

ARTICLE I

WATER DISTRIBUTION SYSTEMS AND APPURTENANCES

1.01 PURPOSE

This Article of the Specifications describes procedures, design criteria, and products to be incorporated into the water distribution system. The Developer shall furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

1.02 GENERAL

- A. Application: When the standards set forth in this manual are more restrictive than those required by any statute, ordinance or regulation applicable within the Authority's service area in Newton County, Georgia, the requirements of this manual shall govern. When the provisions of any other statute, ordinance or regulation require more restrictive standards than required by this manual, the more restrictive standards shall apply.
- B. Definitions: Where the following words or pronouns, used in their stead, occur herein, they shall have the following meaning:
 - 1. "Authority" shall mean Newton County Water & Sewerage Authority, or its authorized and legal representatives.
 - 2. "Developer" shall mean any party wishing to expand, develop, or improve the water distribution system, or the authorized and legal representative, contractor, or engineer of such party.
 - 3. "Provide" shall mean to furnish and install.
 - 4. "Owner" shall mean Newton County Water & Sewerage Authority.

1.03 SUBMITTAL REQUIREMENTS AND PROCEDURES

- A. All parties wishing to expand, develop, or connect to the Newton County Water & Sewerage Authority's system must adhere to the following procedures:
 - 1. Pre-Construction Phase: Prior to construction, plans shall be reviewed and approved by Newton County Water & Sewerage Authority.
 - a. Preliminary Design: Three full sets of drawings showing the proposed development or expansion shall be prepared, stamped and signed by a Registered Professional Engineer currently licensed to practice in the

State of Georgia. The drawings will be submitted to the Newton County Water & Sewerage Authority Director of Engineering. The drawings shall be prepared on 24-inch x 36-inch paper and shall be submitted in blue-line form. Two copies stamped "Preliminary Design" shall be submitted. As a minimum, the following information shall be shown:

- Project Name
 - Land lot, district, zoning, and county
 - 1" = 2000' Location Map with North Arrow
 - Name, Address, and Telephone number of Owner, Developer, Engineer and Surveyor
 - 1" = 100' (minimum scale) plan of existing and proposed roads, with road names and State Route numbers, streets, lots, owner and street addresses of properties, right-of-ways, land lots, districts, high and low spot elevation, topographic features, utilities and existing structures or objects which would affect the construction or design of the water main.
 - Preliminary design of proposed water system showing all existing and proposed mains, valves, hydrants, services, connections, materials and standard details. Topographic overlay with two-foot contours.
 - Dollar amount of maintenance bond taken from Maintenance Bond Schedule, shown in Appendix B.
- b. Preliminary Design Review: The drawings will be reviewed by the Newton County Water & Sewerage Authority for adherence to specifications and design criteria. After Authority review, a "marked-up" set of drawings with any comments or required changes will be returned for revision by the Developer. Any property proposed for commercial, industrial, institutional or residential development (as defined in the ordinances of the Newton County Board of Commissioners and the Newton County Planning Commission) which is within 1500 linear feet of an existing Authority water main as measured along any existing or proposed public road right-of-way from the water main to the nearest point of the property (or easement to the property) must be tied to and served from the Authority's system. The water main must be installed along both existing and proposed roads rights-of-way to the most distant property line. The entire cost of water main installation to and within

the development will be borne by the owner/developer. Flow and pressure tests will be conducted by the Authority or a representative of the Authority in the area of the proposed development (only where the proposed development is to be tied to or served from an existing Authority main). These tests shall be paid for by the developer prior to the performance of tests at the rate then in effect as established by the Authority. No part of the approval process is intended to relieve the developer of the responsibility to comply with minimum standards of the Georgia Department of Natural Resources, EPA, EPD, Georgia Department of Transportation, Newton County Road Department or other appropriate regulatory agency. All applicable construction details in Appendix A and all items listed on the review check lists shall be included in the plans.

The "Check Lists" shown in Appendix C must be completed for and they apply to all development plans submittal for approval for any infrastructure to be dedicated to the Authority.

- c. Final Design: Following incorporation of any required changes, the plans shall be stamped "Construction Plans" and six copies submitted directly to the Newton County Water & Sewerage Authority. The "marked-up" Preliminary Design drawings shall also be returned. Copies of all required permits or applications shall also be submitted..
 - d. If revisions are necessary for approval, the Authority will inform the Developer of the required changes and the Developer shall resubmit revised Construction Plans to the Authority.
 - e. Final Approval: Upon written approval of the Construction Plans, the Authority will notify the Developer and return one set of approved plans.
2. Construction Phase: During the construction phase the Developer must satisfy the following requirements:
- a. Pre-construction Conference: The Developer or the Contractor responsible for constructing the proposed improvements shall pick up an approved copy of the Construction Plans from the Authority prior to start-up. A pre-construction conference will be held at this time between the Authority's inspector and the Contractor. The Contractor shall retain an approved copy of the Construction Plans throughout the construction phase and have them available on the job site at all times. The preconstruction conference is required to be attended before the issuance of the NCWSA construction permit. No water or

sanitary sewer construction shall be allowed until the permit is issued and is displayed at the project site.

b. Construction of water mains shall not start in subdivisions until sanitary and storm sewers are complete. 24 hours advance notice to the Water System inspector is required before construction may begin.

c. The inspector shall be given 24 hours advance notice prior to inspecting the following operations:

- Tapping of Authority mains
- Connection to existing mains or operation of existing valves
- Pressure and leakage testing of mains
- Disinfection of mains. (Sampling and testing of water from disinfected mains shall be performed by the Authority)

3. Post Construction Phase: After all previous inspections have been satisfied, the following requirements must be met by the Developer prior to acceptance by the Authority.

a. Record Drawings: Record drawings, based on "as-built" field notes from the Contractor, shall be prepared and submitted to the Authority by the engineer on a mylar sepia with three prints attached. Electronic files in AutoCad 2005 format shall also be submitted on compact disc.

b. Construction Inspection: The Authority will perform a construction inspection after receiving the record drawings. Any deficiencies found shall be reported to the Contractor and satisfied prior to issuing written acceptance of the work.

c. Final Inspection: The Authority will perform a final inspection upon completion of the project but prior to acceptance by the County or City Planning Department. Within subdivision developments, all utilities shall be in place prior to this inspection. This inspection shall include clean up, smoothing, grading, final elevation of hydrants, valve boxes and collars, valve markers, service location, accuracy of record drawings, and compliance with all specifications. The Developer shall be responsible for any corrections necessary for the work to meet specifications, including damages caused by the construction activities of other utility construction.

