow Required	Orifice Size
2”	25	0.75”
2.5”	40	1”
3”	60	1.25”
4”	100	1.5”
6”	220	2”
8”	400	2.5”
10”	612	Fire Hydrant
12”	882	Special/BO
14”	1200	Special/BO
16”	1570	Special/BO

R. CHAPTER 16 - TESTING

Section 16.0 Testing Water Distribution System

Each valve shall be tested in the closed position after the water line test. Pressure test shall be maintained for at least two hours at a full test pressure. Leaks, if found, shall be immediately repaired.

16.00 The contractor shall provide all necessary equipment, gauges, labor, tools, and services, and shall perform all work required in connection with testing water mains, laterals, and service lines. An official of the City of North Augusta must be present to witness the tests.

16.01 Each valve section of water main shall be slowly filled with water, with care being taken to expel all air from pipes. If hydrants of blow-offs are not available at high points in the main, the pipe shall be tapped at high points to vent the air, and shall be plugged at completion of tests.

Section 16.1 - Pressure Test

The Contractor shall conduct hydrostatic and leakage tests on all piping, valves and successfully meet a pressure test of 150% of its working pressure, but not less than 150 psi, in accordance with AWWA C-600, hereinafter specified and as directed by the Engineer.

16.10 The duration of each pressure test shall be at least two hours.

16.11 All exposed pipes, fittings, valves, and hydrants shall be carefully examined during the test. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequences of this pressure test shall be removed and replaced with sound material in the manner specified. Repeat the test until the results are satisfactory.

Section 16.2 - Leakage Test

After the pressure test is completed, a leakage test shall be conducted in accordance with AWWA Standard C651. The leakage test shall be conducted by measuring the amount of water which enters the test section under test pressures for a period of at least two hours. All measuring devices shall be furnished by the Contractor.

16.20 During the test, the main shall be subjected to a pressure of 150 pounds per square inch.

16.22 No pressure pipe installation will be accepted until leakage is less than the number of gallons per hour for each section tested, as determined by one of the following formulas:

P.V.C. Pipe		Ductile Iron Pipe
$L = \frac{ND \times avgP}{7400}$	or	$L = \frac{SD\ avgP}{133.2}$

L = Allowable leakage in gallons per hour
N = Number of joints in the length of line under test
D = Nominal diameter of pipe, in inches
P = Average test pressure (avgP), in psi
S = Length (Ft.)

16.23 Should any test of pipe laid disclose leakage greater than that specified, the defective joints shall be located and repaired until the leakage is within the specified allowance.

S. CHAPTER 17 - DISINFECTION PROCEDURES FOR COMPLETED WATER DISTRIBUTION SYSTEM

17.00 - After being tested, as described above, all newly installed water mains and repaired portions of or extensions to existing water mains shall be thoroughly flushed, disinfected, and subjected to bacteriological tests. Disinfection shall comply with American Water Works Association (AWWA) Standard C651, Disinfection of Water Mains. In general, one approved method known as "continuous feed" method is as follows:

1. Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.

2. The solution shall be retained in the pipeline for not less than twenty-four (24) hours and then flushed throughly with a potable water of satisfactory bacteriological quality before starting the sampling program.

17.01 The newly laid main shall be thoroughly flushed with water from the existing distribution system or some other source approved by the City of North Augusta Engineering Department. Flushing shall be at a sufficient rate to produce a minimum velocity of 2.5 feet per second in the main. After thorough flushing has been completed. Chlorine for disinfection shall be applied and maintained at a minimum of 50 mg/l available chlorine. To ensure that this concentration is maintained, the chlorine residual shall be measured at regular intervals.

Chlorine may be applied by the following ways:

a. As chlorine gas-water mixture: The chlorine solution shall be applied by means of a solution-feed chlorinating device.

b. As a solution of calcium hypochlorite powder in water: Calcium hypochlorite shall be the commercial product known as H.T.H., Perchloren, or Maxochlor, or approved equal. The solution consisting of five percent (5%) powder and ninety-five percent (95%) water by weight shall be prepared.

17.03 Table I shows how much chlorine is needed for each 100' of line for pipes of various diameters. A 1% chlorine solution may be prepared either with 1 pound of calcium hypochlorite for each 8.5 gallons of water or with sodium hypochlorite.

TABLE I

CHLORINE REQUIRED TO PRODUCE A 50 MG/L CONCENTRATION IN 100 FEET OF PIPE, BY DIAMETER

Pipe Size (Inches)	100% Chlorine Solutions (Pounds)	1% Chlorine (Gallons)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
14	0.328	3.96
16	0.428	5.12
18	0.540	6.48
20	0.680	8.00
24	0.980	11.52

17.04 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 or other connection insuring treatment to the entire line. The chlorinating agent shall be fed into the new line slowly.

