

# WATER SPECIFICATIONS

- SPECIAL CONDITIONS
1. A minimum cover of three (3) feet over the proposed lines is required.
  2. No work shall begin without notifying Franklin County 24 hours in advance. The contractor is responsible for obtaining any and all necessary permits.
  3. No work shall begin without written approval of construction plans.
  4. Work shall be subject to inspection by the County Inspectors and design engineer.
  5. Contractor shall be responsible for locating and uncovering all valve boxes after surface treatment of roads and adjusting boxes to final road grades, if necessary.
  6. All existing utilities may be shown or may not be shown in the exact location. The contractor shall comply with the State Water Works regulations, section 12.05.03 where lines cross.
  7. The contractor shall notify the County of any field connections to the approved plans prior to such construction. Contractor shall maintain a set of red-lined plans showing location of all installations. As-built information shall be submitted to the design engineer for proper action of as-built plans.
  8. All trenches within the existing or future Virginia State Department of Highways and Transportation right-of-way must be compacted in six inch layers.
  9. All lines to be staked prior to construction.
  10. Contractor to coordinate with the Engineer to provide as-built plans.
  11. All construction shall be in accordance to approved construction practices of the applicable trades.
  12. Unless noted otherwise herein all construction shall be in accordance to the latest edition of AWWA standards.

## EXCAVATION, STABILIZATION AND BEDDING

### A. TRENCHING

1. Excavation for trenches shall include the removal of all material encountered regardless of classification in accordance with the elevations and grades at the locations and stations indicated on the plans or specified herein.
2. Excavation, unless otherwise specified, shall be open cut. The Contractor shall open no more than two hundred (200) feet of trench at one time during the laying of pipe, unless approved by the Engineer.
3. Trenches shall be excavated in straight lines and shall be accurately graded in order to establish a true elevation for the invert of the pipe.
4. The width of trenches, from existing grade to one (1) foot above the top of the pipe shall be of sufficient width to permit the proper installation of bracing, shoring or sheeting.
5. The sides of the trenches shall be as vertical as practical.
6. Excavation for structures shall allow a minimum of twelve (12) inches clear between the structure and the sides of the trench or any required bracing, shoring or sheeting.
7. Excavated materials suitable for backfill shall be stockpiled in an orderly manner at a sufficient distance from the sides of the trench in order to avoid overloading the banks of the trench and to prevent slides or cave-ins.
8. Excavated materials which are not required or approved for backfill shall be removed from the site and disposed of by the Contractor, at his expense.
9. Contractor shall adhere to all local, state and federal construction laws, including D.S.H.A. trench safety regulations.

### B. TRENCH STABILIZATION

1. Trench stabilization material shall be coarse aggregate size Number 2 and shall conform with VDOT Section 203 and/or ASTM C 33.
2. Whenever excessively wet or unstable material is encountered in the bottom of the trench, which in the opinion of the Engineer is incapable of properly supporting the pipe or structures, such material shall be removed and backfilled with trench stabilization material and shall be graded to allow for the compacted bedding material.
3. All unauthorized overdepths of excavation shall be backfilled with trench stabilization material and shall be graded to allow for the compacted bedding material.

### C. COMPACTED BEDDING MATERIAL

1. Bedding material shall be coarse aggregate size Number 57 and shall conform with VDOT Section 203 and/or ASTM C 33.
2. The bottom of the pipe trench shall be excavated to a minimum overdepth of four (4) inches below the bottom of the pipe, to provide for the compacted bedding material. Bedding material shall be placed, shaped and compacted.
3. Bell holes and depressions required for the jointing of the pipe shall be dug after the compacted bedding material has been graded and shaped and shall be only of the length, depth and width required to make the joint properly.

## PIPE, JOINTS AND FITTINGS

### A. SCOPE OF WORK

1. All materials and appurtenances required for the work shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail as specified or indicated. All materials found defective, regardless of the circumstances, shall be replaced with new material at the expense of the Contractor.
2. The materials specified for the construction shall comply with the latest revisions of the applicable American Society for Testing Materials (ASTM), American National Standards Institute (ANSI) and/or the Virginia Department of Transportation (VDOT) standards.