Two sets of as-built drawings (paper copies), and one electronic copy on

CD in .dwg format must be submitted to the Authority immediately after the completion of construction. These as-built drawings shall include: locations of fire hydrants, line valves, tees, bends, service locations, water main sizes and types of materials. The Authority shall have the right to withhold water/sewer tap permits until the as-builts have been submitted as required.

- d. **Warranty:** The Developer shall sign a two year maintenance agreement. The maintenance period shall begin on the date that written final acceptance is issued by the Authority to the appropriate Planning and Development Department. In addition to the maintenance agreement, the Developer shall submit a maintenance bond to the Authority in an amount determined during the initial plan submittal to the Authority. The bond shall remain in effect from the date of written final acceptance by the Authority for 12 consecutive months. The bond shall be in the form of that shown in Appendix B, B4.
- e. **Final Acceptance:** Newton County Water & Sewerage Authority will provide written final acceptance of the water system improvements through route sheet submittal to the appropriate City or County Planning and Development Department and by letter of acceptance to the Developer.

ONE-YEAR MAINTENANCE BOND: The developer shall provide a maintenance bond in accordance with Appendix B and shall maintain the improvements in his development for a period of one year from the date the Authority issues written conditional approval of the improvements. The developer shall be notified of the inspection results in writing including a list of deficiencies for immediate correction. If repairs are needed for the development to meet Authority specifications, the developer shall be required to make such repairs within 60 days, after written notification by the Authority. Should any developer/contractor fail to comply with the specifications and regulations of the Authority or fail to correct deficiencies identified by the Authority, a hold may be placed on any remaining meters or sewer taps or, when appropriate, approval will not be given on any future proposals by the developer/contractor until all previous projects of the developer are in compliance with these regulations. If the work is free from defects, or after the required repairs have been completed to the satisfaction of the Authority, a letter of final acceptance will be issued to the Developer. The letter will state that the one year maintenance period has expired and that the Authority is now the owner of the water and sewer facilities and is responsible for all future maintenance of these facilities. After the water main is operational and throughout the one year maintenance period, the Developer will be responsible for locating all water and sewer facilities when called upon by the Utilities Protection Center or the Authority. These utilities must be marked within 72 hours of the time notified. Any water or sewer facilities cut by others will be repaired by the Developer's contractor at the Developer's expense if the lines are not located or if they are improperly located.

1.04 DESIGN CRITERIA

- A. Water Main Sizes: Minimum water mains shall be sized as shown in the following summary:

Residential	8-inch
Office and Institutional	12-inch
Commercial and Industrial	12-inch

This summary shall supersede all ordinances or specifications that show sizes other than the above.

Water main sizes along certain routes shall be sized according to the latest revision of the Water System Master Plan on file at the office of the Newton County Water & Sewerage Authority.

An adequate supply of water for the proposed project must be available prior to the approval of any plans. Flows and pressures must be adequate before approvals of said plans are granted by the Authority. The results of any flow test are valid for one year. Residential water supply for domestic use shall be in accordance with the following table and provide a minimum pressure of twenty (20) psi:

INSTANTANEOUS WATER DEMANDS FOR RESIDENTIAL AREAS

TOTAL NUMBER OF RESIDENCES OR UNITS SERVED	GPM PER RESIDENCE	TOTAL NUMBER OF RESIDENCES OR UNITS SERVED	GPM PER RESIDENT
5	8.0	90	2.1
10	5.0	100	2.0
20	4.3	150	1.6
30	3.8	200	1.3
40	3.4	300	1.2
50	3.0	400	0.9
60	2.7	500	0.8
70	2.5	750	0.7
80	2.2	1,000	0.6

Exceptions may be made when deemed necessary by the Authority. Demand for other than residential to be determined for each specific development. Where a water main extension from an existing Authority water main is required along an existing public right-of-way or future supply route, the size of pipe to be used will be either 8", the size required to meet the demand of the development, or a size equal to the existing authority main, whichever is largest. The Authority may require a larger pipe size to be installed than is required by this standard, and the cost of this over-sizing may be

funded by the Authority, Developers are required to extend all mains along their entire property frontage if the existing main is adjacent to the proposed development.

Minimum flows in GPM with 20 psi residual pressure by type of development are recommended as follows where a system is to be served from an existing Authority Water Main.

- a. Multi-family: 750 GPM for 30 minutes
- b. Shopping Centers: 750 GPM for 30 minutes
- c. Motels, Light Industry and Schools: 750 GPM for 30 minutes
- d. Heavy Industry, Large/Tall Buildings (Warehouses, Office Buildings, Institutional):
1000 GPM for 45 minutes
- e. Residential: 500 GPM for 30 minutes

The Authority may require these recommended flow / duration quantities prior to development of property.

