

1.6 WATER DISTRIBUTION FACILITIES

1.6.01 General Requirements

- A. Public water distribution facilities are to be designed solely for the purpose of supplying potable water and fire protection. Under no circumstances shall cross-connections be allowed to unapproved water facilities. The design parameters included in these Standards are to be used in the design of water distribution facilities. Water transmission facility design parameters are not included herein. Design criteria for water transmission facilities will be established by the Department on a case-by-case basis.

1.6.02 Technical Design

A. System Layout

1. The overall layout and general design shall conform to the parameters set forth in the approved Engineering Report and Section 1.1 of these Standards.
2. In general, main line valves are required at intervals of 1,000 feet and at tees to allow adequate control of the system without major system shutdowns.
3. Sufficient isolation valves are required for all water main extensions to allow adequate isolation of the system for testing and flushing. A minimum of two valves will be located at each tee, one on the branch and one on the main.
4. Typically, butterfly valves may only be used on lines larger than 16” diameter. A butterfly valve may be used on a 16” line only where depth of cover does not permit the use of a gate valve.
5. Public water lines shall be located in accordance with the requirements contained in Section 1.1.01.G, H & I of these Standards, and as follows:
 - a. In paved areas of non-residential lots, in permanent utility easements established for that purpose.
 - b. Under the pavement in subdivision streets where lot size is less than 1 acre. Lines shall be configured in substantial conformance with the DPU *Water and Sewer Geometry Standard*.

- c. In other areas as specifically permitted by the Department.
 - d. Wherever a water line is located outside a public right of way, an appropriately sized Utility Easement must be dedicated to the County as described elsewhere in these Standards.
6. It is not acceptable to run water lines “cross country” in unpaved areas where normal vehicle access for inspection, testing, and maintenance is not practical.
 7. Construction shall generally be parallel to the centerline of roads or easements. The same offset shall be used throughout except when existing utilities dictate a change in offset along the proposed line.
 8. Water lines shall be installed a minimum of 15 feet from any part of any structure, building, or foundation.

B. System Design

1. The proposed facilities together with the pertinent existing facilities shall be evaluated based on the hydraulic design, demand design and fire protection design requirements contained herein.
2. The Design Engineer shall submit to the Department a neat and orderly set of design calculations to illustrate normal and fire flows, pipe size selection and fire protection requirements. Where system flow information is needed, the Engineer shall submit *a Water System Flow Request*.
3. Non-ferrous mains shall have tracer wire attached to the pipe and a detectable tracer tape buried in the trench 18 inches above the main but no less than 24 inches below grade.
4. The Engineer shall refer to the Virginia Department of Health (VDH) *Waterworks Regulations* and the EPA *Cross Connection Control Manual* for backflow requirements. Standard installation schematics are included in the Cross Connection Control Manual.
5. For each building in a commercial, industrial and/or multi-family residential project, domestic meter sizing calculations shall be performed using Form F-07 and shall be provided on the plans.
6. Fire protection flow requirements shall be shown on the plans.

7. The system shall be designed to maintain a minimum residual pressure of 40 psi in the distribution system at all service connections at the maximum day demand. Where existing conditions prevent this, the Department shall determine an acceptable minimum pressure requirement for the project.
8. The system shall be designed to maintain an absolute minimum residual pressure of 20 psi at all points in the system during the design flow. Design flow shall be defined as the greater of maximum day demand plus applicable fire flows or maximum hour demand.
9. Where the pressure at a service connection exceeds 80 psi, a pressure reducing valve (PRV) shall be installed on the service line in accordance with the provisions of the Uniform Statewide Building Code. The PRV shall be installed on the downstream side of the water meter. Maintenance of the PRV shall be the responsibility of the property owner.
10. Where deemed appropriate and practical by the Director, the system shall be designed with looping to allow water to be supplied to the system from two different points.
11. In residential subdivisions, Bac-T Sampling Stations shall be provided as follows:
 - a. One sampling station per 100 lots (or fraction thereof) shall be provided.
 - b. Sampling stations must be placed at least 1,000 feet apart.
 - c. Sampling stations shall be installed within a road ROW or utility easement.
 - d. Wherever practical, sampling stations shall be located at street intersections, adjacent to Open Space. If this cannot be achieved, then they may be aligned with a departing property line between two lots.
 - e. Sampling stations shall not be located in cul-de-sacs or at water line dead ends.
 - f. Sampling stations shall be installed as described in these Standards and as shown on Standard Detail TST-02.
 - g. Sampling stations shall not be connected to fire hydrant laterals.
12. For non-residential projects, a Bac-T Sampling Station shall be provided and located as required by the Department. Installation requirements shall be the same as for sampling stations in residential subdivisions.

