### CHAPTER 5. Wastewater Collection

* 1. **Purpose and Intent**

The purpose and intent of these wastewater collection design standards are intended to assist design engineers in the development of plans and specifications for the Town of Strasburg projects. The materials, configurations, and features described here represent the minimum acceptable level of quality expected in the wastewater collection design. These standards should not be construed as being a complete description of the necessary features for a particular pumping station design. Deviations from these standards must be approved by the Town of Strasburg during the Basis of Design phase of the project.

* 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:

Virginia Sewage Collection and Treatment Regulations Virginia Building Code

Virginia Water Control Board

VDOT (Virginia Department of Transportation); Road and Bridge Specifications Town of Strasburg Approved Materials List

* 1. **General Standards**
		1. The 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. The Town of Strasburg will consider 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.
		2. The property owner is responsible for all water and sewer laterals from the town right‐of‐way to the residence.
		3. All materials used in the construction of the sewer system shall have the approval of the Town. AWWA and ASTM set forth only a set of standards for materials. Since these standards are quite broad, they may or may not meet the requirements or needs of the Town. Any materials not listed in these standards and specifications or not currently accepted by the Town shall be approved by the Town before installation.
		4. The following approval procedure shall be used for alternative materials:
			1. A cover letter along with two sets of manufacturer’s certifications, and shop drawings and/or samples shall be sent to the Town’s engineer.
			2. After his review, the engineer will issue a letter stating whether the product is acceptable or not.
		5. Unapproved materials placed on a job site shall be subject to immediate rejection and barred from any further consideration.
		6. Pipe ‐ Polyvinyl chloride pipe (PVC): (See approved materials list)
			1. Gravity sewer main pipe with cover between 6 — 15 feet shall be SDR26.
			2. Force main pipe shall be DR18, C900 green labeled or cement lined ductile iron force sewer for 4” and larger, and 2” SDR21. ETI, Certain‐Teed, Johns Manville, or our approved equal shall manufacture pipe.
			3. Gravity sewer lateral (4”) pipe shall be SDR26.
		7. Pipe – Ductile Iron
			1. Gravity sewer main with cover greater than 15 feet shall be Ductile Iron Pipe.
			2. Ductile iron pipe shall conform to the requirements of AWWA Standard C 151. The pipe shall be cement lined in accordance with AWWA Standard C 104. Unless otherwise specified, the pipe shall have push‐on joints meeting the requirements of AWWA Standard C111. The wall thickness of the pipe shall be Class 52. The pipe shall be manufactured by Griffin Pipe Co., Clow Corporation, or our approved equal.
		8. Manholes
			1. Manholes shall be pre‐cast concrete conforming to ASTM C478 with eccentric cones and extended bases. Concrete shall conform to the requirements of ASTM C150. Joints shall be 0‐ ring conforming to ASTM C361.
			2. Walls shall be a minimum of five inches thick and the base a minimum of eight inches thick.
			3. The diameter of the extended base shall be 12 inches greater than the outside of the barrel section.
			4. Manholes for sewer through 24 inches in diameter shall have a four foot inside diameter. Manholes for sewer greater than 24 inches in diameter shall have an inside diameter of six feet.
			5. Pre‐cast inverts are acceptable.
			6. The exterior (including adjustment rings) shall be covered with black asphalt Gilsonite paint such as LN‐12, manufactured by Seaboard Asphalt Products Company, or our approved equal.
			7. Pipe shall be secured to the entry hole by a lock joint flexible manhole sleeve as manufactured by Chardon Rubber Co. or our approved equal.
			8. The joint(s) between the frame and cover, grade ring(s) and cone section shall be sealed by use of ¾” diameter concrete anchor bolts and one‐inch nominal size butyl joint sealant. The sealant shall be CS 102 by Concrete Sealants, Inc., or our approved equal.
			9. Joints between sections shall be sealed with 0‐ring gasket and a one‐inch nominal size butyl joint sealant. The butyl sealant shall be CS 102 by Concrete Sealants, Inc., or our approved.

equal. The joint between the top section (cone or flat) and the frame base shall have the same sealant.

* + 1. Manhole Frames and Covers. (See approved materials list)
			1. Manhole frames and covers shall conform to ASTM A‐48. The frame shall be drilled to permit using ¾ inch diameter bolts to secure it to the manhole. Four such bolts shall be used per frame. The words “Sanitary Sewer” shall be cast into the cover so as to be plainly visible. Standard manhole frames and covers shall be:
				1. Quality Water Products, style 40, Type A frame with cover labeled sewer.
				2. B & C model 1012 frame with 1012‐A cover
				3. East Jordon Iron Works, Inc., Product Number 154403.
				4. Our approved equal
				5. Covers shall be solid with two pick holes.
			2. Watertight manhole frames and covers shall be constructed of Quality Water Products, Model Pamtight (assembly No. REGIRIFD), with hex‐head stainless steel bolts, or our approved equal. All manholes located in a water course must be watertight and 1‐foot above the 100‐year elevation water surface elevation.
			3. Areas that may experience heavy surface flows may require a solid cover as determined by the Director of Public Works.
		2. Fittings
			1. PVC fittings in gravity sewer lines shall have the same or greater SDR rating as the pipe used.
			2. Fittings used in sewer force mains shall be Class 350 ductile iron conforming to ASTM A53‐72, minimum grade 70‐50‐05. Nominal thicknesses of fittings shall be equal to, or exceed, Class 54 ductile iron pipe thicknesses. Fittings shall be cement lined in accordance with AWWA C104‐

74. Radii of curvatures shall conform to AWWA C11‐71. They shall be mechanical joints if buried and flanged if used in vault or pump station piping.