B. Water Main Location

- 1. Subdivisions: Along subdivision streets or inside new developments, water mains shall be located 8 feet behind the back of curb. See Standard Drawings A-1 through A-3.
- 2. Existing City and County Right-of-Way: Water mains shall be located a minimum of 5 feet inside the right-of-way limit. A Land Disturbance Permit shall be obtained from Newton County or the appropriate City prior to encroachment on right-of-way. See Standard Drawing A-4.
- 3. Georgia Department of Transportation Right-of-Way: Along Georgia Department of Transportation right-of-way, water mains shall be located a maximum of 5 feet inside the right-of-way limit. A Utility Encroachment Permit shall be obtained from the Georgia Department of Transportation prior to construction. Permit application and required drawings shall be prepared by the Developer and sent through RWR Engineering. See Standard Drawing A-4.
- 4. Easements: Water mains shall be located along roadway right-of-ways unless approved otherwise. Any water mains constructed on private property shall have a recorded easement submitted before construction drawings are approved. The Authority will not accept for ownership water mains installed along roadways that are not dedicated for public use (i.e., are without public right-of-way). The Authority will not extend water mains along private roadways that do not have a dedicated, recorded right-

of-way.

5. Roadway Crossings: Water mains and service lines crossing existing City, County or Department of Transportation paved streets and roadways shall be bored and cased. Permits are required from the proper authority prior to construction. Every effort shall be made to bore under roads, including moving to different boring locations. If subsurface conditions (rock) should prevent boring, then only by written permission from the proper authority shall the road be open-cut. Lines installed by open-cut without written permission shall not be accepted. Department of Transportation roadways shall not be open-cut under any circumstances. Repair of open-cut roadways shall conform to Standard Drawing A-14.
6. Railroad Crossings: When water mains are to cross right-of-ways owned by any railroad, an approved permit shall be required prior to construction. Permit shall be sent through Newton County Water & Sewerage Authority. All fees associated with the railroad crossing shall be paid by the Developer.
7. Depth: Minimum depth of cover shall be 4 feet on water mains and 2.5 feet on service lines.

C. Water Main and Service Line Materials

1. Ductile Iron Pipe (DIP): Water mains constructed along or crossing any existing or proposed City, County, Department of Transportation roadway, or Railroad right-of-way shall be constructed of ductile iron pipe. Water mains shall be installed with a minimum of 48" cover. The developer shall install water services up to and including meter boxes and curb stops. Meters will be set by the Authority after the building permit is issued.
2. Water Service Lines: All water service lines 2-inches in diameter and less shall be constructed of copper tubing. Water service lines 3-inches in diameter and larger shall be constructed of ductile iron pipe.
3. All service lines are to have appropriate backflow prevention ahead of tie-in to county water system.

- D. Fire Hydrant Spacing: The maximum distance between fire hydrants shall be 500 feet. Fire hydrants shall be installed on the end of mains in cul-de-sacs. Fire hydrants should be designed and constructed so that there is no natural or man-made appurtenance within a four-foot radius around the hydrant.

- E. Valve Spacing: Valves shall be located on all mains such that a minimum number of customers would be affected should maintenance become necessary.
1. On water mains 8-inches diameter or larger, valves shall be placed at all road intersections and at 2,000 foot intervals, maximum.
 2. Valves with thrust collars shall be placed on temporary or permanent dead ends of water mains so that future extension may occur without main shut-off.
 3. Refer to the Standard Drawings for water main location and valve installation requirements.
 4. All line valves shall be marked by concrete valve markers. A concrete valve marker is to be placed directly above the plug on all dead-end water mains.
- F. Location of Water Service Lines: Water service lines for all developments shall be a minimum 1-inch in diameter and connect to the main as shown on Standard Drawing A-11 in Appendix A. Depending on anticipated water usage, larger water service lines may be required in certain developments. The Newton County Water & Sewerage Authority shall have final authority on the sizing for the required services. Information regarding underground utilities on these plans is not guaranteed as to accuracy or completeness. Prior to beginning work, the Contractor shall request a field location through the utilities protection center and any utility owners thought to have facilities in the area. The Contractor shall promptly compare these field-marked locations with the project plans and then notify the Designer of any anticipated problems or need for contract changes. It is the Contractor's responsibility to excavate or cause the utility owner to excavate for the purpose of determining exact elevations or locations at utility crossings and other critical locations well in advance of the work under this contract. Damage to existing utilities resulting from the Contractor's negligence shall be repaired at the Contractor's expense. All service lines under pavement shall be encased in PVC casing with a minimum diameter of 1 1/2", extending a minimum of 3 feet beyond the pavement on each side of the road.

1.05 MATERIALS

- A. Applicable Standards: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable. If requested by Newton County Water & Sewerage Authority, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.
- B. Substitutions: Whenever a product is identified in the Specifications by reference to

manufacturers' or vendors' names, trade names, catalog numbers, etc., the Developer may freely choose from those referenced products which ones he wishes to provide. Any item or product other than those designated shall be considered a substitution. The Developer shall obtain prior approval from the Authority for all substitutions. Requests for substitutions shall be received by the Authority with Construction Plan submittal. Provide all pipe, fittings, valves, tapping sleeves and valves, hydrants, and all other materials required for completion of the work. Provide materials in accordance with the following:

- C. Ductile Iron Pipe (DIP) is required for all water mains.
1. Ductile iron pipe shall conform to AWWA C151 and shall be Class 50 or 51 unless shown otherwise. All pipe shall be furnished in minimum lengths of 18 feet. Pipe and fittings shall be cement lined in accordance with AWWA C104. Fittings shall be ductile iron including glands and shall conform to AWWA C110 or AWWA C153 with minimum rated working pressure of 250 psi. Pipe and fittings shall be furnished with a bituminous outside coating.
 2. Joints shall be push-on type for pipe and standard mechanical or flanged joint for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be equal to American "LOK-FAST", "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK", or U.S. Pipe "TR FLEX" or "LOK-TYTE". Restrained joint pipe (RJP) on piers shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet.
 3. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick cloth reinforced rubber; gaskets may be ring type or full face type.
 4. Provide the necessary bolts for mechanical and flange connections. Bolts for flange connections shall be steel with American Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B 17.2. All bolts and all nuts shall be threaded in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit.
 5. Ductile iron pipe shall be encased with polyethylene film where applicable. Polyethylene film shall have a minimum thickness of 8 mils. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Authority.
 6. Acceptance will be on the basis of the Authority's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

7. Concrete blocking and mega-lugs or comparable restrained-joint fittings shall be used at all bends and tees.

D. Copper Tubing (CT): Tubing shall be hard drawn copper, ASTM B 88, Type K. Fittings shall be compression type or sweat type wrought copper, ANSI B 16.22. Where required, sweat to screw adapters shall be cast bronze ANSI B 16.18, wrought solder joint ANSI B 16.22. Unions shall be cast bronze or bronze with solder connections. Joints shall be made with 95/5 silver solder for Type K pipe.

