### CHAPTER 4. Water Distribution

* 1. **Purpose and Intent**

The purpose and intent of this chapter is to establish minimum standards for the planning, design, and construction of typical practices to be followed in the layout and design of water distribution systems. The information contained in this section must be applied in conjunction with the latest edition of the Waterworks Regulations 12 VAC 5‐590‐10 et. seq., as published by the Commonwealth of Virginia, Department of Health, and with other sections of this Manual.

* 1. **Reference Standards**

The design engineer will comply with all relevant industry standards and federal, state, and local regulations, including the following standards, which are incorporated into this document by reference:

 American Waterworks Association Standards (AWWA)

American Society of Sanitary Engineers (ASSE)

Bureau of Water Supply Engineering

Virginia Department of Health (VDH)

Virginia Waterworks Association

* 1. **General Standards**
1. Criteria listed in this section are minimums. Additional separations and clearances are to be furnished as practical to optimize each design. Attention shall be given to locating utilities so as to facilitate their re‐excavation.
2. Abnormal designs due to factors such as depth and magnitude of facility in determining the adequacy of each design and may relax or increase dimensional requirements accordingly. In general, a design is to be sought which minimizes maintenance costs.
3. All water lines shall be constructed according to the approved plans. All linework shall meet all the requirements of the Town of Strasburg. The property owner is responsible for all water laterals from the town right‐of‐way to the residence.
4. The contractor shall tie new water main installations into existing water mains. The Contractor shall tap all service laterals to new water mains. They will furnish the materials for and make the tap. The contractor must make an application for and pay for the cost of this work.
5. Prior to any new water mains being brought into service, all new water mains shall be disinfected per ANSI/AWWA C651-14 Standard, Section 5.
6. The Contractor shall tie in a new line to an existing manhole by core drilling the manhole.
7. Ten (10) Gauge Solid Copper Wire underground rated shall be run with all utilities including: Water main and services ‐ Sewer main and services. All splices/connections shall be waterproof.
8. Where plans call for matching existing pavement, the contractor shall provide cut joint and/or asphalt overlay in accordance with VDOT specifications.
9. All radii and dimension lines are to be from the face of curb. All spot elevations are to the top of curb unless otherwise shown.
10. Contractor shall be responsible for adjustments and/or reconstruction of all utility covers (manholes, frames and covers, valve boxes, covers, etc.) to match the finished grades of the affected areas of construction.
11. The contractor is responsible for any damage to existing roads and utilities which occurs as a result of project construction.
12. The Contractor shall coordinate with, and arrange for inspection with the Town, five business days prior to needing an inspection on‐site.
	1. **Hydraulic Requirements**
		1. **Design Flows**
			1. The water distribution systems and any extensions thereof shall have adequate capacity to supply the normal (average) and peak hour demands of all customers – domestic, public, commercial, and industrial – while maintaining a pressure of not less than 20 pounds per square inch (psi) at all points of delivery. The Town of Strasburg further intends to provide a minimum static service pressure if 30 psi or better to all customers. If considering an extension at higher elevations, such that lesser service pressures could result, the designer should consult with the Director of Public Works to evaluate options for enhancing pressure.
			2. Throughout the Town of Strasburg’s Central System, extensions shall be capable of delivering, on the day of maximum customer demand, flows required for the fire protection to within 300 feet of each building to be served, while maintaining a residual pressure of not less than 20 psi. Flows required for fire protection shall be in accordance with the National Fire Protection Association Standards. For fire flow requirements in community water systems, see Section 7.2.J Capacity of Waterworks (12 VAC5‐590‐690).
			3. Designs of water systems, including pumping facilities, shall be based on the Town of Strasburg’s current Water System Modeling Report and take into the following considerations:
				1. The general design factors established in the Waterworks Regulations.
				2. The estimated tributary population for a period of 30 years hence.
				3. The entire service area, built out according to current residential, commercial, and industrial uses; and allowable land use, as established by the Town of Strasburg Community Plan.
				4. Future commercial development at a population equivalent not less than 30 people per acre.
				5. Future industrial development at a population equivalent to not less than 40 people per acre.
				6. Any applicable Area Facility Plans and Technical Memoranda.
			4. The following criteria will be used in estimating demands for water and accomplishing hydraulic design of the system:

**Exhibit 4A: Water Demand (Minimum)**

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| --- | --- |
| Residential Population | N= number of dwelling units x 3.5 |
| Residential:Average Daily Water Demand in Gallons per Day (gpd) | R = N x 100 |
| Commercial and Industrial: Average Daily Water Demand (gpd) | C = Number of Commercial and Industrial Employees x 100\*‐Note: appropriate additional water demand allowance shall be made for commercial and/or industrial establishments of types having water demands in excess of 100 gpd per employee |
| School:Average Daily Water Demand (gpd) | S=Number of Staff and Students x 20 |
| Average Daily Water Demand (gpd) | A = R+C+S |
| Maximum Daily Water Demand (gpd) | M = A x 2 |
| Peak Hour Demand (gpd) | P = M x 2 |
| Peak Hour Demand in Gallons per minute (gpm) | P/1440 |

* + 1. **Distribution Piping**

Distribution piping design will be based upon providing flows and service pressures in accordance with the Town of Strasburg’s standards. The hydraulic design of distribution piping will be based on pipe carrying capacities consistent with head losses determined in accordance with the Friction Loss Table.

