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N/A	2-10	Peak Flow Curve 1.0 and Greater MGD	10-0102.4B
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DPW-16	4-10	Typical 5' and 6' Diameter Precast Concrete Manhole with 4' Stack	10-0102.5D(7)
DPW-17	5-10	Precast Concrete Cut-In Manhole	10-0102.5D(7)
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DPW-22	10-10	Watertight/Locking Manhole Frame	10-0102.5D(7)
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10-0100 SANITARY SEWER DESIGN CRITERIA

10-0101 **Applicability.** Sanitary sewer facilities, approved by the appropriate County agencies, must be provided for subdivision lots of less than 20,000 square feet in size.

10-0102 General and Hydraulic

10-0102.1 Type of Sewers. The County integrated sewerage system is designed to provide total containment. No new systems, extensions, or replacements, not designed to provide total containment for the design period, must be approved or permitted.

10-0102.2 Compliance with Design Criteria. These criteria are to establish minimum requirements as a basis for expeditious review in order for [DPWES](#) to comply with its [Virginia NPDES Permits](#). It is the responsibility of the design engineer to comply with all the pertinent federal and state regulations including the [Virginia Sewage Collection and Treatment Regulations](#), the [Virginia Waterworks Regulations](#) and [Virginia Uniform Statewide Building Code \(USBC\)](#) for the design of sanitary sewerage facilities in the County, whether public or private. The approval of the plan by the County does not indicate endorsement of compliance with the federal or state regulations.

A. Compliance with Pretreatment Requirements. Equipment must be included to ensure proper pretreatment of industrial wastewater before discharge to the sanitary sewer in accordance with the [Virginia Sewage Collection and Treatment Regulations, Article 3, Requirements for Sewerage Systems and Treatment Works Reliability, 9VAC25-790-300, Reliability](#); and [Chapter 67.1 \(Sanitary Sewers and Sewage Disposal\)](#) of the Code.

10-0102.3 Tributary Population

A. Sewerage facilities must be designed for the estimated ultimate tributary population. Consideration must be given to the adopted [Comprehensive Plan](#) and to the maximum anticipated buildout condition.

B. Trunk (main) and subtrunk (submain) sewers must be designed on the basis of the adopted [Comprehensive Plan](#) densities and/or zoning, whichever is greater, unless the [Board](#) approves otherwise. Design analysis must be provided for all trunk and subtrunk sewers as defined by the [Virginia Sewage Collection and Treatment Regulations](#) and when required by [DPWES, Wastewater Management](#), for collecting sewers.

C. Facilities designed to serve populations of 14,000 or greater or which include pumping stations, force mains or inverted siphons, will be subjected to the

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public hearing process under [§ 15.2-2229](#) and [§ 15.2-2232](#) of the Va. Code, as amended, and compliance with Part 3 of [9 VAC 25-790 Sewage Collection and Treatment Regulations](#).

10-0102.4 Sewage Flow:

A. Recommended Average Design Flows:

Table 10.1 Average Design Flows for Development Types	
Type of Development	Design Flow (GPD)
Residential:	
General, Mixed-use and Planned Developments	100/person
Single family detached	350/residence
Single family attached	280/unit
Multifamily	280/unit
Commercial:	
General	2,000/acre
Motel	130/unit
Office	30/employee 0.20/net ft ²
Industrial:	
General	10,000/acre
Warehouse	600/acre
Varies with type of industry	
School Site:	
general	16/student

B. Sewers must be designed to carry a peak flow when full as determined from applying the appropriate peak flow factor to the average flow. (See [Plates 1-10](#) and [2-10](#).) No separate allowance for infiltration will be required. Other peak flow factors may be approved by the Director based on factors such as long-term flow metering data, age of the sewer, and types of development within the sewer shed.

10-0102.5 Location of Sewers and Manholes

A. In general, sewers should be located on legally established streets or rights-of-way, on the centerline of the street or within 8 feet of the centerline; and should be equidistant from property lines or curb lines wherever possible.

1. In order to reduce the number of manholes in curvilinear streets, manholes must be located within the pavement area but beyond the allowable spread

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of stormwater gutter flow except where reverse curb and gutter is used, and a minimum of 6 feet of clear separation from edge to edge between the sanitary sewer manholes and storm and gas pipes must be provided.