E. Gate Valves (GV)

1. Gate valves with diameters 2 through 12-inches shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C500 or AWWA C509. Gate valves shall be specified for 200 psi working pressure:
2. Valve ends shall be mechanical joint type except where flanged ends are required.
3. Valves shall open left and shall have O-ring type stem seals.
4. Each valve shall be equipped with a valve box. Provide extension stem where required to bring the operating nut to within 24-inches of ground surface.
5. All valves shall be non-rising stem type. Operating nut shall be 2-inch square unless shown otherwise.
6. Gate valves shall be American-Darling, M&H Valve or Mueller.

F. Butterfly Valves (BV)

1. Butterfly valves shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C504. Butterfly valves shall be specified with the following working pressures:

Elevation, feet (Mean Sea Level)	Working Pressure, psi
800 or greater	150
Less than 800, but greater than 600	250

2. Valves shall be the resilient-seated, short body design. End configuration shall be compatible with adjacent piping. Valve bodies shall be high-strength cast iron, ASTM A 126 Class B. Shafts shall be 18-8, type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536,

Grade 65-45-12.

3. Valves shall be equipped with geared operators capable of withstanding 450 feet-pounds of input torque. Operators shall conform to the requirements of AWWA C504. All joint material required for the valve installation shall be furnished by the valve manufacturer.
4. Butterfly valves shall be American-Darling, M&H Valve or Mueller.

G. Fire Hydrants (FH)

1. All fire hydrants shall conform to the applicable requirements of AWWA C502. Fire hydrants shall be specified for 200 psi working pressure.
2. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5-1/4-inches.
3. In the event of a traffic accident, the hydrant barrel shall break away from the lower barrel at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
4. The means for attaching the upper barrel to the lower barrel shall permit facing the hydrant a minimum of eight different directions.
5. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
6. All working parts, including the seat ring shall be removable through the top of the hydrant without disturbing the barrel of the hydrant.
7. The operating nut shall be National Standard. The operating threads shall be totally enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir. A stop nut shall be positioned in the top operating mechanism of the hydrant so that the valve stem cannot contact the bottom of the shoe when the hydrant is fully open.
8. Hydrant shall be a non-freezing design and provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
9. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with

National Standard threads and each equipped with cap and non-kinking chain.

10. Hydrants shall be furnished with a mechanical joint connection to the spigot of an anchor coupling.
 11. Minimum depth of bury shall be 4.5 feet. Provide extension section where necessary for vertical installation and in accordance with manufacturer's recommendations.
 12. All outside surfaces of the barrel above grade shall be painted red with enamel equal to Koppers Glamortex 501.
 13. Hydrants shall be traffic model and shall be American-Darling B-84-B, M&H Valve 129-01 or Mueller Super Centurion.
- H. Valve Boxes (VB): All valves shall be equipped with valve boxes. Valve boxes shall be heavy roadway type. The valve boxes shall be cast iron two-piece slip or screw type with drop covers. The valve boxes shall be adjustable 6-inches up or down from the nominal required cover over the pipe. Extensions shall be provided as necessary. The cover shall be stamped "Water Valve" or "W". A concrete collar shall be furnished for all valve boxes outside the roadway.
- I. Valve Markers (VM): The Developer shall provide a concrete or reinforced fiberglass valve marker for each valve installed. Valve markers shall be stamped "Water Valve" and have the distance to the valve box stamped or engraved on them.
- J. Tapping Sleeves and Valves (TS&V): Tapping sleeves shall be cast or ductile iron of the split sleeve, mechanical joint type. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The valve shall have tapped plug on the bonnet for release of trapped air. The necessary bolts, glands, and gaskets shall be furnished by the manufacturer. The tapping sleeve and valve shall be supplied by the same manufacturer.
- K. Tapping Saddles: Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as required.
- L. Service Saddles: Service saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be for AWWA or NPT threads. Service saddles shall be equal to Rockwell #313, Dresser #291, or Ford F202.
- M. Corporation Stops and Curb Stops: Corporation stops and curb stops shall be ground key type or ball valve type; shall be made of bronze conforming to ASTM B 61 or B 62; and shall be suitable for the working pressure of the system. Ends shall be suitable for flared copper tube or compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B 16.26. Corporation stops and curb

stops shall be manufactured by Mueller, Ford or Hays.

- N. Retainer Glands: Retainer glands shall be equal to ACIPCO A 90857 or EBBA Iron Megalug.
- O. Hydrant Tees: Hydrant tees shall be equal to ACIPCO A 10180 or U.S. Pipe U-592.
- P. Anchor Couplings: Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U-591.
- Q. Meter Box: Meter boxes shall be oval shaped, cast iron and equal to Vulcan VMB-2 or Russell Foundry. In lieu of cast iron meter box, the Developer may provide a high density polyethylene box with an Authority-approved lid.
- R. Detection Tape: Detectable mylar encased aluminum foil marking tape will be installed over all water mains. Tape will be Precaution Blue in color, at least 1-1/2-inches wide, and shall bear the printed identification "Caution: Water Line Buried Below" (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall be equal to Lineguard Type II Detectable.
- S. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when water enters the valve. The valve shall have a minimum orifice diameter of 3/16-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion resistant materials. Valves shall be designed for potable water service. Valves shall be equal to Golden-Anderson, APCO, Crispin, Empire, or Val-Matic.