**Exhibit 4B: Friction Loss Table**

|  |  |
| --- | --- |
| **Pipe Diameter** | **Hazen‐Williams Coefficient “C”** |
| 6” | 100 |
| 8” | 110 |
| 10” | 115 |
| 12” and greater | 120 |

**Exhibit 4C: Pipe Material Table**

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| --- | --- |
| **Pipe Material** | **Hazen‐Williams Coefficient “C”** |
| Ductile Iron (DIP) | 120 |
| PVC | 130 |

* + 1. **Hydraulic Models**

When requested, hydraulic models will be submitted to the Town of Strasburg for review. The following are minimum requirements for all models submitted.

* + - 1. Provide a written model summary, area map, along with an electronic copy of the model for review. Identify the computer modeling software used to create the model. Submit all related database files to ensure the model will be imported into WaterGEMS software Version 8.
			2. Provide a map showing the pipe network. Label all pipes, nodes, road names, north arrow, scale, number of units, unit type, demands and outline the division of different unit types.
			3. Demonstrate that the development(s) can meet the following demands: average day, maximum daily, peak hour, and maximum daily plus fire flow, throughout development.
			4. Model must represent the entire development, including each planned sequence of phases. Each phase of the development must be hydraulically adequate. The model must support the desired phasing.
			5. The system demands must be included in the model to accurately represent system pressures.
			6. Identify model assumptions, including water source and calculated demands based on the number of units and the type of units in the development.
			7. State the required fire flow demands for each unit type and call out specific nodes that require different fire flow demands, such as a development of single-family homes with a school; where the school requires a higher fire flow demand, the node needs to be identified.
	1. **Water Pipe Layout**
		1. Redundant Supply. More than one extension from the existing system is required to serve subdivisions (5 homes or more) and commercial and industrial projects. Furthermore, the water system shall be looped to eliminate dead ends. The maximum length of permanent dead‐end water pipe is 300 feet.
		2. Distribution piping shall be laid on a loop or grid system. Primary grids shall be of 10‐inch or larger diameter pipe and spaced at approximately 1/8-mile intervals. Secondary loops of 8‐inch diameter will be placed everywhere else.
		3. Distribution piping design should eliminate parallel and/or multiple lines. If parallel lines are proposed, the applicant shall prepare a waiver, and submit it to the Director of Public Works, prior to the submission of plans.
		4. Dead end mains shall not exceed a length of 300 feet beyond the last service lateral.
		5. All dead-end lines shall terminate with a fire hydrant assembly. A dead‐end line in a cul‐de‐sac shall terminate with a fire hydrant assembly.
		6. It is discouraged to use water lines less than eight (8) inches in diameter and larger than twelve (12) inches in diameter.
		7. Joint restraints are required if the water line slope is 20% or greater, at every valve and fitting, at all fire hydrants, and at all stream crossings, as required by the Town.
		8. The maximum curvature by joint deflection for water pipes equal to or less than 12‐inch diameter is a 300-foot radius arc (3.5 degrees/joint with 18-foot pipe sections). For pipes larger than 12 inches, the maximum curvature by deflection is a 500-foot radius arc. When restrained joint pipe is specified, consult manufactures recommendations for maximum joint deflection.
		9. All piping must be capable of providing a minimum flow of three gallons per minute per connection at a minimum of 20 psi residual pressure.
		10. Piping shall be sized to provide fire flow of at least 1000 gpm at 20 psi residual pressure.
		11. Fittings and blockings should not be placed atop other utilities to avoid placement in disturbed ground.
		12. Any relocation of existing water facilities due to development is the responsibility of the Developer. Where grading is to occur, resulting cover on existing water pipe must remain above design minimum and below design maximum unless prior approval is granted by the Director of Public Works.
		13. Separation
			1. Provide a minimum 10-foot horizontal separation (outside to outside) with sanitary sewers, including manholes.
			2. Provide a minimum 6-foot horizontal separation (outside to outside) with storm drainage structures.
			3. Provide a minimum 15-foot horizontal separation to a building or other above‐ground structure.
		14. Location
			1. In the public right‐of‐way, placement must be in accordance with the Town of Strasburg Chapter 4 and Virginia Department of Transportation.
			2. Along undivided roads, water pipes will be allowed under the pavement, a minimum of 5 feet from the outside edge of pavement or gutter pan (7 feet from the face of standard curb and gutter). Where the pavement width is 24 feet or less, 3-foot horizontal separation from the gutter pan is permitted, if needed to attain separation from sanitary sewer. Generally, the centerline of water pipe should be located 8 feet off the centerline of subdivision streets, with sewer on the opposite side of street, resulting in the required 10-foot separation (outside to outside).
			3. When located with sanitary sewer in curved streets, locate water on the outside of prominent turns. Such is intended to foster separation with sewer while minimizing the number of sanitary sewer manholes, and to provide undisturbed ground for the blocking of water pipe bends.
			4. Keep the waterline on one side of the street as much as practical, crossing only where necessary to provide needed branches or where imperative for attaining separations with other utilities.
			5. Water laterals that cross under a street shall be encased in PVC pipe. The pipe shall be 3” diameter SDR21 or schedule 40 for 1” service laterals. The pipe shall be 4” diameter SDR21 or schedule 40 for 1 1/2”and 2” service laterals. It shall run 1’ beyond the near sidewalk and the far sidewalk.
		15. Surface Water Crossings