17.05 While the chlorine is being applied, the valves shall be manipulated so that the treatment dosage will not flow back into the line that is supplying the water. The application of chlorine shall be continued until the entire line being treated is filled with the chlorine solution. Then the chlorinated water shall be retained in the line for at least 24 hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After 24 hours, the treated water shall have a chlorine concentration of at least 25 mg/l throughout the line.

17.06 After the application retention period, the heavily chlorinated water shall be flushed from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system. Such flushing shall be performed only at sites where there is adequate drainage.

17.07 The velocity of the water used to flush a line shall be at least 2.5 fps.

17.08 Once the line has been flushed, tests shall be performed to make certain that the rendered chlorine in the water is within acceptable limits.

17.09 Flushing shall not be considered a substitute for taking preventive measures before and during the laying of water lines.

T. CHAPTER 18 - BACTERIOLOGICAL TESTS

18.00 After a potable water line has undergone final flushing, following the disinfection but before it is placed into service, a sample shall be collected for bacteriological testing from the end of that line. In the case of extremely long lines, additional samples shall be taken as the City of North Augusta Engineering Department request.

18.01 The contractor or owner shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet.

18.02 Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.

18.03 These samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria. The chlorine residual must also be measured and reported.

18.04 If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated. All samples must be analyzed by a State certified laboratory.

ADDENDUM

DESIGN CRITERIA
CITY OF NORTH AUGUSTA
PUBLIC WATER SUPPLY SYSTEMS

(PREPARED BY ENGINEERING DEPARTMENT)

All water supply systems shall be designed in accordance with the *South Carolina DHEC "State Primary Drinking Water Regulations*" and these following requirements:

Design of Water Supply: Any proposed addition of to the City of North Augusta municipal water supply should address the following items with **design data** and **design calculations** which include.

1. Maximum instantaneous flows, based on what's being served. Refer to tables **1**, **2**, and **3** (end of this section).

2. Number and types of proposed service connections.

3. Fire flow requirements. *Should equal 500 + 1/5 (or 20%) of the maximum instantaneous flows.*

4. **Flow tests conducted from a location near the tie-on site must be submitted.** Each test must include the following : static and residual pressures using a flow greater than the proposed demand for this project: the distance, pipe size(s), and pipe material(s) from the test point to the tie-on site; elevation at the test point; and the date, time , and duration of each test. Design calculation shall be based upon flow test(s) *conducted within the last twelve (12) months.*

5. Design head loss calculations, including elevation changes shall show **25 psi minimum residual** when either instantaneous demand occurs or when flushing flow in excess of peak hourly flow occurs, whichever is greater. ***The normal working pressure in the system shall not be less than 35 psi.***

6. No line *extension* shall be made of an existing line when the existing line does not meet the minimum pressure and flow requirements.

7. *Avoid dead-end lines if possible.* ***Check lines less than 200 feet*** to ensure that they may avoid stagnant water in the lines in addition to maintaining chlorine residual. Include a plan to extend these lines within one year of acceptance by the City.

8. Blow-offs required where changing pipe size, unless engineer can demonstrate that there is adequate pressure to flush the lines. Plans should specify size of blow-off. Dead end lines shall be provided with a fire hydrant if flow and pressure

are sufficient, or with a blow-off valve in a box for flushing purposes, *except for lines*: *200 ft or less in length will not require blow-offs, unless specifically required by the City*.

9. *Post-type hydrants are not used in the City* and therefore are not an adequate design flushing means. Standard fire hydrants are required on lines 6-inch in diameter and greater.

10. Lines 10 inches in diameter and larger require flows in excess of 500 GPM to achieve a 2.5 ft /second (FPS) scouring velocity. This requires a standard fire hydrant or other approved blow-off, for flushing designed to provide at least 500 GPM in excess of peak hourly flow *and a minimum residual pressure of 25 psi*.

11. No flushing device shall be directly connected to any sewer.

12. Sufficient valves shall be provided on water mains so that customer inconvenience and sanitary hazards will be minimized during repairs.