1.06 TEMPORARY EROSION AND SEDIMENTATION CONTROLS

- A. The Developer shall submit a description, working drawing and schedule for proposed temporary erosion and sedimentation controls to the local authority. The description and working drawings shall meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 (as amended) and local soil erosion and sedimentation control ordinances. The Developer shall acquire land disturbance permits from the local authority and shall pay any fees for said permits. The Developer shall be responsible for submitting to the local authority sufficient documents such that the local authority can acquire approval from the Newton County Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Developer. A copy of the local soil erosion and sedimentation control ordinances is available from the County.
- B. Water main construction activity shall not commence until the Land Disturbance Permit is issued.
- C. Description and working drawings shall indicate controls which will ensure that

drainage from jobsite areas which will be denuded, stripped or modified of its natural existing or artificially established stabilization or protection against erosion shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.

- D. Specified grassing shall be performed as soon as practical.
- E. Silt dams, traps, barriers, and appurtenances shall be installed as indicated on the approved plans and working drawings, and shall be maintained in-place until no longer needed, and then removed. Hay bales which deteriorate, and filter stone which becomes dislodged shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition which will ensure that unfiltered water will not leave the pond.
- F. Materials used in temporary erosion and sedimentation control shall meet the following requirements:
 - 1. Silt fence shall be nylon reinforced polyester netting with a fabric weight in excess of 4.0 ounces per yard and having a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than 6 feet on center. Silt fence fabric shall be equal to Mirafi 100X.
 - 2. Hay bales shall be clean, seedfree cereal hay type.
 - 3. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh. Netting stakes shall be either steel rods not smaller than 1/2-inch diameter or shall be either fir, southern pine or hemlock.
 - 4. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01H, Size Number 3.

1.07 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. The Construction Plans shall indicate underground utilities or obstructions that are known to exist according to the best information available. The Developer, as required by Georgia Law 25-9-1, shall call the Utilities Protection Center (UPC) (404-325-5000 or 1-800-282-7411) and those utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site to verify the location of the existing utilities.
 - 1. Electronic Pipe and Cable Locator: Furnish and have available at all times an electronic pipe locator, in good working order, to aid in locating existing pipe lines or other obstructions.
 - 2. Water and Sewer Separation: Water mains shall maintain a minimum 10 foot edge to edge separation from sewer lines, whether gravity or pressure. Where

the water main crosses a sewer line, an 18-inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. The sewer line in this area shall be D.I.P. Any deviation shall be requested in writing for approval.

1.08 CLEARING AND GRUBBING

- A. Clear and grub 5 feet on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.
- B. Clearing
 - 1. All vegetation such as trees, shrubs, brush, logs, upturned stumps and roots of down trees, and other similar items shall be removed and disposed of. Cultivated growth shall be removed and trees felled as necessary and in accordance with the requirements of paragraph 1.21 PROTECTION AND RESTORATION OF WORK AREA.
 - 2. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.
 - 3. All buildings, fences, lumber piles, trash, and obstructions, except utility poles, shall be removed and disposed of by the Contractor. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
 - 4. All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored, and replaced.
- C. Grubbing: All stumps, roots, foundations and planking embedded in the ground shall be removed. Piling and butts of utility poles shall be removed to a minimum depth of 2 feet below the limits of excavation for structures, trenches, and roadways or 2 feet below finish grade, whichever is lower.
- D. Disposal of Refuse
 - 1. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Developer and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material be left on the project, shoved onto abutting private properties, or buried on the project.

2. When approved in writing by the Authority and when authorized by the County and other proper authorities, the Developer may dispose of such refuse by burning on the project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Developer in any way from damages which may result from his operations. On easements through private property, the Contractor shall not burn on the site unless written permission is secured from the property owner.

E. Scheduling of Clearing

1. On existing right-of-way, The Developer shall clear at each construction site only that length of the permanent or construction easement which would be the equivalent of two week's pipe laying.
2. The Authority may permit clearing for additional lengths of the pipe line provided that erosion and sedimentation controls are in place and a satisfactory stand of grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.
3. A satisfactory stand of grass shall have no bare spots larger than 1 square foot. Bare spots shall be scattered and the bare area shall not comprise more than 1 percent of any given area.
4. The Developer shall be responsible for all damages to existing improvements resulting from his operations.

1.09 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

- A. Install water lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of and permits issued by the Department of Transportation, Newton County and the municipality with reference to construction operations, safety, traffic control, road maintenance and repair.
- B. Traffic Control
 1. The Developer shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; shall provide qualified flagmen where necessary to direct traffic; shall take all necessary precautions for the protection of the work and the safety of the public. Flagperson shall be certified by attending a Georgia DOT approved flagging training program.
 2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.

- C. Construction Operations: Perform all work along highways, streets and roadways to minimize interference with traffic.
 - 1. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.
 - 2. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
 - 3. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.
- D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.
- E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material and free to drain at all times.
- F. Maintaining Highways, Streets, Roadways and Driveways
 - 1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.
 - 2. During the time period between pavement removal and replacement, maintain roads by the use of steel running plates. Asphalt shall be placed around all edges of the running plate to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
 - 3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.
 - 4. Repair all driveways that are cut or damaged immediately. Maintain them in a suitable condition for use until completion and final acceptance of the work.

1.10 HANDLING MATERIALS

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped

will be subject to rejection without additional justification.

- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.
- C. Distribution: Distribute and place pipe and materials to not interfere with traffic along roadways. Do not string pipe more than 1,000 feet beyond the area where pipe is being laid on existing roads. Do not obstruct drainage ditches.
- D. Storage: Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

1.11 CONNECTIONS TO EXISTING PIPE LINES

- A. Make connections to existing lines with tapping sleeves, solid sleeves, saddles and valves as specified. Prepare lines for connection as described under Pressure and Leakage Test. Contractor must have NCWSA approval before any work is performed on the existing water distribution system. Notice should be provided to Dispatch office and Engineering.
- B. Location: Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for the Authority inspection.
- C. Interruption of Services: Make connections to existing pipe lines only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.
- D. No one other than NCWSA personnel are to operate system valves.