			1. Where water pipe is to cross a natural stream or large engineered drainage channel, the water pipe is to be designed so as to ensure its integrity during flooding. Restrained joint piping may be employed. Provide valves to allow for the segment to be isolated, and a hydrant (preferably low in segment) to enable the segment to be flushed and tested. These appurtenances are to be beyond limits of 100-year flood waters.
			2. Surface water crossings present special problems and should be discussed with the Town before final plans are prepared. The following is to be used as guidance for surface water crossings:
				1. All surface water crossings shall be a minimum of 3‐feet underground. There will be no above-water crossings allowed by the Town of Strasburg.
				2. Pipes shall be of special construction with flexible watertight joints.
				3. Valves shall be provided at both ends of the water crossing so that the section of pipe can be isolated for repairs or testing. All valves shall be easily accessible and not subject to flooding.
				4. Permanent taps shall be made for testing and for locating leaks.
		16. Sampling Stations. Sampling stations should be provided along the water main for testing. Stations shall be coordinated with the Director of Public Works during the design phase for the location of the station. Sampling stations shall conform to the following requirements:
			1. The station shall be in a locked box, located a minimum of two feet behind the edge of curb and or pavement.
			2. The bottom of the station shall sit level and flush to the finished grade.
			3. A ten‐foot easement shall be provided around the sampling station.
			4. Sampling stations shall be installed to include but not limited to dead end lines between the final service and the hydrant.
			5. The sampling station shall comply with Detail 4-17
		17. Future Extensions
			1. Identify places where future extension of public or service pipe appears practical to allow service to other buildings or properties. Water pipes are to be constructed beyond the area being developed, so as to terminate in a location from which it can readily be extended in the future. This will be beyond proposed pavements, past adjacent buildings, and beyond crossing storm drains that would otherwise be undermined during subsequent water installation. Provide a spur consisting of a pipeline valve, 20 feet of piping, dead‐end anchor, and temporary blow‐off assembly.
			2. Future extensions, if constructed, must comply with the standards set forth. No temporary lines will be relocated to a new elevation will be accepted.
			3. In cases where the future extension will provide a loop that is necessary to support the subject project, provide the spur all the way to the site or subdivision boundary.
			4. Easement for future lines must be conveyed, extending to the site or subdivision boundary. Associated temporary construction easement may also be needed, as dictated by the scope of the future installation.
		18. Valves
			1. Valves shall be installed at appropriate points in all pipes to permit interruption of flow to segments of the system, as needed to facilitate operation, maintenance, and repair.
			2. Valves shall be provided so that no more than one commercial or multifamily building(s) are served from the segment.
			3. Segments of waterlines that cross private lots are to be isolated.
			4. Provide a valve on each side of a surface water crossing.
			5. Provide valves in transmission and distribution lines to establish maximum 1,000-foot segments.
			6. Where connecting to existing water pipes, the locations of existing valves and hydrants requiring operation shall be indicated on construction plans. If during construction, the valve(s) is found to be not operational or damage occurs, it is the responsibility of the contractor to replace the entire valve assembly.
			7. Valves shall be located on all branches (tee, wye, and/or cross)
			8. A water line that may be extended shall have a gate valve at the end. There shall be one full section of pipe on each side of the valve.
			9. Butterfly valves will not be accepted.
			10. Combination air release and air/vacuum valves shall be installed at high points where accumulation of air may interfere with flow.
			11. Valves may be added or deleted during plan review as required by Public Works for special operational reasons.
		19. Horizontal Location
			1. Specify a minimum cover of 3 feet for pipe of 12 inches or smaller diameter, and of 3.5 feet for pipe of 16 inches or larger diameter. Specify a minimum cover of 4 feet where the pipe passes below rip rap or is susceptible to extraordinary loadings.
			2. Cover over existing water pipe shall not exceed 6.0 feet.
			3. Water pipes crossing sewers and storm sewers (including service spurs) shall have a separation of at least 18 inches between the bottom of the water pipe.
			4. When local conditions prevent a vertical water/sewer separation described above and water pipes pass under sewer, the following protection shall be provided subject to approval by the Director of Public Works.
				1. Provide vertical separation of at least 18 inches (outside to outside) between the bottom of the sewer and the top of the water line.
				2. Provide adequate structural support for the sewer to prevent excessive deflection of the joints and settling over the water line.
				3. A full section of the water pipe shall be centered at the point of the crossing so that joints shall be equidistant from the sewer.
			5. Provide a minimum vertical clearance of 1.5 feet with other utilities. If water is atop other utilities, this requirement may be relaxed to as little as 1.0 foot if such is critical to maintaining water’s position on top.
			6. Label clearances with all utilities.
			7. Specify controlled fill wherever the water line is above the existing grade.
			8. When water piping crosses a steel gas main or other underground facility with impressed current, or upon which impressed current may later be added, design will specify measures to prevent corrosion of the water pipe.
		20. Easements. The minimum easement width shall be provided:

**Exhibit 4D: Water Easement Width**

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| **Location** | **Minimum Width (feet**) |
| Within pavement | 15 |
| Unpaved portions of lots | 20 |
| Undeveloped areas | 30 |
| Along lot lines of subdivisions or between structures | 30 |

* + - 1. If a 16‐inch waterline or larger is used and/or project specific easements may be larger.
			2. Vehicular access from the street shall be allowed. The vehicle access will have a maximum slope of 8%.
			3. Hydrants shall be surrounded by a 10-foot easement (minimum).
		1. Hydrants
			1. In residential areas, hydrants shall be installed such that there will be at least one hydrant within 300 feet of the nearest corner of any building and at the end of any dead-end line.
			2. In commercial, industrial, multi‐family residential and townhouse areas, hydrants shall be placed such that a maximum of 300 feet of hose is required to reach any point on the exterior of all buildings.
			3. A hydrant is required within 100 feet of the Siamese connection, also known as fire department connection (FDC), of a building’s fire suppression system.
			4. Locate hydrants a minimum of 50 feet from the building being protected.
			5. Hydrants are to come off the main by means of a tee and branch valve, or as part of a dead-end assembly. Hydrants shall not come off the main at a cross.
			6. Each permanent termination of water main must be by means of a fire hydrant.
			7. When locating dead end fire hydrants ensure adequate space is provided for appurtenances up stream of hydrant.
			8. No more than one hydrant is permitted on a dead‐end 6‐inch pipe. Such hydrants must be within 300 feet of a looped pipe.
			9. At stream crossing, place one hydrant to enable draining, sampling, and flushing of the segment between required isolation valves. Position hydrant as low in segment as practical, while keeping away from bed and banks of the natural water course.
			10. Along transmission mains, provide hydrants at intervals not exceeding 1,000 feet.
			11. Along ditch and shoulder roadways, fire hydrants should not be placed on the opposite side of road from the water main.
			12. Locate hydrants a minimum of 3 feet behind the face of curb and in straight segments of curb as much as practical. The distance behind the face of curb may be increased at the Town of Strasburg’s discretion where roadway design speed is 35 miles per hour and greater.
			13. Provide a minimum separation of 5 feet between a hydrant and any driveway. Additional separation is desired.
			14. Hydrants shall not be placed in areas of concrete pavement.
			15. Specify bollards where hydrants are unprotected by curb and gutter, placed in open space or at the rear of commercial/industrial buildings.
			16. Fire hydrants are to be placed at high points of pipes, and at low points for 16‐inch and larger pipes to facilitate release of air and flushing of the pipe and require the use of a tangent tee.
			17. Maximum depth of a fire hydrant is 7 feet (measured from the invert of the pipe to the finished grade). Wherever practical, select a hydrant placement that will allow for installation of a 7-foot hydrant or shorter.
			18. Water services and fire lines are not allowed to connect to a hydrant’s lead.
			19. Hydrants shall be painted as identified in exhibit 4E.

**Exhibit 4E: Hydrant Paint Colors**

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| **GPM** | **Cap and Bonnet Color** |
| Under 500 GPM | Gloss Regal Red |
| 500 – 999 GPM | Gloss Orange |
| 100 – 1499 GPM | Gloss Deep Paris |
| 1500 + GPM | Gloss Regal Blue |
| **Barrell Color shall be Aluminum** |
| Valspar Professional Industrial Maintenance Oil Base Enamel |