* + 1. Valves
			1. Gate valves and tapping sleeves and valves 3” through 24” shall be manufactured to meet and/or exceed all the AWWA requirements for resilient wedge valves. The following shall be required:
				1. The valve body shall be of ductile iron with a 250-psi working pressure.
				2. The valve wall thickness shall exceed the minimum AWWA C 153.
				3. The valve shall have a fusion bonded epoxy coating inside and out.
				4. The valve shall have a smooth, full diameter waterway with no recesses.
				5. The valve stem shall be high‐strength corrosion resistant bronze.
				6. The valve shall have upper and lower 0‐ring stem seals, with the upper 0‐rings field replaceable under pressure with valve in the open position.
				7. The valve shall have torque‐minimizing thrust washers.
				8. The valve shall have cast into the body of the valve the material of manufacturer “Ductile Iron” (DI) and pressure rating 250 psi.
				9. The valve wedge and nut wrench shall be ductile iron and fully encapsulated with nitrile rubber.
				10. Sealing gaskets shall be energized 0‐rings.
				11. The stuffing box shall be constructed of ductile iron.
				12. Mechanical joint gate valves 6” through 12” shall have anti‐rotational bolt slots.
				13. Valves shall be listed by Underwriters Laboratories, Inc. and approved by Factory Mutual Research Corporation.
				14. Flanged face valve sizes 3” through 12” shall have 125 lb. flanges as required and shall be rising stem with hand wheel.
				15. The valve shall be equipped with ductile iron lifting lugs integrally cast in the stuffing box, allowing ease of handling and installation, minimizing possible damage of valve.
			2. Check valves shall conform with the specifications in AWWA Standard C508. Valves shall be equipped with an outside weighted arm unless specified otherwise. Valves shall be manufactured by American Darling, or our approved equal.
			3. Sewage combination air release and air/vacuum valves shall have cast iron bodies with stainless steel floats. Other internal parts will be either stainless steel or bronze. Valves will be sized appropriately for each application. Valves shall be Val‐MATIC Model VM‐8O1BWA, or our approved equal.
		2. Valve Boxes. Valve boxes for gate valves shall be two-piece cast iron with a 5 1/4” drop lid marked “sewer”. Boxes shall be of the screw type adjustable with a 5 1/4” shaft diameter. Adjustment range shall be one foot. The box length shall be determined by the depth of the burial. The valve box shall be East Jordan Ironworks.
		3. Joint Restraints
			1. Glands to restrain MJ fittings and pipe bells to DI pipe shall be EBAA Iron Megalug series 1000, Ford uni‐flange series 1400, or our approved equal.
			2. Glands to restrain MJ fittings and pipe bells to PVC pipe shall be EBAA Iron Megalug series 2000PV, Ford uni‐flange series 1500, or our approved equal.
			3. Glands to restrain PVC pipe bell to spigot shall be EBAA Iron Megalug series 6500, Ford uni‐ flange series 1390, or our approved equal.
			4. Glands to restrain DI push joint pipe bell to spigot shall be EBAA Iron Megalug Series 1700, Ford uni‐flange series 1450, or our approved equal.
		4. Sewer Laterals – Gravity Only
			1. In new construction, wyes shall be used to connect the four‐inch lateral to the sewer main.
			2. In connecting to existing lines, wyes, 18” stub pieces, and an approved coupling shall be used to connect the 4” lateral to the sewer main. (See details or approved materials list)
			3. Allow saddles
			4. Following the leg of the wye there shall be: (see detail?)
				1. A SDR26 spigot by gasket bell 45‐degree bend.
				2. SDR26 gasket pipe and fittings as needed.
				3. Wye and 45 to make a cleanout (See Figure 17)
				4. A SDR26 spigot by SCDE 40 adapter.
				5. A SCH4O solvent weld cap (see Figure 15).
		5. 2” Laterals ‐ Forcemain Only
			1. Saddles for PVC pipe shall be Ford style S 90 or our approved equal.
			2. Corporation stops shall have an inlet threaded in accordance with AWWA standard C800 and a male iron pipe outlet. It shall be a Ford Series FB400 or our approved equivalent.
			3. The connection at the property line will contain a two‐inch ball valve with a two‐inch square operating nut. The valve shall be a Ford Series B 11 777 or our approved equivalent.
		6. New Lines into Existing Manholes. All new openings into existing manholes shall be core drilled. The connection between the pipe and the manhole shall be made by Kor‐N‐Seal.
		7. Metering Station. Metering stations shall be rectangular in shape and contain a flume of appropriate size for present and future flows. A Sparling FT400‐1 11 ultrasonic open channel flow transmitter used with a Sparling XD400‐ 110 open channel flow transducer shall monitor the flow. In non‐flood areas, the metering station shall have a Bilco K2 access door or our approved equal. The door shall have a recessed hasp covered by a hinged lid flush with the surface. In flood areas, a watertight manhole frame and cover shall be required. Refer to Figure 18.
		8. Cleanouts materials shall be specified as in Figure 17.
		9. Blow Off Assemblies materials shall be specified in Figure 10.
		10. Sewage Pump Stations, as provided in this TDM.
		11. Pipe Casings for sewer mains shall be sized in accordance with Figure 3. Casing pipe shall be steel and shall meet ASTM specifications A252 Grade 2, or Grade B.
		12. Pipeline Casing Spacers
			1. Manufactured steel and/or plastic casing spacers. Spacers shall be by PSI, Inc., Recon, or our approved equal.
	1. **Hydraulic Requirements**
		1. Designs of sewer systems, including pumping facilities, shall be based on the Town of Strasburg’s Community Plan, Zoning Ordinance, technical memoranda and any other pertain documentation.
		2. Sewers serving out of town residents shall be designed on the basis of a population density resulting from the land uses listed in Shenandoah County documentation.
		3. Analysis shall be provided for all trunk and subtrunk sewers, and when required by the Town of Strasburg, for collecting sewers.
		4. In determining the required capacities of sanitary sewers, these factors shall be considered are peak hourly quantity of domestic sewage and additional maximum sewage or waste from commercial and industrial facilities.
		5. New sewer systems shall be designed on the basis of an average per capita flow of sewage from the equivalent population served of not less than 100 gallons per day (gpd). On this basis, the following unit factors shall be used in flow calculations:

**Exhibit 5A: Wastewater Loadings**

|  |  |
| --- | --- |
| Single Family Detached Unit | 350 gpd |
| Single Family Attached Unit | 280 gpd |
| Multi‐Family Dwelling Unit | 280 gpd |
| Retail Space | The greater of 0.093 gpd/sq ft. or 30 persons per acre |
| Commercial/Office Space | The greater of 0.160 gpd/sq ft. or 30 persons per acre |
| Industrial Space | The greater of 0.160 gpd/sq ft. or 30 persons per acre |

* + 1. Sewer capacity shall be designed to support peak hour flows (PHF) when running full, in accordance with the following equations where PFF is the peak flow factor and QAVG is the average daily flow in MGD:

PFF = 3.81(QAVG) -0.187 PHF = PFF(QAVG)

* + 1. Where appropriate, alternative peaking factors to those determined above will be considered.
			1. Minimum peaking factors shall be as follows:

**Exhibit 5B: Peak Factor**

|  |  |  |
| --- | --- | --- |
| **Category** | **Size** | **Factor** |
| Lateral and building sewers | ≤ 6‐inch | 4.0 |

|  |  |  |
| --- | --- | --- |
| Collector and trunk sewers | 8‐inch through 24 inches | 2.5 |
| interceptors | ≥ 30‐inch | 2.0 |

* + - 1. Computations shall be based on the following values for Manning’s formula “n”:

|  |  |
| --- | --- |
| **Size** | **“n” Value** |
| 8‐inch through 24‐inch | 0.013 |
| >24‐inch | 0.012 |

* + 1. Unless evidence is presented to demonstrate a different flow from industry at ultimate development, the minimum allowance for industrial flow shall be determined by providing an equivalent population of 40 persons per acre or one (1) equivalent population per employee, whichever is greater, in the industrial area. “Area” shall include entire area planned for industry, except public road, street and highway rights‐of‐way, flood plains on which construction is prohibited, and “green zones” at least 100 feet in width separating industrial from residential areas on which construction is prohibited.
		2. The minimum allowance for flows from commercial areas shall be determined by providing an equivalent population of 30 persons per acre, or 1/2 equivalent population per employee, whichever is the greater, in the commercial area. Area shall include entire area zoned for commercial development, including off‐street parking areas and landscaped areas, but excluding the rights‐of‐ way of public roads, streets and highways, flood plains of streams on which construction is prohibited and “green zones” 100‐feet or wider separating commercial from residential areas, on which construction is prohibited.
		3. In cases where the above criteria are not applicable, an alternative design procedure may be submitted to the Town of Strasburg for approval. A description of the procedure used and justification for the modifications for sewer design proposed shall be included with the Design Analyses and plans submitted for approval.
		4. Minimum size of public sewer is 8‐inch diameter.
		5. The design must account for 400 percent of the average design flow.
		6. The minimum peak design flow for mains, trucks and/or interceptors shall be 300 percent of the average design flow.
	1. **Sewer Pipe Layout**
		1. Ten (10) Gauge Solid Copper Wire underground rated shall be run with all sewer mains and services. All splices/connections shall be waterproof.
		2. Facilities being decommissioned shall be abandoned and associated easements vacated. Manholes, structures, pipe, and appurtenances are to be removed.
		3. At manholes, the minimum angle between influent and effluent lines is 90‐degrees.
		4. Show sanitary sewer crossings on all applicable profiles of other utilities.
		5. Separations
			1. Provide a minimum 10-foot horizontal separation (outside to outside) with water pipe, including manholes, in accordance with the Waterworks Regulations (12 VAC 5‐590‐1150).
			2. Provide minimum 6-foot horizontal separation (outside to outside) with storm drainage piping and structures, including at sanitary manholes. Under no circumstances may any sewer cross beneath storm drainage structures.
			3. Provide a minimum 15-foot horizontal separation with a building or any other above ground structure. This requirement may be increased for deep and/or large diameter sewers, as determined by the Town of Strasburg.
			4. Provide a minimum 50-foot horizontal separation with wells. Show all wells within 100 feet of sanitary sewer easements.
		6. Pipe deflections will not be allowed.
		7. Location of Sewer
			1. Manhole location in pavement is preferred. Locate manholes at crown of pavement if possible. Where separation requirements preclude manholes on crown or centerline, manholes should be placed in the center of the travel lane.
			2. In public roads containing both water pipes and sewer pipes, there will typically not be sufficient width to accommodate waterline with sewer on centerline. In this case, center manhole 5 feet from the centerline of the roadway. In such cases, the waterline is typically located 8 feet from the centerline, on opposite side of street, resulting in the required 10-foot separation (outside to outside).
			3. Locate manholes beyond spread of gutter’s flow.
			4. Identify places where future extension of public or service pipe appears practical to allow service to other buildings or properties. Sewer is to be constructed to 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 adjacent or crossing waterlines or storm drains that would otherwise be undermined during subsequent sewer installation. Easement for the future line 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.
			5. Any relocation of existing sewer facilities due to development is the responsibility of the Developer. Where grading is to occur, resulting cover on existing sewer must remain above design minimum and may be considered excessive if resulting in total cover in excess of 15 feet. Encumbrance of pipes or manholes for future access and/or reexcavation will necessitate replacement in kind, in the form of a parallel facility.
			6. Sewers installed above existing grade shall be placed in controlled fill compacted at optimum moisture, within ± 20 percent of 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).
			7. Minimum slopes (percent(s)) of pipes are as follows:

**Exhibit 5C: Pipe Slope (Minimum)**

|  |  |
| --- | --- |
| **Size** | **Slope** |
| 6‐inch | 1.00 |
| 8‐inch | 0.50 |
| 10‐inch | 0.37 |
| 12‐inch | 0.29 |
| 16‐inch | 0.20 |
| 20‐inch | 0.14 |
| 24‐inch | 0.10 |
| 30‐inch | 0.06 |

* + 1. Minimum slopes for larger pipes will be determined on a case‐by‐case basis. Terminal upstream sections of sewers and those sections discharging into lift stations, sewage treatment plants, plant effluent into streams, etc., will require a minimum slope of double that indicated in above table.
			1. Maximum slope on all gravity sewers is 10.00 percent.
			2. Minimum velocity is 2.25 feet per second for gravity flow. Maximum velocities should not exceed 15 feet per second (fps). Calculations shall be provided.
			3. Maintain minimum vertical separation of 2.0 feet if sewer is below and/or above another utility.
			4. Maintain a minimum cover of 6.0 feet. Cover may be reduced to 4.0 feet when justified in isolated instances at the upper reaches of the system, and where the pipe is located in grassy areas. Maximum cover is 15.0 feet for sanitary sewers.
			5. Gravity sewers less than or equal to 12‐inch diameter shall be constructed of PVC SDR‐26 where cover is less than 6 feet, or where cover exceeds 15 feet. Pipe specifications for all other diameters and materials shall be made in accordance with the Approved Materials List. Pipe material, pressure class, and/or dimension ratio must remain constant between manholes.
			6. Minimum cover at a stream crossing is 2 feet if in rock or 4 feet if in soil or alluvial deposits. Concrete encasement shall be provided where the cover is less than 4 feet.
			7. Locate outside of areas supporting foundations of structures. Where sewers are deep and in close proximity to structures, the Town of Strasburg may request a loading plane diagram showing that the sewer may be excavated through conventional means without disturbance to the surrounding structure(s). Adequate easement must be provided so that future excavation and maintenance is feasible.
			8. Sewer stub connections for future build out is a minimum of 1.0 percent.
	1. **Manholes**
		1. Manholes shall be provided at the following locations:
			1. All junctions, changes in horizontal alignment, changes in gradient, and temporary or permanent terminus of pipe;
			2. Every 300 feet of developed length (8‐inch through 16‐inch diameter) and every 300 feet of developed length (greater than 16‐inch diameter);
			3. Changes in pipe diameter;
			4. Lateral connections for laterals 6‐inch diameter and larger.
		2. Pre-Cast Manholes will only be accepted.
		3. A minimum separation of 10 feet horizontally and 6 feet vertically from the exterior edge of the manhole to any utility.
		4. No more than a maximum of 4 connecting sewer pipes (including laterals) can enter a single manhole.
		5. The inside diameter of the manhole shall be a minimum of 4 feet. Pipe sizes larger than 24‐inch diameter will require a minimum of 6 feet and may need to be enlarged.
		6. There should be a minimum of 6‐inches between pipes in the manholes.
		7. Minimum depth of the manhole is 6 feet, with a maximum depth of 15 feet. Manholes maximum depth shall be measured from the rim to the lowest invert.
		8. Inside the manhole, provide a maximum of 0.50 feet and a minimum of 0.15 feet between invert elevations of pipes of like diameters. When influent pipe is of smaller diameter than effluent pipe, its minimum invert elevation is that which results in matched elevations between crowns of influent and effluent pipes. Additional drop across manholes may be required to insure that a positive hydraulic grade is maintained across the manhole so that flows do not surcharge one or more of the influent pipes.
		9. Drop connections shall be approved by the Director of Public Works prior to approval of plans and there shall be no more than a 5-foot drop.
		10. The maximum slope within a manhole shall not exceed 2 percent.
		11. “Doghouse” manholes are not permitted. Any manhole installed on an existing sewer pipe must be cut in.
		12. Heavy duty covers must be provided for all manhole lids.
		13. All manholes located in a water course must be watertight and 1‐foot above the 100‐year elevation water surface elevation.
		14. When crossing surface water, a manhole shall be placed on either side of the channel.
		15. If the manhole is placed in undeveloped areas, the manhole must be 2‐foot above the surrounding grade. No manhole shall be more than 4‐feet above the surrounding grade.
		16. Provide positive drainage around each manhole proposed.
		17. Cleanouts/handholds will not constitute as a manhole and will not be accepted into the Town system.
		18. Pipe material from Manhole to Manhole shall remain the same.
		19. Exterior of manholes must be waterproof coated.
		20. Manholes shall not pond water in the inverts.
	2. **Easements**
		1. Provide easements which are a minimum of:

**Exhibit 5D: Sewer Easement Width**

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

* + 1. Easement requirements for gravity sewers larger than 12‐inch diameter will be specified on a project‐ specific basis.
		2. Provide vehicular access to easement from street, including drop curb where applicable, and grade easement to allow vehicular traverse, with slopes not to exceed 8 percent. Access shall be to all manholes. The road shall be at least 10 feet wide and paved, graveled, or stabilized with an engineered product for all weather access by maintenance vehicles. This requirement may be reduced in environmentally sensitive areas.
	1. **Service Connections**
		1. For each premises receiving service, provide one or more independent connection(s) to public sewer.
		2. Connections to single family homes shall be 4‐inch minimum; connections to multifamily, commercial, and industrial buildings shall be 6‐inch minimum.
		3. Services of single-family dwelling (attached and detached) units are preferred to connect directly to pipe, not to manhole. Services of multi‐family residential, commercial, and industrial premises are preferred to connect at a manhole.
		4. Laterals 6‐inch diameter and larger must connect at a manhole. Additionally, manholes are required in lieu of clean‐outs at all changes in horizontal alignment and vertical grade on all laterals 6‐inch diameter and larger.
		5. Significant commercial/industrial users, as indicated in the Town Code shall include grease interceptors, oil/water separators, and other pretreatment devices. These devices must connect with a lateral at a manhole prior to entering the town system.
		6. Significant commercial/industrial users, as indicated in the Town Code shall provide a maintenance schedule and a list of responsible parties for removal and cleaning of the pretreatment devices.
		7. When connecting to pipe just outside a manhole, a minimum distance of 5.0 feet is required between outside wall of manhole and connection point.
		8. Laterals shall extend at exactly 90 degrees when directly connecting to sewer pipe.
		9. Provide minimum horizontal separation of 5.0 feet (center to center) between laterals directly connecting to sewer pipe.
		10. When connecting at a manhole, a lateral must describe no less than a 90-degree angle with effluent pipe.
		11. Laterals shall be located to minimize the number of bends in the subsequent extension of building sewer, taking into account all known architectural constraints or proposed structures.
		12. Laterals must be terminated at the Town’s right‐of‐way or easement of the anticipated house site.
		13. Owner/developer shall not connect sewer lateral to clean out riser pipe.
		14. Lateral service from the rear of lots is discouraged, due to the typical encumbrance of pipes for maintenance.
		15. Provide minimum horizontal separation of 6.0 feet between lateral and driveway apron.
		16. Provide minimum horizontal separation of 6.0 feet between lateral and water service.
		17. Maintain minimum vertical separation of 2.0 feet if service spur is above or below another utility.
		18. Laterals connecting at a manhole may match crown elevations with the highest influent sewer or be higher.
		19. Laterals are to be at sufficient depth to allow sewer service to the lowest portion of a structure, including basement. A minimum slope of 2.08 percent to a point 2 feet below the lowest floor elevation, at the most remote portion of the building.
		20. Where depth of pipe would result in excess depth of lateral, the slope of the lateral may be increased from 2.08 percent (.”:1’) to 4.17 percent (.”:1’). If further reduction of cover is warranted, specify a vertical offset (1:1 riser) in accordance with the Standard Details. Such vertical offsets must be 3.0 vertical feet or more, and must be exterior to right‐of‐way, easement, and traffic court.
		21. All lateral connections must be stationed in the profile of the sewer main.
		22. Show crossing laterals on profiles of storm drains and water pipes if vertical clearance (outside to outside) is less than 3.0 feet.
		23. Specify a clean‐out where developed length reaches 100 feet.
		24. Specify a clean‐out at the building’s property line. Clean‐outs must be shown in the plan and profile of all commercial laterals. Clean outs must be surrounded by a 10-foot dedicated easement.
		25. No drains subject to receiving storm water may be tributary to the sanitary sewer.
	2. **Force Mains**
		1. The use of force mains shall be discussed with the Town Manager and Director of Public Works prior to use and approval of a force main. It is recommended that a gravity feed system is preferred.
		2. The hydraulic design of force mains shall be based on the following:
			1. Force mains shall be designed for a minimum velocity of two (2.0) feet per second and a maximum velocity of eight (8.0) feet per second.
			2. The minimum size of force mains shall be four (4) inches in diameter, except for grinder pumps which shall be two (2) inches.
			3. An air release valve shall be placed at all high points in the force main as necessary to provide for air release that has accumulated in the pipeline.
			4. Force main piping and fittings shall be C‐900 or cement‐lined ductile iron pipe and shall be designed to meet the maximum pressure of the system.
			5. Force mains shall enter the gravity sewer system at a manhole or special junction chamber. The force main shall enter the termination structure with its centerline horizontal and at a point no higher than one (1) foot above the flow line of the receiving gravity sewer. The design of the force main termination structure shall ensure a smooth flow transition to the gravity flow section to prevent turbulence and release of gases. All interior walls of the force main termination structure shall be coated with coal‐tar epoxy.
			6. Force mains shall be sufficiently anchored throughout the line length. The number of bends shall be as few as possible. Restrained joints shall be provided where restraint is needed.
			7. All force mains shall be tested at a minimum pressure of at least 50 percent (5 0%) above the design operating pressure, for at least 30 minutes. Leakage shall not exceed the amount given.
	3. **Pumps/Grinders**

Pumps/Grinders are not to be used in the collection system. Pumps may be added behind the cleanout on the owner’s property, provided that the pump is maintained by the owner. If a pump is to be used by the owner, the Town of Strasburg shall be notified 2 weeks in writing prior to installation. Pumps/Grinders may also only be used within a pump station or within the wastewater treatment plant.