### B. OPTIONAL PIPE SELECTIONS

1. The Contractor shall install only one (1) type of pipe

between structures except where ductile iron pipe is specified or indicated. Where existing pipe is to be replaced or extended the same type of pipe shall be installed, unless specified or indicated otherwise.

2. Water line shall be either PVC or ductile iron.

3. Service laterals shall be either copper or polyvinyl chloride pipe, at the Contractor's option, unless specified or indicated otherwise.

### C. TYPES OF PIPE (K)

1. Polyvinyl chloride (PVC) pipe shall conform to ASTM D2241, SDR 21 2000 PSI as a minimum unless specifically noted otherwise. All PVC pipe must bear the National Sanitation Foundation Portable Water (NSFPW) stamp. Only bell and spigot with elastomeric gasket joints shall be used. To facilitate future locating of PVC water pipe, a metallic wire or locator tape shall be laid with the pipe and in contact with all fittings and valves.
2. Ductile iron pipe shall conform with AWWA C 151/ANSI 21.51 and fittings shall conform with AWWA C 110/ANSI 21.10. The pipe and fittings shall be bituminous coated and cement lined in accordance with AWWA C 104/ANSI 21.40. The pipe thickness shall conform with AWWA C 150/ANSI 21.50 and shall be Class 51, as a minimum, unless specified or indicated otherwise.

### D. JOINTS, COUPLINGS, AND APPURTENANCES

1. PVC pipe and fittings shall be bell and spigot type joints. The bell and spigot joint shall be sealed with elastomeric gaskets conforming to ASTM D 3212. The joints shall be made in strict accordance with the recommendation of the pipe manufacturer.
2. All PVC pipe fittings must meet pipe specifications for SDR-21 pipe and be of the same manufacturer as the pipe. All in accordance with AWWA specification C-110 and ANSI specification A21.10.
3. Gate Valves shall be iron-body, bronze-mounted, double-disc, parallel-seal, D-ring sealed, inside-screw, non-rising stem, fitting with 2 inch square operating nut. For valve vault service, all in accordance with AWWA Standard C500 (latest revision). Connections shall be suitable for the pipe with which it is used. The valves shall be tested at twice the rated working pressure. All gate valves shall be installed in the valve vaults and equipped with a 2-inch square operating nut. The nut shall be marked with an arrow and the word "OPEN" and shall open by turning to the right (clockwise).
4. Valve vaults shall be precast concrete with cast iron frame and covers. The cover shall be marked as shown on the details. Sizes and dimensions shall meet those shown on plans and details.
5. All valve boxes, base extensions, head and cover shall be of cast or ductile iron. Valve boxes shall be of the Mueller sliding type, round head marked "Mueller". The valve boxes shall have a minimum range of extension to fit two inch (2".0) to twelve inch (12".0) valves inclusive, placed on mains at depths of three feet, (3'); to five feet (5') of cover in order that the cover of the valve box is set to finished grade. Valve boxes shall be Mueller Company 10364, or approved equal. Valve boxes shall be centered over the valve screw and set plumb.
6. The water meter box and accessories therein necessary for meter installation shall be furnished and installed by the Contractor just within the right-of-way/easement at the property line as shown on the approved subdivision or other property plat. Water meter box and meter setter shall be furnished and installed as shown on the Project Details. All meter setters shall be equipped with integral lockable valves on both sides of the meter connections. All valves, setters and boxes shall be set plumb and compacted to ensure a stable setting.
7. All water meters shall be installed by the Contractor as directed by the Owner. Meters shall be 5/8" x 3/4" disc meter as made by Badger Meter Co. or equal.
8. All other materials and appurtenances to be in accordance with details shown on plans.