* + 1. Fire Lines
			1. All water lines serving a fire suppression system in a building shall be shown in the drawings.
			2. All fire lines shall be owned and maintained by the property owner.
			3. A valve shall be located on the fire line at the point it connects to the public water system.
			4. The minimum size fire line shall be 6‐inch ductile iron pipe (DIP).
			5. Fire lines shall be downstream of service connections when located on dead end main.
	1. **Service Connections and Meters**
		1. **Service Connection**
			1. The location of the tap and the termination point of the lateral are to be coordinated with Public Works. An application for services must be made and fees paid at least five days prior to scheduling with Public Works.
			2. The exact locations of all water service lines on new mains are to be coordinated with the Town’s inspector.
			3. A separate water service connection is required for each primary structure or commercial space.
				1. Each dwelling of a duplex or condominium structure shall be considered a primary structure.
				2. For multi-use structures, the nonresidential and residential portions shall require separate service connections.
				3. Apartment buildings may be served by a single connection. The property owner is responsible for the installation of any submetering.
			4. The water service shall only be from distribution lines.
			5. Special approval will be required for any taps over 12‐inch services.
			6. Service connections shall not come off mains with reduced cover, or off deep mains.
			7. Service lines must only be profiled if they are 1.5‐inch or larger in diameter.
			8. Provide a minimum 6-foot horizontal separation with sanitary laterals.
			9. Provide a minimum 5-foot separation with driveways.
			10. Provide a minimum 5-foot separation between water service connections along the main.
			11. The service line between the pipe and the meter shall be the same as the nominal meter size, except that ¾ inch ‐inch meters are supplied through a 1‐inch line. Upsizing or reduction beyond the meter is permitted subject to the requirements of the Shenandoah County Building Inspections.
			12. The Town shall be responsible for the installation of all water meters up to 2”. Before a permanent meter is set, the Town requires the following:
				1. The frame and cover are properly aligned with the meter box and setter.
				2. The frame and cover are set to the final grade of the lot.
				3. The distance between the top of the cover and the setter shall be between 18” and 21”.
				4. All components of the meter box assembly are to be in proper working order. It is the developer / contractor’s responsibility to have the meter box assembly installed correctly.
			13. The service line to a fire suppression system must branch off the pipe independently of other service demands. Where it leaves the pipe, the fire service shall include a valve of a minimum 6 inches in branch diameter. This valve shall be restrained to the tee.
			14. Service lines for multi‐family structures shall enter the building through the mechanical room.
				1. Service laterals shall be 1”, 1 ½”, or 2” diameter lines and shall include saddle, corporation stop, and meter box assembly or vault. Service lateral maximum depth shall be 48”.
				2. Water lateral and meter box assembly or vault shall be placed at the center of the lot wherever possible. The meter box shall be set one foot beyond the property line.
				3. Water laterals that cross under a street shall be encased in PVC pipe. The pipe shall be 3” diameter SDR21 or schedule 40 for 1” service laterals. The pipe shall be 4” diameter SDR21 or schedule 40 for 1 1/2”and 2” service laterals. It shall run 1’ beyond the near sidewalk and the far sidewalk.
				4. Service for industrial and commercial areas shall be sized to provide the flows required by the industrial or commercial customer and shall be installed at the time the lot is developed. A gate valve must be installed within five feet of the building.
		2. **Meter Placement**
			1. The location of outdoor water meters shall be shown on the plans. Meters are to be located outdoors, in underground meter boxes. No meters shall be located in a building/structure. Larger than 2” meters shall be located outdoors (in a vault) with a bypass line The vault needs to be a minimum of 5 feet in diameter with a 2-foot clearance between the water meter and/or bypass line from the top of the interior of the vault structure and bottom of the structure. Plans showing the vault and details of the vault must be provided.
			2. 1 ½” and 2” meters shall have Ford custom setters with by‐pass and check valves.
			3. ¾” water meters may be placed over storm sewer if there is a minimum 5‐foot vertical clearance from top of storm sewer pipe and bottom of meter box.
			4. ¾” fire flow rated meters shall be specified where fire suppression sprinklers are used in single family or townhouse units.
			5. For all services with meters 1.5‐inches and larger, provide an approved backflow prevention device to accomplish the required service line protection. There devices are to be located in the building’s mechanical room, within the service entrance. This requirement shall be noted on the site plan.
			6. The Town shall install meters for service lines.
			7. The Owner/Developer shall provide and install the meters for 3” and larger service lines. An additional meter shall also be provided to the Town. The meter manufacturer and model number shall be noted on the plans. Specifications on the meter shall be provided to the Town prior to plan approval.
			8. Meter size shall be shown on the plans.
		3. **Cross Connections and Backflow Prevention**
			1. Provide a service and maintenance schedule for a backflow prevention device and indicate the responsible parties to provide the regular inspection and maintenance information to the Town of Strasburg on a regular schedule.
			2. A double check valve backflow assembly is to be installed on any line (fire or domestic) that goes into a building. The assembly is to meet ASSE Standard No. 1015 or 1013. If the assembly is mounted inside a building, a remote readout is required.
			3. Where water is supplied to fixtures or systems deemed high hazard, the device providing service line protection is typically required to be one using the reduced pressure zone principle. High hazard fixtures and systems are associated with the following facilities, among others:
				1. Commercial greenhouses and nurseries
				2. Multi‐use commercial, office, or warehouse facilities
				3. High rise buildings (four or more stories)
				4. Fire suppression systems with chemical additives
				5. Hospitals, mortuaries, clinics, veterinary establishments, nursing homes, and medical buildings
				6. Laboratories, and schools or colleges with laboratory facilities
				7. Food and beverage processing plants
				8. Health clubs with swimming pools, therapeutic baths, hot tubs or saunas
				9. Petroleum or natural gas processing or storage plants
				10. Car washes and laundries
				11. Pesticide or exterminating companies, and associated vehicles with storage or mixing tanks
				12. Farms where water is used for purposes other than typical household use.
			4. All Service lines (fire and domestic) shall have an A.S.S.E. (American Society of Sanitary Engineers) approved backflow prevention assembly. Installation must be made in accordance with the Town of Strasburg Cross Connection Backflow Prevention Program.
				1. The backflow prevention device must be installed immediately after the water meter on domestic service lines, and immediately upon entering the structure on the fire service lines.
				2. Backflow prevention equipped with detector meters must be provided with a remote visual readout wired to an exterior wall.
	2. **Pump Stations**
		1. Prior to the design of any pumping station, alternatives should be reviewed to see if a pumping station can be avoided. If a pumping station is absolutely necessary, prior to design, the owner/developer/engineer shall meet with the Town to discuss the needs of the station and the basis of design.
		2. A pump report shall be furnished to the Town that includes the minimum information:
			1. Pump Number
			2. Pump Manufacturer
			3. Pump Definition (3-point curve or horsepower)
			4. Location Elevation (ft) of the Pump
			5. Pump Run Time Status (how long will the pump run and how long it will be off)
			6. Elevation (ft) of the Intake Grade
			7. Elevation (ft) of the Discharge Grade
			8. Discharge (gallons per minute (gpm))
			9. Head (ft)
		3. A result report shall furnish the following minimum information.
			1. Static conditions average day demand
			2. Maximum day demand
			3. Fire Flow Conditions at various nodes during maximum day demand
		4. Prior to acceptance a complete set of operation and maintenance manuals for all operating equipment and materials and the installation thereof required by the project specifications shall be approved by the Town.
		5. Pumping stations shall be protected against lightning.
		6. A schematic drawing showing pipes and nodes with label superimposed on overall project site plan showing streets, buildings, natural drainage features and topography/contour lines with elevation data.
		7. Water pumping stations or water storage tanks must be submitted to VDH for review and approval. These plans will be submitted to the VDH by the County after review and comment by the Town.
		8. Pumping stations shall be located above ground. Underground facilities will not be accepted.
		9. All driveway entrances must have a slope between 2% to 8%. The driveway must be constructed of asphalt with a minimum section of 1.5” Top Course SM‐9.5A, 6” BM‐25 and 10” 21B.
		10. A 12-foot-wide maintenance road shall be required.
		11. Pump stations shall have three‐phase 208-volt power to the site. No roto‐phase units will be allowed.
		12. Pump facilities shall have an alternative power source provided in 208 volt three‐phase. In addition to the alternative power source the station shall have a generator receptacle.
		13. No underground fuel storage tanks shall be allowed.
		14. A third (spare) pump shall be provided to the Town prior to acceptance.
		15. The alarm light and horn shall be 110 volt and have a silence switch.
		16. Underground power shall be provided wherever possible.
		17. **Adjacent Utilities**