* 1. **Adjacent Utilities**

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

* 1. **Installation Requirements**
		1. All sewer pipe and appurtenances shall be installed in accordance with the best practice, with materials and workmanship of the best quality. Specifically, installations shall be in accordance with applicable sections of AWWA Standard C600 ‐ Installation of Ductile Iron Water Pipes and AWWA Standard C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe.
		2. Blasting, where required, shall be done with care in accordance with all applicable Federal, State, and local laws, ordinances and regulations, and shall not be done within a distance of 25 feet from a previously laid pipe or a previously installed structure.
		3. Backfill shall be placed promptly after inspection by the Town of Strasburg
		4. Backfill shall be placed with 6‐inch mixture of Grade A sand with #68 stone under the sewer line and/ lateral. 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 fills compacted at optimum moisture, within ± 20 percent of optimum. The density shall be 95 percent when compacted to the theoretical maximum density as determined in accordance with the requirements of VTM‐1 (standard proctor).
		5. Lateral connections must be stubbed to the property line before the street is paved.
	2. **Acceptance Tests**
		1. No more than 5,000 feet of pipe shall be installed without testing. The contractor shall not proceed with further construction until the preceding section has been approved by the Town of Strasburg.
		2. Testing shall not be conducted until at least 7 days have elapsed after all concrete thrust blocking has been installed.
		3. At the cost of the contractor, all lines shall be inspected through the use of closed-circuit television inspection. Inspection shall take place prior to preparing the subbase, in which the contractor shall clean sewers prior to each television inspection. If the interior of the pipe shows poor alignment, incorrect joining, displaced pipe, leakage, or any other defect, the defect shall be remedied before acceptance.
		4. Completed sewers and laterals must hold at constant pressure for a minimum of no less than 15 minutes and 1 second 4 psi. A ball plug on each end of the segment shall be inserted at each end of the pipe. At one of the ball plugs shall have a tube and gauge for the filling of air and pressure testing. Installations of sewer and laterals shall exhibit zero exfiltration.
		5. All completed manholes shall be tested for leakage. Ball plug(s) on each interior connection of the manhole. A vacuum and mercury gauge shall be placed on the manhole frame and cover. The manhole shall hold a minimum of nine inches of mercury for not a time on less than the following:

**Exhibit 5E: Manhole Leakage Testing**

|  |  |
| --- | --- |
| **Depth** | **Pressure Change of 1 Hg Mercury (in inches)** |
| 8 feet and less | 60 seconds |
| 8 feet to 10 feet | 75 seconds |
| 10 feet to 12 feet | 90 seconds |
| Above 12 feet | Approval is required for manholes deeper than 12 feet deep |

* + 1. The Contractor shall provide the Town with inspection and calibration records of equipment as requested.
		2. Manholes may be tested with associated pipe. Where entire depth has not been included in the testing of pipe, the manholes shall be used to plug all lines into and out of the manhole being tested. The manhole shall be plugged independently and filled with water to the top.
		3. If the system needs to be shut down, the Town shall be given 72 hoursnotice to the Town prior to shut down.
		4. Hydrostatic pressure testing (Force Mains)
			1. Fill pipeline with water in accordance with these specifications for a minimum of 24 hours immediately prior to testing for leakage.
			2. Test piping under the greater of a hydrostatic pressure of 125 percent of the maximum expected working pressure at the high point of the line unless otherwise shown. Purge air from the pipeline through taps in the pipe prior to testing. Apply test pressure to the piping by means of a hand pump or other approved method and maintain pressure for minimum of two hours. The test pressure shall not vary by more than plus or minus 5 psi (35 KPA) at any time during the test.
			3. The leakage as determined by the preceding test shall not exceed the allowable leakage.
		5. Force main sewer line inspection and testing
			1. The Contractor will furnish meters and gauges for testing purposes.
			2. The Contractor shall test the force main for leakage in the presence of a Town inspector and incur the cost of the test. All tests shall be conducted in a manner to minimize interference with the Contractor’s Work or progress. A maximum of 2,500 feet (800 meters) of force main may be tested at one time.
			3. Test each section of force main between adjacent valves separately. The maximum differential pressure across any valve during testing shall not exceed the test pressure recommended by the valve manufacturer. The Contractor shall provide all temporary bulkheads and thrust restraint to isolate the force main test section and shall provide all long solid sleeves necessary to make the permanent connection to the system at no additional cost.
			4. Notify the Town when the Work is ready for testing. All labor, equipment, and materials shall be furnished by the Contractor, unless otherwise specified.
			5. Testing shall not be conducted until at least 7 days have elapsed after all concrete thrust blocking has been installed.
			6. The Town reserves the right to check the completed pipeline for vertical alignment prior to filling with water and testing.
			7. Install air relief/vacuum valves as indicated on the drawings and check each for proper operation prior to filling the force main for testing. If for any reason it is necessary to drain the force main, the Contractor shall take all precautions required to ensure the safety of personnel entering and inspecting the force main. When draining the force main, all air valves shall be rechecked for proper operation. This is required to avoid the formation of a vacuum lock which could prevent the water from properly draining and become a hazard to men working within

the pipeline if released. Pipelines containing large orifice valves shall be filled at a maximum rate of 1 foot per second (300 millimeters per second).