## PIPE INSTALLATION

### A. GENERAL

1. The Contractor shall not lay pipe or place manholes until all water has been removed from the trench, or when in the opinion of the Engineer, the trench or the weather conditions are unsuitable for work.
2. Pipe that may require field cutting shall be done so in a neat and workmanlike manner, so as to leave a smooth end at right angles to the axis of the pipe. Care shall be taken to avoid damaging the pipe and any coatings or linings. Ductile iron pipe shall not be cut with an oxyacetylene torch.
3. The materials shall be visually inspected for defects before lowering the pipe or placing the manholes into the trench. During the laying operation no tools, clothing, or other material shall be placed in the pipe or manhole. The interior of the pipe shall be clear of all soil, debris and superfluous materials prior to and during the installation.

4. The Contractor shall exercise every precaution to prevent foreign material from entering the pipe while it is being placed in the trench. Failure by the contractor to take such precautions may result in the Engineer requiring a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and removed only when the joint can be made properly.

5. The pipe and manholes shall be lowered carefully into the trench by suitable means and handled with care at all times to avoid damage. Under no circumstances shall the materials be dropped or dumped into the trenches.

6. When work is not in progress, the Contractor shall plug the open ends of the pipe to prevent trench water or other substances from entering the pipe. The plug shall be watertight and shall remain in place until any required dewatering has been completed.

7. Water pipe shall not be laid closer horizontally than ten (10) feet from a sewer line except where the bottom of the water pipe will be at least 18 inches above the top of the sewer line and will be in a separate trench. Water pipe shall not be allowed to pass through a sewer manhole.

8. Before joints are made the pipe shall be well bedded on a firm foundation and no pipe shall be brought into position until the preceding length has been thoroughly embedded and secured in place. Any defects due to settlement shall be made good by the Contractor at his expense. Bell holes shall be dug sufficiently large to insure the making of proper joints.

9. Pipe shall be jointed in full accordance with

manufacturer's recommendations. Push-on joints shall be thoroughly cleaned, the rubber gasket inserted in the bell socket, a thin film of approved gasket lubricant applied, the spigot end of the pipe centered into the socket and the joint completed by forcing the spigot end to the bottom of the socket by a jack-type tool or other device approved by the Engineer. Mechanical joints shall be thoroughly cleaned, the gland slipped over the spigot end of the pipe, the rubber gasket painted with soap solution and placed on the spigot end, the spigot end of the pipe seated in the bell, the gasket pressed into place within the bell, the gland moved into position, and bolts and nuts assembled by hand and tightened with an approved torque-limiting wrench.

### B. INSTALLING WATER MAINS

1. The water main shall be laid and maintained at the required lines and grades with fittings and valves at the required locations.
2. Deflection of the line of pipe, in either, the vertical or horizontal plane to avoid obstructions, or in locations where long-radius curves are required, the amount of deflection shall not exceed approved AWWA standards. Alignment that may require deflections in excess of the recommended limitations, special bends, or a sufficient number of shorter lengths of pipe to provide the angular deflections within the limits as set forth, shall be approved by the Engineer.
3. All plugs, except mechanical joint plugs at connections for future lines, all tees, and all bends in water mains under pressure shall be provided with reaction backing consisting of concrete thrust blocks. Valves for connections to future lines and fire hydrants shall be anchored to the water main with the rods.

### C. DISINFECTION OF WATER MAINS

1. All pipe shall be disinfected, tested and flushed in accordance with AWWA Standard C651 (latest revision).
2. Contractor shall provide all materials, equipment, necessary taps and perform all work required for the sterilization, testing and flushing of the water main.
3. No tested section of water line shall be approved to deliver water service until a favorable laboratory report has been achieved. Any tested section of water line failing to meet the requirements specified shall be repaired by the Contractor and retested until the results are within the limits specified.
4. The water main or valved off section that has been completed shall be filled, tested and flushed. Test locations shall be subject to the discretion of the Engineer and as valves and blow-offs permit.
5. After testing and before final inspection of the completed systems, water mains and service laterals shall be flushed and disinfected in accordance with AWWA Specification C601 latest revision. Flushing shall be accomplished at a flow velocity of not less than 2.5 feet per second.