Adjacent utilities shall be in accordance with the standards as set forth in Section 3.8 of this manual.

* + 1. **Installation Requirements**
			1. All water pipes and appurtenances shall be installed in accordance with best practice, with materials and workmanship of full quality. Materials and installation shall be in accordance with all applicable sections of American Waterworks Association Standards, with installation specifically conforming to AWWA C600, Installation of Ductile Iron Water Pipes, and with this Manual. The installation contractor shall be solely responsible for ensuring that appropriate and acceptable construction materials, means and methods are used.
			2. Backfill shall be placed promptly after inspection by the Town of Strasburg.
			3. Backfill shall be placed with 6‐inch of #68 stone under the waterline. Then place #68 stone in 6‐inch layers from the top of the pipe bedding to a point 12‐inches above the top of pipe. Crusher run shall be placed in 6‐inch compacted lifts.
			4. Optimum moisture, within ±20 percent of the optimum. The density shall be 95 percent when compared to the theoretical maximum density as determined in accordance with the requirements of VTM‐1 (standard proctor)
			5. Service connections must be stubbed to the property line before the street is paved.
			6. The water released by cutting or opening existing pipes shall be removed and the excavations kept dry until all necessary work within the excavation has been completed.
		2. **Disinfection**

Disinfection testing shall be performed after the pressure testing has been completed. All pipe and equipment shall be disinfected by the continuous feed method or the tablet method in accordance with AWWA C‐65 1‐86 or current revision.

* + - 1. The Continuous Feed Method. Potable water shall be introduced into the pipeline at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/I. The chlorinated after shall remain in the pipe at least 24 hours, after which its chlorine concentration shall be at least 10 mg/l.

**Grams of 11TH Powder Required for Dose of 50 mg/I\***

**Length of Section (feet) Diameter of Pipe (inches)**

**2 6 8 10 12**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 13 | 0.60 | 5.56 | 9.88 | 15.45 | 22.24 |
| 18 | 0.85 | 7.69 | 13.69 | 21.39 | 30.80 |
| 20 | 0.95 | 8.56 | 15.21 | 23.76 | 34.22 |

\*Based on 65% available chlorine in HTH powder.

* + - 1. Tablet Method. Tablets shall be of calcium hypochlorite, containing 70 percent available chlorine by weight. They shall be placed at the top of each section of pipe and in appurtenances by an adhesive approved by the Town of Strasburg. Tablets shall not be completely covered by adhesive. After completion of the construction, the main shall be filled with water at a velocity of less than one foot per second. A minimum concentration of 50 mg/l of chlorine solution shall be in the system at this time. A concentration of 25 mg/l residual chlorine must be present after 24 hours. When water temperature is below 41° F (5° C), this method can only be used if

the retention time is increased to a minimum of 48 hours.