* + 1. Leakage Test (Force Mains)
			1. Conduct a leakage test concurrently with the pressure test. The pressure to be induced at the high point of the test section for the leakage test shall be equal to the elevation of the hydraulic gradient minus the high point elevation of the water main section to be tested, multiplied by 0.433, but never less than 100 psi. Maintain this pressure for a minimum of 2 hours.
			2. The leakage as determined by the preceding test shall not exceed the allowable leakage as given by the following formula:

L= ND √ P 7,400

Where:

L = Allowable leakage, in gallons per hour

N = Number of joints in the length of pipe tested D = Nominal diameter of the pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch (gauge) (psi)

* + - 1. Valves shall be operated from the fully closed position to the fully open, and back to the fully closed position after the valve has been installed in the water line. Valve parts shall function smoothly in the manner intended or shall be corrected by the Contractor until satisfactory performance is demonstrated. Test valves 16‐inches and larger diameter for leakage simultaneously with or immediately after successful testing of the water main. Each side of the valve gates shall be subjected to the same test pressures as required for the water main leakage test for two hours while the other side is depressurized. Allowable leakage shall not exceed 1.0 oz./hr./in. of nominal valve size.
			2. When a leakage occurs, defective pipes, valves, fittings, appurtenances, or joints shall be located and repaired at the expense of the Contractor. If the defective portions cannot be so located, the Contractor, at his own expense, shall remove and reconstruct as much of the original Work as necessary to obtain a water main that does not exceed the allowable leakage upon retesting.
			3. All visible leakage shall be eliminated. Should test results show displacement, damage, or leakage in excess of allowable amount, the contractor shall repair the displacement and damage and eliminate the leakage. He shall retest until specified conditions are met, to the satisfaction of the Engineer, at no cost to the district and/or Town.
			4. Should construction standards and or tests not be met, the Town shall reject all or any portion of the facilities. Any project or portion of a project rejected by the Town shall not be permitted to discharge into any previously approved system until the rejected system or portion of system has been repaired to meet all standards governing the construction of sewer mains.
			5. All repair methods, other than replacement of the defective areas with new materials, shall be subject to prior approval of the Town. Grouted, collared, clamped, or otherwise patched‐up gravity or force main sewer pipe will not be acceptable.
			6. Upon completion of such inspection or tests as required in these specifications, all foreign matter, (to include but not limited to sand, rock, dirt, concrete, joint sealant, gravel) shall be removed from all sewers and manholes before final approval is granted.
		1. Leakage Test (Wetwells)
			1. Ex‐Filtration Method
				1. Inflatable stoppers shall be used to stop all lines into and out of the wetwell to be tested. The stoppers shall be positioned in lines far enough from the wetwell to assure testing of those portions of the lines not otherwise tested. Once the wetwell has been filled with water to the top, a 12-hour soak shall be allowed prior to testing.
				2. The maximum leakage for hydrostatic testing shall be 0.015 gallons per foot of wetwell diameter per foot of wetwell depth per hour. The testing period shall be 24 hours.
				3. If the wetwell fails the test, necessary repair shall be made. The ex‐filtration test and repairs shall be repeated until the wetwell passes the test.
	1. **Wastewater Pumping Stations**
		1. **Scope**
			1. Intent. These sewage pumping station (SPS) design standards are intended to assist design engineers in the development of plans and specifications for the Town of Strasburg projects. The materials, configurations, and features described here represent the minimum acceptable level of quality expected in pumping station design and reflect the goal of standardizing the Town of Strasburg equipment. These standards should not be construed as being a complete description of the necessary features for a particular pumping station design. Deviations from these standards must be approved by the Town of Strasburg during the Basis of Design phase of the project. The Town of Strasburg has the final authority regarding the acceptability of any particular pumping station design.
			2. Limitations. The sewage pumping station standards presented herein shall supplement the latest edition of the Sewage Collection and Treatment (SCAT) Regulations 9 VAC 25‐790, as published by the Commonwealth of Virginia, Virginia Department of Environmental Quality (DEQ). The SCAT Regulations represent the minimum design requirements set forth by the DEQ. All aspects of the SCAT Regulations shall be adhered to. As the owner, the Town of Strasburg may identify and determine the need for standards and requirements that are more stringent than those contained in Part III of the SCAT Regulations. The Town of Strasburg reserves the right to amend or modify this publication without notice, and to interpret the meaning of all statements made herein.
		2. **References**

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:

Virginia Sewage Collection and Treatment Regulations Virginia Building Code

Virginia Water Control Board

VDOT (Virginia Department of Transportation); Road and Bridge Specifications Town of Strasburg Approved Materials List