C. Hydraulic Design

1. Hydraulic design (Modeling) shall be accomplished by the use of the Hardy-Cross Network Analysis Method or similar method acceptable to the County. A Hazen-Williams coefficient of friction equal to 120 shall be used for purposes of design unless the Department has data to indicate a lesser coefficient should be used for existing lines.
2. Hydraulic calculations shall show system pressure during static (no flow), average, maximum daily, maximum hourly, and fire flow scenarios.
3. The Design Engineer shall consult with the Department on the variability of supply pressures at the proposed connection point(s) and account for this variability in the hydraulic calculations.

D. Demand Design

1. Maximum rates of water consumption shall be calculated and used as a basis of hydraulic design. Average daily water consumption rates shall be estimated and justified by the Design Engineer and approved by the Department. The average annual daily water consumption rates shall be adjusted by a multiplier to arrive at the maximum daily and maximum hourly water consumption rate by the application of a multiplier, expressed as follows:

$$Q_M = Q_A \times C, \text{ where:}$$

Q_M is the maximum daily water consumption rate.

Q_A is the average annual daily water consumption rate.

C is a constant varying from 1.5 to 2.0.

$$Q_P = Q_A \times C, \text{ where:}$$

Q_P is the maximum hourly water consumption rate.

Q_A is the average annual daily water consumption rate.

C is a constant varying from 2.0 to 6.0.

Furthermore, demand design shall follow the “General Design Considerations” listed in 12VAC5-590-640 of the VDH *Waterworks Regulations* including:

- a. Demand design shall be based on the estimated water demand 10 to 30 years in the future.

- b. Historical data or typical usage figures of service areas with similar characteristics, and appropriate peaking factors, shall be used to support the design.
- c. The design shall account for diurnal demand patterns.
- d. The Uniform Statewide Building Code (USBC) may be referenced to support the design water usage of non-residential buildings, as appropriate.

E. Fire Protection

- 1. Rates of flow for fire protection shall be estimated based on the latest revision of the Virginia Statewide Fire Prevention Code.
- 2. The minimum fire flow from any individual fire hydrant shall be 500 gpm. The minimum design fire flow during any fire event shall be 1,500 gpm. The minimum residual pressure during a fire flow event shall be 20 psi.
- 3. During maximum rated fire flow conditions, the pressure drop in any fire protection system shall not exceed 15 psi from the point of connection at the existing County system to any fire hydrant or any combination of required hydrants.
- 4. The sizing of fire service lines shall be determined using the procedures contained in these Standards and the latest edition of the Virginia Statewide Fire Prevention Code.
- 5. The minimum size water line used for fire protection shall be 8 inches in diameter.
- 6. Wherever possible, minimum sized fire service lines shall be looped to provide a feed from at least two directions.
- 7. Not more than one fire hydrant shall be installed on an 8-inch dead end line. Dead end lines shall not contain more than 600 feet of the minimum sized line.
- 8. Fire hydrants shall be placed in legal rights-of-way or easements and shall generally be located at street intersections.
- 9. Where distances between intersections require the use of intermediate fire hydrants, they shall be placed in line with a property boundary between

adjacent lots or parcels of land, wherever possible. Where fire hydrants cannot be placed in a legal right-of-way, an easement shall be provided.