**Number of Hypochlorite Tablets Required for Dose of 50 mg/I\* Length of Section (feet) Diameter of Pipe (inches)**

2 6 8 10 12

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 13 | 1 | 2 | 2 | 3 | 5 |
| 18 | 1 | 2 | 3 | 5 | 6 |
| 20 | 1 | 2 | 3 | 5 | 7 |

\*Based on ¾ grams of 70% available chlorine per tablet.

* + - * 1. All valves and appurtenances shall be operated while chlorinated water is in the pipeline.
				2. After the retention period, the main shall be flushed of the high chlorine water until the water leaving the system shows a chlorine concentration of less than 1 mg/l or no higher than that prevailing in the water used for flushing. After final flushing, a minimum of two water samples shall be collected 24 hours apart for bacteriological tests. During flushing, an acceptable dichlorination unit shall be utilized.
				3. The samples shall be collected at regular intervals not to exceed 1,000 feet throughout the length of the pipe. The Contractor shall assist the Town in taking the bacteriological tests. These bacteriological tests must be analyzed by a State approved laboratory. The results of these samples must indicate the absence of coliform contamination. The costs of flushing and sampling are to be paid by the Contractor/Owner.
				4. The disinfection tests must be satisfactorily completed prior to placing the line in service.
				5. If a disinfection test fails, the chlorination/dichlorination procedure must be repeated until the required results are obtained (Sec. D Charges apply).
				6. If at any time the water in an existing line becomes contaminated, this piping shall be disinfected as specified for new piping, back to the nearest gate valve or valves, or beyond those points as necessary to include all contaminated piping. On completion of disinfection, the piping shall be flushed thoroughly, and samples shall be taken. The after shall be proven safe for human consumption before acceptance of disinfection.
		1. **Acceptance Tests**
			1. All lines shall be thoroughly flushed through the blow‐offs and/or hydrants provided in accordance with AWWA C600 for final acceptance by the Town of Strasburg. Water used will be estimated by the Town of Strasburg and its cost charged to the developer.
			2. Water pipes shall be tested by the procedure outlined in AWWA C600, with the exception that test pressure shall be conducted at 150 percent of normal operating pressure at a minimum of 150 psi at 1000’ maximum intervals.
			3. If the system needs to be shut down, the Town shall be given 72 hours’ notice prior to shut down. Furthermore, only Town of Strasburg Staff may operate valves within the system.
	1. **Corrosion Control**

All storage tanks, pumping stations, vaults, treatment equipment, and similar facilities shall be protected from corrosion using project‐specific design guidelines, which are not included within this discussion. The following is to be applied to all underground water, reclaimed water, and pressurized wastewater pipelines that are to be made of metallic pipe. In certain cases, upon completion of the Decision Process described below, the Town of Strasburg may choose to specify a nonmetallic piping material in an application that would otherwise be built of ductile iron.

* + 1. **Installation Requirements**

All installations of corrosion control measures shall be made according to the approved construction plans and specifications for the project, the Standard Details and the Approved Materials List. Upon completion of the work, it shall be tested, operated, inspected, and surveyed. Any and all repairs or replacement of defective or improperly installed corrosion control systems shall be made by the contractor, at no additional cost to the Town of Strasburg.

* + 1. **A. Contractor Qualifications**
			1. Installation, quality assurance, and testing personnel must have demonstrated experience with similar work. Resume of work experience shall be submitted to the Town of Strasburg for approval.
			2. Personnel shall be specifically named in qualification submittal and have completed at least three successful corrosion control systems within the last three years for underground pipelines of similar type, similar size and equal complexity.
			3. Personnel shall be a full‐time contractor or subcontractor employees. Part‐time or contract personnel hired only for this work will not be permitted.
			4. Only personnel approved by the Town of Strasburg shall be permitted. Personnel changes during the course of the project must be minimized and submitted by the Town of Strasburg at least two (2) weeks prior to plan implementation.
			5. The contractor shall oversee and certify installation and related testing, including pipe joint bonding, magnesium anode ground‐beds, and corrosion control equipment.
			6. The contractor shall issue a letter of compliance indicating all corrosion control measures are satisfactorily installed and are in compliance with contract documents. The letter of compliance shall be signed by the contractor's responsible person.
		2. **B. Anodes**
			1. The prepackaged anodes shall be installed where indicated. Prior to installation, remove all shipping covers from the anode (the packaged box shall not be removed). Install the anodes in existing soils (free from rocks, roots, organic material, trash, or any other debris) and backfill with existing soil (as described above). Do not install the anode in sand, rock, or gravel backfill. Do not lower the anode into the excavation by the lead wire. If necessary, temporarily wrap a rope around the anode and lower the anode into the excavation by the rope. Remove the rope after the anode is installed. Provide a minimum spacing of two feet from other pipelines. Pre‐soak the anode with 5 gallons of water after placement, but prior to backfilling.
			2. Anode header cable shall be buried a minimum of 18 inches below grade. Handle wire with care. All anode lead wire to header cable splices shall be made with a compression connector. Tape the splice with three layers of high voltage rubber splicing tape (50% overlap). Terminate the ends of the anode lead cable in the test stations.
		3. **Bonded Joints**

All pipeline joints within the cathodic protection areas, including those on pipe, fittings, valves, all branch connections, shall be bonded with two insulated copper cables.