* + 1. **Design Specifications**
			1. Data and design calculations for pump stations and force mains shall be shown on the plans. Pump station capacity calculations, design elements, pump choice, station schedule and electrical data are to be given. Data and calculations for the total dynamic head (TDH) shall be shown and plainly noted (see Figure 19).
			2. Pump stations shall have three‐phase 208-volt power to the site. No roto‐phase units will be allowed.
			3. No underground fuel storage tanks shall be allowed.
			4. Pumps shall be wet‐well mounted suction lift unless station is low volume.
			5. Submersible grinder pumps may be used if:
				- Discharge pipe diameter is 3” or less.
				- The TDH is 80 feet or less.
				- The peak design flow is 100 gpm or less.
			6. F. A third (spare) pump shall be provided with each submersible grinder pump station.
			7. Suction lift stations shall be installed in a building (see figures 21, 22, and 23).
			8. Submersible grinder pump stations shall be installed per Figures 24, 25, and 26 and shall include gates and fencing as shown in detail 35.
			9. All pumping stations shall be equipped with a pump station bypass, as shown in Figure 32. No portable pump will be allowed.
			10. All pumps (suction or grinder) shall be 208 volts.
			11. The alarm light and horn shall be 110 volt and have a silence switch.
			12. A 12-foot-wide maintenance road shall be required.
			13. A 6‐foot high fenced‐in area (20’ x 20’ minimum) with a 12‐foot double drive gate shall be required at all grinder pump stations.
			14. Underground power shall be provided wherever possible.
			15. No electrical splices or boxes are to be installed inside the wet well.
			16. Two stainless steel bands shall be used to hold the influent pipe to the wet well sleeve.
			17. Flanged ductile iron piping shall be used in suction lift wet wells. The connection between pump station discharge line and force main piping shall be by solid sleeve with Megalugs.
			18. 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.
			19. 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.
			20. Telemetry units shall be Mission Model #110RTU.
			21. See figures 19 — 26.
		2. **Material Specifications**
			1. Wet wells shall be precast concrete manholes. Concrete shall conform to ASTM C 150.
			2. Joints shall be 0‐ring conforming to ASTM C361. There shall be no steps in the wet well.
			3. Suction lift station wet wells shall be eight foot inside diameter. Walls, base, and flat top shall be a minimum of nine inches thick.
			4. Grinder station wet wells shall be six foot inside diameter. Walls shall be a minimum of seven inches thick, and the base a minimum of eight inches thick.
			5. The exterior of the wet well shall be covered with fibrous bit mastic waterproofing such as Tar Mastic 100 manufactured by Porter Paint Company.
			6. Pipe shall be secured to the entry hole by a lock joint flexible manhole sleeve as manufactured by Chardon Rubber Co. or our approved equal.
			7. Each sewage pump shall have an hour meter which shall record accumulated running time.
			8. Mercury float switches shall be used.
			9. Generator hookup receptacle shall be Crouse Hinds, cat. #AR1041‐S22. 4W/4P.
			10. The alarm light shall be Edwards model No. 50‐R and the horn shall be Edwards model No. 876‐N5 or our approved equal.
			11. There shall be a four‐inch galvanized mushroom vent in the wet well. It shall be vented to the atmosphere and contain a bug‐proof screen.
			12. For new sewage pump stations, the automatic dialing alarm system shall be HIGH TIDE HT 900 with antenna, to be selected per site requirements as recommended by the manufacturer.
			13. Suction lift stations shall have:
				- Pumps manufactured by Smith & Loveless.
				- Self‐priming vacuum pumps manufactured by Gast Manufacturing Co., or our approved equal.
				- A 0‐10-minute adjustable time delay relay on each vacuum priming pump (to act as a pump failure sensor). Should a vacuum pump not be able to prime within a pre‐set time, the vacuum prime pump will be shut off and an alarm sensor will indicate pump failure.
				- Flanged ductile iron piping in the wet well. The connection between pump station discharge line and force main piping shall be by solid sleeve with Megalugs.
			14. Submersible grinder pump stations shall have:
				- Pumps manufactured by Barnes, Myers, or ABS
				- Stainless steel or pultruded (fiberglass) guide rails
				- Flanged ductile iron piping (for 4” lines) or SCH 80 PVC (for 2” and 3” lines) in the wet well and valve vault.
				- Any PVC discharge pipe shall be braced (stainless) every 5 feet.
				- Hand wheels on gate valves
				- A floor mounted stainless steel lifting hoist socket. It shall be for a Halliday Products hoist model No. D1A24B
				- Electrical controls enclosure containing individual boxes for the items in the enclosure.
			15. Five (5) 0 & M manuals for each station shall be delivered to the Town’s engineer.
			16. See Drawings 19 through 26.
		3. **Construction Specifications**
			1. A 12-foot-wide paved maintenance road shall be required with a paved turn‐around at the station. The maintenance road shall have no less than a 2% slope and a maximum of 8% slope. 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.
			2. A six‐foot high fenced‐in area (20’ x 20’ minimum), with a 12‐foot double drive gate shall be required at all grinder pump stations.
			3. Underground power shall be provided wherever possible with wiring provided for an emergency generator.
			4. No electrical splices or boxes are to be installed inside the wet well.
			5. Two stainless steel clamps shall be used to hold the influent pipe to the wet well sleeve.
			6. Flanged ductile iron piping shall be used in the wet well. The connection between pump station discharge line and force main piping shall be solid sleeve with Megalugs.
			7. The top of the wet well shall be above the surrounding grade. Suction lift stations shall be 3 to 6 inches above grade and grinder stations shall be 6 to 12 inches above grade.
			8. See Figures 19 through 26.
		4. **Information required on the site plan.**
			1. Determination of Sewage Flows
				- Total commercial acreage served
				- Estimated GLFA per acre
				- Estimated retail floor area
				- Water used per 100 sq. ft.
				- Total Residential acreage served
				- Estimated lots/area
				- Water used per residential lot
				- Total industrial acreage served
				- Estimated employee per acre
				- Total employees served
				- Water use per employee
				- Total commercial flow
				- Total residential flow
				- Total industrial flow
				- Total flow
				- Average sewage use
				- Peak design flow (at a peak factor of 2.5)
			2. Pump Station Design
				- Wet well volume required (for one pump running a minimum of one minute)
				- Wet well diameter
				- Required working depth (distance between pump in and pump off)
			3. Design Elements
				- Low water level (pump off)
				- Force main discharge elevation
				- Static head
				- Force main size (velocity between 2 -8 fps)
				- Designed pumping rate
				- Length of force main
				- Fitting loss
				- Equivalent length of force main
				- Friction head loss
				- Total friction head loss
				- Total dynamic head
			4. Pump Manufacturer (pumps shall be Smith and Loveless, Barnes, or ABS
				- Model
				- RPM
				- Motor BPH
				- Impeller diameter
				- GPM actual
				- TDH actual
			5. Station Schedule
				- Top of station
				- Existing grade
				- Influent invert (lowest)
				- High water alarm
				- Second pump on
				- First pump on
				- Pump off
				- Bottom of wet well
				- Working volume provided
			6. Electrical Data
				- Phase
				- Voltage
				- Conductor size
				- Disconnect rated amperage
				- Fuse amperage

### CHAPTER 6. Definitions and Notes

* 1. **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

* 1. **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 7. Construction Details

* 1. **Construction Drawings and Renderings**