10. Fire hydrants shall be located no more than 10 feet from the edge of roadway shoulder or back of curb.
11. Fire hydrants spacing for properties zoned or planned for agricultural or single family residential use shall not exceed 1,000 feet or require a hose lay of over 500 feet from the hydrant to any part of any structure to be protected.
12. Fire hydrant spacing for properties zoned or planned for multi-family, residential, commercial, or industrial uses shall not exceed 500 feet or require a hose lay of over 350 feet from the hydrant to any part of any structure to be protected. Where multiple fire hydrants are needed to supply the required fire flow, all necessary hydrants must be located within the specified hose lay.
13. No fire hydrant shall be placed within the collapse zone of any building. The collapse zone is defined as 1.5 times the height of the building, or as otherwise determined by the Fire Marshal.
14. For commercial, industrial, and multi-family construction, fire hydrants shall be rated in accordance with the Insurance Service Office (ISO) standards and the Virginia Statewide Fire Prevention Code.
15. The above criteria for spacing fire hydrants may be modified by the Department or the Fire Marshal to improve fire hydrant accessibility for firefighting purposes.
16. Structures fully protected by an automatic sprinkler system and directly connected to the County's water system require installation of a reduced pressure detector assembly (RPDA) with enclosure.
17. Structures protected by automatic sprinkler systems with a Fire Department Connection (FDC) require installation of an RPDA with enclosure and a dedicated fire hydrant. The dedicated hydrant is not credited towards external protection requirements. The FDC must be located within 50 feet of the dedicated hydrant, and typically will be located at the RPDA enclosure.

F. Structural Design

1. Structural requirements must be considered in the design of all water mains and appurtenances.
2. The proper strengths shall be specified for the pipe material being specified. Strength shall be based on operating pressures, surge analysis pressures, depth of bury, trench width, and foundation conditions. This is an engineering matter and not subject to generalization.
3. Proper blocking and/or restraints must be provided and shown on the drawings. Where blocking is not detailed on the drawings, restrained joints shall be used.
4. Proper support shall be provided for aerial or suspended lines, where specifically permitted by the Department.
5. Potable water line crossings above surface water must be specifically permitted by the Department prior to start of design, and must be:
 - a. Adequately supported.
 - b. Protected from freeze damage.
 - c. Accessible for repair or replacement.
 - d. Above the 100-year flood plain elevation.
 - e. Designed for expansion and contraction, where applicable.
6. Potable water lines crossing under surface water must meet the following requirements:
 - a. The pipe shall be of special construction having flexible watertight restrained joints.
 - b. A valve shall be provided at each end of the water crossing so that the section can be isolated for test or repair. Valves will typically be within 50 feet of each end of the crossing, but in any event shall be easily accessible and not subject to flooding.
 - c. For the purpose of testing the section of line located under surface water, and for locating leaks in that section, permanent sample taps shall be installed a reasonable distance from each end of the crossing

in an area not subject to flooding.

- d. Adequate cover shall be provided over the waterline.
 - e. For open-cut stream crossings, rip rap shall be placed in the stream bed to prevent erosion above the water line.
7. Steel casing pipe shall be sized in accordance with the permitting agency or these Standards, whichever is more stringent.

G. Miscellaneous Considerations

1. The minimum size water line pipe to be used on a public water system shall be 4 inches. Consideration should be given to the use of 4-inch diameter mains at the ends of cul-de-sacs where no fire hydrants are to be located and where extension of the water line is not anticipated.
2. Where deemed necessary by DPU, air, air/vacuum or pressure reducing valves, blow off tees and related fittings shall be provided. These shall be as specified by the Design Engineer, subject to approval by the Department.
3. The minimum design depth of cover for water mains 12" or smaller shall be 3-1/2 feet (42 inches). Additional depth shall be provided where required for thrust restraint or to clear underground obstructions.
4. The minimum design depth of cover for water mains larger than 12" shall be 5 feet (60 inches), or as otherwise required by the Department.
5. Any deviation from required design depths of cover must be approved by the Director. A profile of each water service which crosses a ditch line shall be shown on the plans. A minimum of 36 inches of cover shall be provided at the ditch invert. A typical profile is acceptable on plans with multiple minimum-sized service lines.
6. Service lines larger than 1 inch, with meters larger than 5/8 inch, shall be sized in accordance with AWWA Manual M-22, Sizing Water Service Lines and Meters except as follows:
 - a. Use constant pressure factor of 1.
 - b. Include all outside hose bibs in combined fixture value total.
 - c. For non-residential facilities or facilities with flush-valve fixtures,

meters shall be sized as follows:

<u>METER SIZE (INCHES)</u>	<u>COMBINED FIXTURE VALUE TOTAL</u>
1	41 - 100
1-½	101 - 400
2	401 - 1200

- d. For residential facilities and office buildings with tank-type water closets, meters shall be sized as follows:

<u>METER SIZE (INCHES)</u>	<u>COMBINED FIXTURE VALUE TOTAL</u>
5/8	1 - 40
1	41 - 400
1-½	401 - 5500

- e. Plumbing Fixtures Values shall be as shown in AWWA Manual M-22 for 35 psi.

- f. Meter installations requiring a flow of greater than 160 gpm or with greater than the combined fixture value totals indicated above shall be reviewed, and meter size set, on a case-by-case basis in accordance with AWWA Manual M-22.

- g. A 5/8-inch meter may be used for non-residential facilities with tank type water closets and a combined fixture value total of 40 or less.

- h. A 1-inch meter is the minimum allowable size for any facility with flush valve fixtures.

7. Cathodic Protection: The Design Engineer shall consider soil conditions in the case of metallic pipes and conduits; and shall provide suitable cathodic protection where necessary.
8. Irrigation systems shall use Reduced Pressure Zone (RPZ) backflow prevention devices and shall be approved by the County's Building Inspection Department.
9. Where exposed to traffic, meter boxes, and vaults shall be designed for the appropriate traffic loading.
10. Meter Boxes for residential units shall be rated for a minimum 15,000-pound load and be installed in accordance with the Standard Drawings.

11. Meter Boxes for 1-½ and 2-inch meters shall be rated for a minimum of Tier 22 load.
12. Wherever practical, dead-end lines shall be avoided by looping mains. Where looping is required, the minimum size pipe shall be 8 inches.
13. Dead ends of all mains shall be provided with either a fire hydrant or a flushing hydrant, as appropriate, to provide adequate flushing of the main.
14. No flushing devices shall be connected directly to any sewer.
15. The minimum size service line from the County main to the meter shall be 1 inch.
16. Vaults or pits containing valves, blow-offs, meters, or other such appurtenances to the distribution system shall not be connected directly to any storm drains or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.
17. Vaults or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits underground.
18. The open end of an air relief valve should extend one-foot above ground and be provided with a screened downward facing elbow.

1.6.03 Drawings

- A. In addition to the requirements of Section 1.2 of these Standards, the drawing shall incorporate the following features:
 1. Drawings for water lines shall show stationing, pipe size and material, deflection angles, and curve data to adequately define the water line location with Northing and Easting coordinates. Water line dimensions including distances to structures, right-of-way, face of curb, edge of pavement, and property lines shall be shown.
 2. All valves, tees, bends, service lines, meters, fire hydrants, flushing valves and other fittings shall be shown on the plans. Northing and Easting coordinates shall be provided for all valves, hydrants, and meter boxes.
 3. Profiles shall be provided for all water lines. Existing and proposed grades shall be calculated and shown on the profiles. Profiles shall show and provide stationing for all valves, tees, bends, fire hydrants, flushing

valves, water service connections, and other fittings.

4. Blocking and/or restraint details and calculations shall be provided on the plans.
5. General Notes, Current Goochland County Water and Sewer Notes (Form F-09), Stormwater Management and Erosion Control Notes (Form F-14), and a table of Estimated Materials Quantities shall be shown on the plans.
6. All drawings for water mains, crossing sewers, force mains, or other utilities shall show points where crossings occur. Crossings shall be shown in both Plan and Profile. The Profile shall clearly indicate vertical edge-to-edge clearance between utilities.
7. Meter sizing form(s), backflow prevention details, and ISO calculations shall be included on the plans.

END OF SECTION 1.6