1.12 EXCAVATION AND BEDDING

- A. Excavate trenches by open cut. Pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of paragraph 1.16 REMOVING AND REPLACING PAVEMENT. Perform all excavation in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596) as amended. The Developer shall pay particular attention to Safety & Health Regulations Part 1926, subpart P "Excavations, Trenching & Shoring" as described in OSHA publication 2226.
- B. Depth of Trenches: Excavate trenches to provide a minimum cover of 4 feet. Within the right-of-way of highways, streets, or roadways, excavate to place the top of the pipe a minimum of 4 feet below the nearest pavement edge.
- C. Additional Trench Depth: Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and

obstructions.

- D. Width of Trenches: Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than 9-inches clear of the outside barrel of the pipe on any side at any point.
- E. Bell Holes: At each joint, excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve pipe bell of any load.
- F. Earth Excavation: Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. If the trench is excavated to excessive width or depth, provide crushed stone meeting the requirements of Georgia DOT Specification 800.01 for No. 57 stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151.
- G. Rock Excavation: Excavate and prepare the trench bottom to support the pipe uniformly throughout its length.
 - 1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (comparable to Caterpillar Model 215), and occupying an original volume of at least one-half cubic yard.
 - 2. Excavation: Where rock is encountered, excavate to the minimum depth and width which will provide 6-inches clearance beyond the outside diameter of the pipe bell.
 - 3. Blasting: Provide experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.
- H. Bedding
 - 1. Bed water mains in suitable earth materials. Bedding shall be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
 - 2. Bedding shall meet all requirements of Standard Laying Condition Type 2 in accordance with AWWA C151 and as shown in Standard Drawing A-17. Where Type 4 or Type 5 bedding is called for on the Construction Plans, specified or ordered by the NCWSA, this bedding shall meet all requirements of Standard Laying Condition Type 4 or Type 5 in accordance with AWWA C151 and as detailed on the Drawings, utilizing crushed stone as specified below. If the trench is excavated to excessive width or depth, provide crushed stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Construction Plans.

3. Crushed stone shall be quartzite granite meeting the size requirements of ASTM C 33, Coarse Aggregate, Size Number 57.
 4. For restrained joint pipe, bedding shall meet all requirements of Standard Laying Condition Type 3 in accordance with AWWA C151 and as detailed on the Construction Plans.
- I. Bracing and Sheeting: When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, trees, or private property which are specifically required to remain, provide bracing and sheeting.
1. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the County it cannot be safely removed. Cut off sheeting left in place at least 2 feet below the surface.
 2. Steel Sheet Piling: Continuous lockjoint steel sheet piling may be substituted for timber sheeting when approved by the Authority. Steel piling may be removed, without cutting, provided the rate of removal keeps pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by the Authority for reasons of safety, will be cut off where directed.
 3. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the bedding of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.
- J. Dewatering Trenches: Dewater excavation continuously to maintain a water level below the bottom of the trench. Dewater running sand by well pointing. Where soil conditions do not permit use of well point, construct french drains of crushed stone or gravel to conduct water to sumps.
- K. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, the Authority will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and

backfill with crushed stone. Place and compact this material to bring the trench to the required grade.

1.13 LAYING AND JOINTING PIPE AND FITTINGS

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Construction Plans.
- B. Handling
 - 1. Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe and the cement lining. Examine all pipe carefully for cracks and other defects as it is laid. Do not lay pipe or other materials which are known to be defective.
 - 2. Lower pipe, fittings, valves, and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench.
 - 3. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.
 - 4. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it.
- C. Alignment and Gradient
 - 1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
 - 2. Maintain a transit and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, close the end with a mechanical joint plug.
- E. Laying Pipe in Trenches: Lay the pipe with solid bearing throughout its length.
 - 1. Earth Trenches: Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics, and other unsuitable materials.
 - 2. Rock Trenches: Bed the pipe in at least 6-inches of clay or granular bedding

material. Backfill with the same material to at least 2 feet above the pipe.

3. Wet Trenches: Do not lay pipe in water. Provide dewatering equipment to maintain a ground water level below the bottom of the pipe while pipe is being laid.
- F. Joints: Push-on, mechanical, flanged and restrained type joints shall be made in accordance with the manufacturer's recommendations.
- G. Cutting: Cut ductile iron pipe using an abrasive wheel saw or other suitable saw; remove all burrs and smooth the end before jointing.

1.14 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Harnessing: Install harness rods only where specifically directed by the Construction Plans. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.
- C. Hydrants: Hydrants shall be attached to the water main with hydrant tees and anchor couplings.
- D. Concrete Blocking
 1. Provide concrete blocking for all other bends, tees, valves, and other points where thrust may develop.
 2. Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Authority. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.
 3. Form and pour concrete blocking at fittings as shown on the Construction Plans and as directed by the Authority. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

1.15 BACKFILLING

- A. Backfill and compact to prevent settlement and displacement of the pipe.
- B. Material: Backfill trenches with earth only. Do not use rock excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench.

- C. **Compaction:** Place backfill material in the bottom of the trench and up to 2 feet above the pipe in 6-inch layers. Compact with two hand operated air hammers with tamping feet, one on each side of the pipe, operated simultaneously. Backfill above, shall be compacted as follows:
 - 1. In 6-inch layers, if using light power tamping equipment, such as a "jumping jack",
 - 2. In 1 foot layers, if using heavy tamping equipment, such as hammer with tamping feet.
- D. **Backfill Under Pavements:** Backfill underlying pavement and backfill under dirt and gravel roads shall be compacted to 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). Developer shall supply compaction test reports as required by the inspector.
- E. **Backfill Along Restrained Joint Pipe:** The backfill around the pipe, up to the top of the pipe, shall be compacted to 80 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D 698.
- F. **Detection Tape:** Bury detection tape 12 to 18-inches below finished ground surface directly over all pipe and services. Install according to the manufacturer's written recommendations.