* + 1. **Test Station**
			1. 1. Install test stations at the locations required. Test stations are to be located directly over the pipeline except in areas that would place the station in the roadway. Locate these test stations to the closest point at the edge of the road.
			2. Attach test wires as indicated using the proper thermite welding equipment and charges specified for the wire size and respective pipe material. Follow all procedures as outlined above.
			3. All test station wires shall be routed a minimum of 18 inches below finish grade. Maintain sufficient slack in the test wires so that the wires can extend a minimum of 18 inches from the compression thermal lugs for 0.25-inch bolt size. Install a shunt to connect the anode lead to the pipe lead where indicated on the design drawings.
			4. The test stations shall be set in poured concrete. Cathodic protection test station pad concrete shall be Class B concrete.
			5. The flush mounted test station lids shall be free of concrete and not cemented over.
		2. **Clearance Requirements**

If 12” separation is not possible, positive separation shall be provided using glass mesh. A minimum of 6” separation shall be maintained from any foreign pipeline or structures.

* + 1. **Electrical Isolation**
			1. Insulating Flanges: Approved insulating flanges shall be installed in accordance with specific design considerations.
			2. Insulating Unions: Approved insulating unions shall be installed in accordance with specific design considerations to isolate bimetallic service lines and other type connections that may create corrosion conditions from dissimilar metallic connections.
			3. Die‐electric Pipe Materials: Approved die‐electric pipe materials shall be used to isolate metallic pipe, where specified as part of design consideration for foreign pipeline crossings as part of stray current mitigation considerations. Polyvinyl chloride and high-density polyethylene pipe sections are permissible materials. Pipe materials, thickness design, and pipe specifications shall be provided by the Town of Strasburg.
		2. **Trench Excavation**

The trench and backfill material around the pipeline shall be clean of all debris, such as trash, wood, and rocks. Strip forms at blockings.

### CHAPTER 4. Definitions and Notes

**Definitions and Abbreviations**

Abbreviation Key to Abbreviations

AASHTO American Association of State Highway Transportation Officials ADAG American Disabilities Act Guidelines

ASSE American Waterworks Association Standards

AWWA American Waterworks Association Standards

BMP Best management practices

BODR Basis of Design Report

LD Land Development Program

CP Capital Programs

CRZ Critical Root Zone

EPA Environmental Protection Agency

FDC Fire department connection

FHWA Federal Highway Administration

ITE Institute of Transportation Engineers

LID Low impact development

LOS Level of Service

MUTCD Manual on Uniform Traffic Control

NCUS Non-Motorized User Circulation System

NFI National Flood Insurance Program

OM Operations and Maintenance

PM Project Manager

SPS Sewage Pumping Station

Town Town of Strasburg

VDCR Virginia Department of Conservation and Recreation

VDEQ Virginia Department of Environmental Quality

VDOT Virginia Department of Transportation

VDH Virginia Department of Health

USGS United States Geological Survey

**Interpretation of Terms**

* + 1. “Town of Strasburg” or “the Town” shall mean the Town Council, its employees, or authorized representatives. The Town of Strasburg shall hereinafter be referred to as the “Town” and be recognized as the policy making body over facilities herein described.
		2. “Owner” or “Developer” shall mean any person(s), group, corporation, or affiliations associated with or responsible for the initiation, design, and/or construction of facilities herein described. These facilities are intended to be under the jurisdiction of, and become a part of, the public utilities system of the Town.
		3. “Contractor” shall be any person(s), firm, group, corporation, or affiliations charged with the responsibility of constructing the facilities herein described, and subject to the provisions and regulations set forth herein.
		4. “Consultant” or “Engineer” shall mean a professional engineer registered to do business in the state of Virginia.
		5. “Surveyor” shall mean a professional surveyor registered to do business in the state of Virginia.

### CHAPTER 4. Construction Details

* 1. Trench & Bedding
	2. Buttresses for 90 Degree Bends
	3. Buttresses for Tees, Plugs and Caps
	4. Buttresses for 11-1/4, 22-1/2, & 45 Degree Bends
	5. Stream Crossings
	6. ¾” & 1” Meter Installation
	7. 1-1/2” & 2” Meter Installation
	8. 3”-8” Meter Vault with Exterior Bypass
	9. 3”-8” Meter Vault with Interior Bypass
	10. Gate Valve
	11. Fire Hydrant Assembly
	12. Blow-off Assembly
	13. Combination Air Release and Vacuum Valve Vault
	14. Water Line Marking System
	15. Concrete Pier & Water Crossing
	16. Double Gate Fencing for Facilities
	17. Sampling Station