Disinfection as described in AWWA C651 - "Placing of calcium hypochlorite tablets" shall be used. 5 gram calcium hypochlorite tablets with 3.25 g available chlorine per tablet shall be attached at the inside top of the pipe by an adhesive such as Permabond No. 1 or equal. The following number of tablets for the given pipe size shall be used for an initial dose of 25 mg/l (ppm) chlorine:

Pipe Diameter	Number Tablets Per 18-20 Ft. Pipe Section
6" or less	1
8"	2
10"	3
12"	4
16"	7

on the number of tablets equal to 0.0012d L rounded to the next higher integer, where d is the inside diameter, in inches and L is the length of the pipe section, in feet. Use of the continuous feed or slug method of disinfecting may only be used to rechlorinate a water pipe after the initial disinfection or in other specific cases approved by the Design Engineer. When filling the pipeline for disinfection, the rate of filling must result in a velocity of less than 1 ft./sec.

Following chlorination, the piping shall be thoroughly flushed. The Virginia Waterworks Regulations require at least two consecutive satisfactory bacteriological samples at 24 hour intervals from the distribution system at maximum spacing of 2000 feet before the system can be placed in service. If the initial testing is not satisfactory the new lines will be retested until satisfactory results are achieved. Samples will be collected in accordance with the Virginia Waterworks Regulations.

## BACKFILLING

### A. JOB CONDITIONS

1. Prior to placing backfill, all organic, rubbish, debris or other unsuitable or objectionable material within the trench shall be removed. All concrete forms shall be removed. All shoring or sheeting shall be removed or cut off at the depth stipulated by the Engineer.
2. Prior to placing backfill, the trench, shall be removed. All concrete forms shall be removed. All shoring or sheeting shall be removed or cut off at the depth stipulated by the Engineer.
3. Backfill material shall be placed in uniform horizontal layers and thoroughly compacted with proper mechanical or hand operated tampers or other equipment as approved by the Engineer to perform such work.
4. Backfill material shall be placed and compacted so as to not unevenly support, damage or displace the alignment of the pipe or structures.
5. Backfill shall not be placed or compacted against cast in place concrete until it has obtained sufficient strength to withstand the backfilled pressure placed upon it.
6. Upon the completion of backfilling, all excess soil, stones and debris shall be removed from the site and disposed of by the Contractor.

### B. BACKFILL MATERIAL

1. Materials for backfill shall be approved excavated material or approved suitable material obtained from other sources. All material shall be approved by Soil Engineer.

2. Material shall consist of durable natural granular material or granular aggregates free from organic material, loam, debris, or other objectionable material which cannot be thoroughly compacted.
3. Material shall not contain stones larger in diameter than those specified herein, granite, broken concrete, masonry rubble or other material which in the opinion of the Engineer is unsuitable for backfill.
4. Excessively wet excavated material shall not be used as backfill. Frozen material shall not be placed in the trench, nor shall approved backfill be placed upon frozen material. However, backfilling may be allowed in freezing weather with prior approval of the Engineer.

### C. BACKFILL BELOW UNPAVED AREAS

1. Backfill from the top of the pipe bedding or bottom of the pipe trench to one (1) foot above the top of the pipe shall be free of stones larger than one (1) inch in diameter and shall be placed in layers not to exceed six (6) inches and compacted with hand operated tampers.
2. Backfill from one (1) foot above the top of the pipe to the topsoil subgrade shall be free of stones larger than six (6) inches in diameter and shall be placed in layers not to exceed twelve (12) inches and compacted with mechanical tampers.
3. Drainage channels to be constructed of fill material shall be graded and shaped to the topsoil subgrade with material free of stones larger than four (4) inches in diameter and shall be placed in layers not to exceed eight (8) inches and compacted with mechanical tampers.