1.16 REMOVING AND REPLACING PAVEMENT

- A. **Removing Pavement:** Remove existing pavement as necessary for installing the pipe line and appurtenances.
 - 1. **Marking:** Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.
 - 2. **Breaking:** Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
 - 3. **Machine Pulling:** Do not pull pavement with machines until completely broken and separated from pavement to remain.
 - 4. **Damage to Adjacent Pavement:** Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
 - 5. **Sidewalk:** Remove and replace sidewalks disturbed by construction for their

full width and to the nearest undisturbed joint.

6. Curbs: Remove and replace or tunnel under any curb disturbed by construction to the nearest undisturbed joint.

B. Replacing Pavement: Upon completion of backfilling and consolidation of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by the Authority. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed. Gravel roads and drive shall meet the requirements for graded aggregate sub-base.

1. Materials: Place materials for pavement replacement to dimensions shown on the Drawings.

- a. Graded Aggregate Sub-Base: Furnish graded aggregate sub-base in two sizes of such gradation that when combined in approximately equal quantities, the resulting mixture is well graded from coarse to fine, meeting the gradation requirements of Section 815 of the Georgia Department of Transportation Standard Specifications.

- b. Black Base: The base for all paved roadways shall conform to the requirements of the Georgia Department of Transportation Specifications for the Black Base (Hot Mix). Use a Pug Mill Rotary Drum type mixer with minimum capacity of not less than 50 tons per hour for asphalt production. Apply and compact the base in two courses by asphalt spreader equipment of design and operation approved by the Authority. After compaction, the black base shall be smooth and true to established profiles and sections.

- c. Surface Course: The surface course for all pavement, including paint or tack coat when required by the Authority, shall conform to the requirements of the Georgia Department of Transportation Specifications for Asphaltic Concrete, Section 400, Type "F". Produce surface course in an asphalt plant of the same type as noted above for Black Base. Apply and compact the surface course in a manner approved by the Authority. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

- d. Concrete: Provide concrete and reinforcing for concrete pavement in accordance with the requirements of Georgia Department of Transportation Specifications for Portland Cement Concrete Pavement, Section 430.

2. Supervision and Approval

- a. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.
 - b. Obtain the Authority 's approval of restoration of pavement if it is not the responsibility of a regulatory agency (such as private roads and drives.)
 - c. Complete pavement restoration as soon as possible after backfilling.
3. Replacement: Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of damaged pavement. Make the cut using a rotary saw. Remove asphalt pavement 9-inches back from the edge of damaged pavement. Make the cut using a rotary saw. Remove asphalt pavement 9-inches back from the edge of the damaged pavement using jack hammers or other suitable tools. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks, and curbs with the same material and to the same dimensions as existing.
 4. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the work, promptly restore or repair defects.

1.17 ROADWAY CROSSINGS

- A. Furnish and install tunnel liner or casing pipe and install the pipe line therein in accordance with the Drawings and the following specifications:
- B. General: The Developer shall provide to the Authority, for approval, a detailed plan for the methods proposed for the construction of the tunnel or casing. These plans shall include the methods proposed for groundwater control and face protection.
 1. Groundwater Control: The Developer shall control the groundwater throughout the construction of the tunnel or casing. The groundwater shall be controlled by dewatering (well points or deep wells), grouting, compressed air, freezing or other method approved by the Authority.
 2. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the tunnel or casing. This protection is to be provided by bulkheads, shields or other means approved by the Authority.
- C. Casing: Furnish all material and equipment and perform all labor required to install steel casing pipe. A minimum of five years of experience in steel pipe casing construction is required by the casing installer.
 1. Materials: The casing shall be made from steel plate having a minimum yield

strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36. The outside of the casing pipe shall be coated with coal tar epoxy having a minimum dry film thickness of 16 mils. Surface preparation shall be SSPC-SP 10. Epoxy shall have a minimum solids content of 65 percent by volume and shall be air or airless spray applied; minimum drying time shall be seven days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be equal to Tnemec, Indurall or Valspar.

UNDER RAILROADS

Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406

UNDER HIGHWAYS

Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250

2. Construction: Install the steel casing pipe by the dry boring method. Bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. Fully weld lengths of casing pipe to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

D. Tunnel

1. Install the tunnel liner in strict accordance with Department of Transportation (DOT) and/or Railroad Company requirements. Provide any special insurance

coverage required by the governing body. A minimum of five years of experience in construction of tunnels of the general size is required of the tunnel installer. Submit evidence of experience with shop drawings for review by the Authority.

2. Excavate tunnel by full face, heading and bench, or multiple drift procedures. Any procedure utilizing a full or partial shield, a tunneling machine or other equipment which exerts a force on the liner plates for the purpose of propelling, steering or stabilizing the equipment will not be allowed.
3. Prior to any work involving explosives, make application to DOT for a special permit which will be in addition to any tunneling permit not involving explosives.
4. Comply with all requirements and conditions of all permits including required submittals.
5. Schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. Provide all required safety measures as specified in the Manual On Uniform Traffic Control Devices.

a. Materials: Tunnel liner plates shall be manufactured from steel meeting the chemical requirements of ASTM A 569 with the following mechanical properties before cold forming:

Minimum tensile strength	=	42,000 psi
Minimum yield strength	=	28,000 psi
Elongation, 2-inches	=	30 percent

b. Liner plates shall be 10 gage and shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be a multiple of the plate length so that plates having the same curvature shall be interchangeable and will permit staggering of the longitudinal seams. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of Section 13 of AASHTO Standard Specifications for Highway Bridges.

c. All liner plates in one tunnel shall be the same type.

d. Liner plates shall be hot-dip galvanized in accordance with ASTM A

123 and bituminous coated.

- e. Bolts shall conform to ASTM A 307 Grade A, and shall be hot-dip galvanized in accordance with ASTM A 153.
- f. Grout nipples shall be 2-inch minimum diameter tapped couplings welded into place over holes cut in the liner plate.
- g. The quantity of mixing water used shall be that which will produce a workable mixture of grout capable of being pumped into the voids created by the tunneling.
- h. Brick shall be whole and hard-burned, conforming to ASTM C 32 Grade MS. Mortar shall be made of 1 part Portland cement and 2 parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 53.