13. Valves required at all intersections and loops.

14. Use DIP with mechanical joints for any lines being installed in rock.

15. Water mains <u>smaller than six (6) inches</u> *may be installed in residential areas* providing that all of the following conditions are met:

Note: These water are Not Designed to Provide Fire Protection, however, in addition to the above requirements, these lines must meet the following conditions:

a. *No public water line* or main *may be smaller than two (2) inches*.

b. Lines shall also be designed to provide a minimum residual pressure of *not less than 25 psi* under maximum instantaneous demand conditions as given in the tables below, **Tables 1, 2, 3**.

c. All residences must be *within* ***500 feet*** of fire protection.

d. Dead end lines smaller than 6” shall not exceed ***200 feet*** unless a properly sized blow-off is installed.

e. Where dead end mains occur they shall be provided with an *approved blow-off.*

f. Blow-offs shall be sized to provide a minimum velocity of 2.5 ft/sec. in the main line *and maintain a residual pressure of 25 psi*.

16. **Water mains six (6) inches or Larger must meet the following additional requirements for fire protection purposes**:

a. The minimum size of water main providing fire protection and serving fire hydrants shall be six (6) inches.

b. All residences must be within 500 feet of fire protection.

c. Lines shall be designed to maintain a *minimum residual pressure* of not less than 20 psi ***when fire flows are provided in excess of peak hourly demand.***

d. Peak hourly demand (flow) = *2.7 times average demand or 1/5 (one-fifth) of maximum instantaneous demand.*

e. In the absence of historical data, a value of 100 gal/person/day may be used for average daily demand.

f. Fire flow required shall be based on ISO requirements, *but not less than 500 gpm.*

g. Lines shall also be designed to provide a *minimum residual pressure* of *not less than 25 psi* ***under maximum instantaneous demand conditions*** as given in the following tables (Ameen, 1974):

h. Dead ends shall be minimized by looping of all mains whenever practical.

i. Where dead end mains occur they shall be *provided with a fire hydrant if flow and pressure are sufficient*, **or with an approved flushing hydrant or blow-off.**

j. *No Post Hydrants are used in the City of North Augusta*. All lines six (6) inches and greater will only have standard fire hydrants installed to be also used for flushing.

k. Blow-off shall be sized to provide a minimum velocity of 2.5 ft/sec. in the main line *and maintain a residual pressure of 25 psi*.

Table 1. Maximum Instantaneous Flows for Residential Areas

Number of Residences Served	Flow Per Residence in GPM	Number of Residences Served	Flow Per Residence in GPM
1 (First)	15.0	91-100	2.0
2-10*	5.0	101-125	1.8
11-20**	4.0	126-150	1.6
21-30	3.8	151-176	1.4
31-40	3.4	176-200	1.3
41-50	3.2	201-300	1.2
51-60	2.7	301-400	1.0
61-70	2.5	401-500	0.8
71-80	2.2	501-750	0.7
81-90	2.1	751-1000	0.5

*Second, third, etc., through tenth residence served
**Eleventh, twelfth, etc., through twentieth residence served

Table 2. Maximum Instantaneous Flows for Commercial Areas

Type of Business	GPM on Basis Shown
Barber Shop	3.0 gpm per chair
Beauty Shop	3.0 gpm per chair
Dentist Office	4.0 gpm per chair
Department Store*	1.0-3.0 gpm per employee
Drug Store	5.0 gpm
Industrial Plants**	4.0 gpm plus 1.0 gpm per employee
Laundry	30.0 gpm per 1,000 pounds clothes
Launderette	8.0 gpm per unit
Meat Market, Super Market	6.0 gpm per 2,500 sq. ft. floor area
Motel, Hotel	4.0 gpm per unit
Office Building	0.5 gpm per 100 sq. ft. Floor area Or 2.0 gpm per employee
Physicians Office	3.0 per examining room
Restaurant	2.0 gpm per seat
Drive-in	2.0 – 7.0 gpm
Service Station	10.0 gpm per wash rack
Theatre	0.2 gpm per seat
Drive-in	0.2 gpm per car space
Other Establishments	Estimate at 4.0 gpm each

*Including customer service
**Not including process water
***Non-water using establishments

Table 3. Maximum Instantaneous Flows for Institutions

Type of Institution	Basis of Flow, GPM
Boarding Schools, Colleges	2.0 gpm per student
Churches	0.4 gpm per member
Clubs: Country, Civic	0.6 gpm per member
	4.0 gpm per bed
Nursing Homes	2.0 gpm per bed
Prisons	3.0 gpm per inmate
Rooming Houses	Same as Residential*

SCHOOLS: DAY, ELEMENTARY, JUNIOR, SENIOR HIGH

Number of Students	GPM Per Student	Number of Students	GPM Per Student
0-50	2.0	800	1.38
100	1.90	900	1.32
200	1.88	1,000	1.20
300	1.80	1,200	1.04
400	1.72	1,400	0.86
500	1.64	1,600	0.70
600	1.56	1,800	0.54
700	1.44	2,000	0.40

*****Each unit of an apartment building should be considered as an individual residence