### D. BACKFILL BELOW EXISTING OR NEW PAVED AREAS AND SIDEWALKS

1. Backfill from the top of the pipe bedding or bottom of the pipe trench to one (1) foot above the top of the pipe shall be free of stones larger than one (1) inch in diameter and shall be placed in layers not to exceed six (6) inches and compacted with hand tampers.
2. Backfill from one (1) foot above the top of the pipe to the pavement subgrade shall be free of stones larger than four (4) inches in diameter and shall be placed in layers not to exceed eight (8) inches and compacted with mechanical tampers.

## INSPECTION AND TESTS

### A. TESTING OF WATER LINES

1. After placing all harnessing and all valve support concrete, sufficient backfill shall be placed prior to filling the pipe with water and field testing to prevent lifting of the pipe. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing shall be carried out after backfilling has been completed but prior to placement of the permanent surface. At least fourteen (14) days shall elapse after the last valve support or hydrant block has been cast (Type I Portland Cement) prior to testing, unless high early strength concrete (Type III) is used, in which case three (3) days shall elapse.
2. All testing will be performed in accordance with the AWWA C600-82 or current revision.
3. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing.

Test pressure restrictions. Test pressures shall:

- a. not be less than 1.50 times the working pressure at the highest point along the test section;
- b. not exceed pipe or thrust restraint design pressures;
- c. be of at least 2-hour duration;
- d. not vary by more than + 5 psi;
- e. not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants;
- f. not exceed the rated pressure of the valve.

Each valved section of pipe shall be filled with properly disinfected water slowly and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants.

All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired until it is satisfactory to the Engineer.

4. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{S \cdot D \cdot \sqrt{P_2}}{137,200}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. When testing against closed metal-seated valves, an additional leakage per enclosed valve of 0.0079 gallons/in. of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than the allowable amount, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

## ADDITIONAL REQUIREMENTS

### A. GENERAL

1. No water main shall be laid within thirty (30) feet of a sewage manhole.
2. If rock is encountered in the water main trench, the rock shall be removed to a level where six (6) inches of gravel bedding can be installed for the water main.

### B. SEPARATION OF WATER MAINS AND SEWERS

#### 1. Parallel Installation

- a. Normal conditions - Water mains shall be laid at least ten feet horizontally from a sewer or sewer manhole. The distance shall be measured edge-to-edge.
- b. Unusual conditions - When local conditions prevent a horizontal separation of ten feet, the water main may be laid closer to a sewer or sewer manhole provided that:
  1. The bottom (invert) of the water main shall be at least eighteen inches above the top (crown) of the sewer.
  2. Where the vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.
  3. The sewer manhole shall be of watertight construction and tested in place.

#### 2. Crossing

- a. Normal conditions - Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.
- b. Unusual conditions - When local conditions prevent a vertical separation described in Item 2, a, the following construction shall be used:
  1. Sewers passing over or under water mains shall be constructed of the materials described in Item 1, b, 2
  2. Water lines passing under sewers shall, in addition, be protected by providing:
    - a. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.
    - b. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the waterline.
    - c. That the length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.
3. Sewers or Sewer Manholes - No water pipes shall pass through or come in contact with any part of a sewer manhole.

### C. JOINTS, COUPLINGS, AND APPURTENANCES

1. Ductile iron pipe and fittings shall be bell and spigot type joints. The bell and spigot joint shall be sealed with elastomeric gaskets conforming to ANSI/AWWA C111/A21.11-90. The joints shall be made in strict accordance with the recommendation of the pipe manufacturer.

REVISION	DATE	DESCRIPTION
DESIGNED		WATER SPECIFICATIONS FOR SECTION No. 3 "BoxwoodGreen"
DRAWN		PREPARED FOR
CHECKED		ALOUF CONSTRUCTION AND DEVELOPMENT CO.
		GILLS CREEK MAGISTERIAL DISTRICT FRANKLIN COUNTY, VIRGINIA
		LUMSDEN ASSOCIATES, P.C. ENGINEERS-SURVEYORS-PLANNERS ROANOKE, VIRGINIA
		COMM: #94-48
		DATE: 29 Dec 1994
		SHEET 2 of 5