2. Construction of Tunnel

- a. Construct tunnel so that no settlement of the over-passing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary.
- b. Install steel liner plates as soon as possible, but no more than 5 feet of tunnel shall remain unlined while tunneling operations are in progress. No portion of the tunnel shall be left unlined at the end of the day's operation.
- c. Liner plates shall be installed in accordance with the manufacturer's recommendations and shall be self-supporting.
- d. The tunnel excavation shall have a diameter essentially the same as the outside diameter of the liner plates.
- e. Locate liner plates with grout couplings at the top of the tunnel at intervals not to exceed 10 feet.
- f. Install additional plates with grout couplings on each side of the tunnel between the top couplings.
- g. Pressure grout all voids in the area outside the plates every 10 feet and at the end of the work shift. Pressure grout more frequently if soil conditions dictate. Before grouting any segment of tunnel liner, seal that segment sufficiently between the liner plates and the surrounding soil to retain the grouting pressure. Locate seals at the entrance of the

tunnel, between grout couplings, and within 1 foot of the end of the tunnel at the end of the work shift.

- h. Provide pumping equipment for grouting operations. Pump horsepower and the resulting pressure in the grouting line shall be sufficient to completely fill the voids without buckling or shifting the liner plates or damaging the roadway.
- i. Repair damaged spelter coating in accordance with Georgia DOT Specifications, Section 645. Any plates having damaged spelter or bituminous coatings which, in the opinion of the Authority cannot be satisfactorily repaired, shall be replaced at no additional cost.

E. Installation of Pipe

- 1. After construction of the casing or tunnel is complete, and has been accepted by the County, install the pipeline in accordance with the detailed Drawings and the Specifications.
- 2. Check the alignment and grade of the casing or tunnel and submit a plan to the County for approval to set the pipe at proper alignment, grade and elevation. The pipe shall be supported by wooden skids strapped to the pipe barrel, or some similar arrangement approved by the Authority, to preclude movement within the casing or tunnel. Fill the void between pipe and casing or tunnel with grout. Grout shall be pumped through a pipe, gradually filling the void from the lower end to the upper end.
- 3. Close the ends of the casing with 4-inch brick walls, tunnel with 3 course brick walls, plastered with Portland cement mortar and waterproofed with asphaltic roofing cement.

F. Safety

- 1. Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.
- 2. Begin the tunneling or boring operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of DOT and Railroad regulations. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all of the work with DOT.
- 3. Complete all tunneling work at one particular location before tunneling work is started at another location.

4. A temporary bulkhead against the face of the excavation shall be provided and well braced during each cessation of tunneling work while the heading is within 20 feet of railroad tracks or highway pavement.
5. If, in the opinion of the Authority, the tunnel installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling and boring shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling, the Developer shall be required to submit a plan to repair the roadway. The plan must be acceptable to DOT, the Railroad if applicable, and the Authority.
6. The Authority will not be responsible and shall be saved harmless in the event of delays to the Developer's work resulting from any cause whatsoever.

1.18 STREAM AND DITCH CROSSING

- A. At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.
- B. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing stream or drainage ditch. Place rip rap a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. Extend rip rap from 1 foot below stream bed to top of bank. Place to conform with the natural slope of the stream bank.
- C. Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or higher.
- D. Minimum weight of individual stones shall be 50 pounds. The maximum allowable dimension for an individual stone is 24-inches. The minimum allowable dimension for an individual stone is 6-inches. At least 50 percent of the stones shall have a minimum dimension of 12-inches.
- E. Imbed stone rip rap by hand so as to form a compact layer at least 12-inches thick. Place rip rap in such a way that the smaller stones are not segregated but evenly distributed. Place chinking stones in the crevices between the larger stones so that a dense, well graded mass is produced.

1.19 PRESSURE AND LEAKAGE TEST

- A. All sections of water line subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint. Backfilling at fitting locations is optional. Each segment of pipeline between line valves shall be tested individually.

B. Test Preparation

1. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.
2. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
3. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.
4. Before installing tapping sleeves, lines shall be cleaned with soap and water then rinsed with 5% chlorine solution. Air shall be released from tapping valve through tapped plug. Sleeve and valve shall pass pressure test with water at 200 psi for 10 minutes before cutting operation can start.
5. Fill pipeline slowly with water. Provide a motor driven test pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall not exceed manufacturer's pressure rating.

C. Test Pressure: Test the pipeline at 200 psi measured at the highest point for at least 2 hours. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. The test pressure shall not vary by more than 5 psi for the test duration. Provide an accurate pressure gage with graduations not less than 5 psi.

D. Leakage

1. Leakage shall be defined as the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
2. Leakage through existing valves shall not prevent the contractor from successfully testing all new work. The contractor shall be responsible for testing all new work beyond existing valves. Provide temporary plugs as required.

E. Test Results: No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test

results.

- F. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on Record Drawings.

1.20 DISINFECTION

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method.
- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination: Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.
- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to that of existing distribution system prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing: After final flushing and before the water along main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division. Testing shall be performed by a laboratory certified by the State of Georgia. Re-chlorinate lines until required results are obtained.

1.21 PROTECTION AND RESTORATION OF WORK AREA

- A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
- B. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the County. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- C. Cutting of Trees: Do not cut trees for the performance of the work except as

absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Developer. No stumps, wood piles, or trash piles will be permitted on the work site.

- D. Grassing: Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in rye, fescue, bermuda, clover or other suitable ground cover on completion of work in any area. In all areas, promptly establish successful stands of grass.
- E. Erosion Control: Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. All owner/developer and contractor activities should comply with Georgia's NPDES General Permit No. GAR100000 for Storm Water Discharges Associated with Construction Activities.
- F. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.