2. The sanitary sewer pipe may be located anywhere within 5 feet of the right-of-way line.
3. Sanitary sewer pipe and manholes may be located within the paved portion of privately owned and maintained pipestem driveways when it has been demonstrated that such location will result in a substantial saving of trees. This provision does not preclude the crossing of pipestem driveways at generally 90 degrees with a sanitary sewer pipe.
4. The horizontal and vertical separation between sewers and waterlines must be in accordance with the requirements of [12VAC5-590-1150](#) of Article 6, of the Virginia Waterworks Regulations.
5. The minimum horizontal separation required for storm sewer and sanitary sewer lines and their respective structures (“the sewer facilities”) must be 6 feet between the nearest exterior surface of each pipe, with the exception of the convergence and intersection of sewer facilities which must cross one another. When crossing, the minimum vertical separation between the sewer facilities must be as follows: When storm sewer lines are above sanitary sewer lines, there must be a minimum of 2 feet separation between the sewer facilities unless the storm sewer line is encased in steel and/or concrete piers are installed which extend through any fill areas and into original ground. When sanitary sewer lines are above storm sewer lines, there must be a minimum of 18 inches’ separation between the sewer facilities unless the sanitary sewer line is encased in steel and/or concrete piers are installed which extend through any fill areas and into original ground.
6. Design of sanitary sewer lines should honor natural drainage patterns or topography and must be of sufficient depth to provide gravity flow to serve the basement/lowest floor of dwellings and buildings. Manhole depths may not exceed 16 feet and pipe depths may not exceed 18 feet without approval of the Director. When extenuating circumstances are thought to exist by the applicant to allow manhole depths greater than 16 feet, such as crossing under natural or man-made features (e.g., highways, railroads or bodies of water) or making connections to proposed or existing systems in which the applicant considers good engineering practice to dictate a modification of this standard, specific approval must first be obtained from the Director. In considering such modification requests, the Director may consider safety concerns, maintenance considerations, soil conditions,

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construction material to be used, and the availability of other feasible alternatives. The Director may require a larger diameter manhole or larger easement on a case by case basis.

7. The installation of sanitary sewer is not permitted at depths exceeding 18 feet without approval by the Director in accordance with [§ 10-0102.5A\(6\)](#). Ductile iron pipe or PVC DR 14 is required where sewer depths exceed 18 feet and must be installed from manhole to manhole.
 8. Manholes installed on existing sewers must be cut-in in accordance with [Plate 5-10](#).
- B. Sanitary sewer service must be provided to the satisfaction of the Director such that the main must be extended to the nearest property line of the last lot to be served and easements extended to a property line where adjoining areas must be served.
- C. Sanitary sewers should not be located closer than 15 feet from existing or proposed buildings and 5 feet from the loading plane of building foundations. Proposed sanitary sewers may not be located under retaining walls.
- D. Manholes for access to sewers must be provided:
1. At all intersections of sewers that are 27 inches in diameter or smaller
 2. At all points of change in alignment
 3. At all changes in grade and diameter
 4. At points of industrial discharge if required by [DPWES](#) to facilitate observation and sampling
 5. Within 10 feet (centerline to centerline) of any connection to a 30-inch diameter sewer or larger, and any connection to an 8-inch diameter lateral or larger
 6. At the terminal of the line
 7. At intervals not exceeding 400 feet on all sewers 15 inches in diameter or less and not exceeding 500 feet apart on all sewers larger than 15 inches in diameter (see [Plates 3-10](#) through [13-10](#)).
- E. When it is necessary to drop the elevation of the sewer at a manhole due to unusual circumstances such as bad soil, rock, high water table, utility conflicts

or excessive depths, a 5-foot diameter manhole with an inside drop connection is required (see [Plate 14-10](#)). Any drop connection for a sewer line diameter of 15 inches or greater requires a special design to be approved by [DPWES](#). The maximum difference in elevation permitted between the influent and effluent lines in a standard manhole will be 6 inches.

1. Typical 5-foot Manhole with Inside Drop Connection – Special Notes:
 - a. Chamfer on all pipe sizes to be at a 15-degree angle.
 - b. Vertical stack to be SDR 40 PVC pipe connected to drop fitting with standard coupling and solvent weld.
 - c. Vertical stack will be strapped to manhole at the joint when more than one section of pipe is used. Strap to be made of material noncorrosive to sewer gases.
 - d. Elbow at bottom of the stack will be either a 45-degree or 90-degree turn made of SDR 40 PVC pipe placed in the direction of the flow in manhole, with bench constructed to conform to manhole bench.
 - e. When pipe material is other than PVC, a full circle clamp coupling will be used at the intersection of the incoming main to the PVC inside drop fitting. This coupling must be tested in accordance with [§ 10-0105](#). The length of this coupling may not be less than the size of the nominal pipe diameter of which it is being used on (e.g., 8-inch diameter pipe requires a coupling no less than 8 inches in length).
- F. Sewer manholes for sewers up to 21 inches in diameter may not be less than 4 feet inside diameter. Manholes for sewers 24 inches and up to 36 inches must have an inside diameter of not less than 5 feet. If the angle of deflection does not permit use of a 5-foot inside diameter manhole, then a special manhole detail must be shown.
- G. Line connections to existing manholes must be made by coring the manhole wall. No more than four openings are allowed in one manhole. The distance between openings on the inside wall of the manhole may not be less than 6 inches between the outside edge of one opening to the outside edge of another opening. Pipe, 10 inches or less in diameter, must be connected to the manhole by an approved flexible connector. Pipe, 12 inches or more in diameter, may connect to the manhole wall with a short length of pipe with a joint within 2 feet of the inside face of the manhole wall. Where the pipe bell is in conflict with the manhole footing, the length of pipe may exceed 2 feet in order to clear the edge of the footing.

- H. When designing new sewers to tie into an existing manhole, the invert elevations of the existing manhole must be stated on the plans, so that the invert of the new tie-in is established correctly. When the existing sewer line is larger than the new connection, the crown of the new pipe must be no lower than the highest crown of the existing line within the manhole. Where grade does not permit, approval must be obtained from the Director at the time of first submission.
- I. All sanitary sewer manholes or appurtenances subject to infiltration of surface water must be provided with a County standard watertight manhole frame and cover, which must be shown on the plans. Should actual field conditions require it, however, alterations may be permitted. Wherever manholes are constructed in unmaintained areas, those manholes must be raised above the finished grade by at least one foot, and the surrounding area must be graded to drain away from the manhole.
- J. Ventilation of gravity sewers must be provided where continuous watertight sections greater than 1000 feet in length are incurred.
- K. Provisions for flow measurement should be provided at major junctions in the collection system if required by [DPWES](#), [Wastewater Management](#) (i.e., generally at the 2 MGD collection points).
- L. Sewers adjacent to or crossing streams, estuaries, lakes and reservoirs must be designed, constructed and protected in accordance with requirements of [9VAC25-790-360](#) of the Virginia Sewage Collection and Treatment Regulations. Except that:
 - 1. Sewer lines that cross a well-defined watercourse with bed and banks must be located under the watercourse and must be ductile iron pipe CL-52 with mechanical joints extending from manhole to manhole. If less than 3 feet of suitable cover is provided between the watercourse invert and the top of the sanitary sewer line, then a special design will be required to protect the section of the pipe under the watercourse from exposure due to future erosion. The special design must consist of tunnel liner extending a minimum distance of 5 feet into the stream banks on either side of the watercourse and stabilization of the watercourse with riprap or equivalent channel lining as approved by the Director to prevent erosion to the bottom of the watercourse.
 - 2. Sewer lines should not be located within a detention area. However, if sewer lines must be placed in a detention area, the lines are permitted only

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in a dry detention area with a minimum cover of 4 feet and must be ductile iron.

M. For sanitary lines constructed in fill areas, pipe must be ductile iron CL-52 and must run continuous from manhole to manhole (i.e., no adaptor). Manholes in fill areas are subject to special design provisions by the design engineer, must extend into the original ground, and must be filled with Class A-3 (20) concrete to the invert elevation except in cases where a special design is approved by the Director.

10-0102.6 Minimum Sewer Size. Minimum pipe diameter for public gravity sanitary sewers is 8 inches.

10-0102.7 Acceptance Tests. Acceptance tests are required for all gravity sanitary sewer lines and manholes. The test may be either a water test, air test, or vacuum test. Consult [§ 10-0105](#) for additional details.

10-0102.8 Hydraulic Design Criteria. The hydraulic design and determination of sewer size must be based on the following conditions:

- A. Sewers must have a uniform slope and straight alignment between manholes and the interior downstream angles formed by consecutive manhole sections may not be less than 90 degrees.
- B. At all junctions where a smaller diameter discharges into a larger one and at all locations where the sewer increases in size, the invert of the larger sewer must be lowered so that the energy gradients of sewers at junction are at the same level. This condition will be met by placing the 0.8-foot depth of flow in each sewer at the same elevation.
- C. Sewers must be designed to be free flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity of not less than 2.25 FPS when running full. Computations of velocity of flow must be based on a coefficient of roughness “n” in the Manning Formula of 0.013.
- D. For sewage flow depth less than 1/4 full, no allowance will be made for increased value of “n” and in no case are velocities of less than 1.3 FPS permitted. The improved velocities must be accomplished by steeper grades. In no case shall a terminal manhole section be less than 1.0 percent grade.
- E. The maximum permissible velocity at average flow (before applying peak flow factor) is 15 FPS.

F. Suitable drop manholes must be provided to break steep slopes to limit the velocities in the connecting sewer pipes between manholes. Where drop manholes are impractical for reduction of velocity, the sewer must be of ductile iron or other abrasion resistant material.

G. The following are minimum grades to be provided:

Table 10.2 Minimum Grades (%) for Pipes

Sewer Size in.	Pipe Lengths Up to 5'	Pipe Lengths 6' or More
Terminal Section	1.0	1.0
8	0.47	0.42
10	0.34	0.31
12	0.26	0.24
14	0.23	0.22
15	0.18	0.17
16	0.17	0.16
18	0.14	0.13
21	0.11	0.11
24	0.08	0.088
27	0.08	0.08
30	0.07	0.07
33	0.06	0.061
36	0.05	0.056
39	0.05	0.05
42	0.04	0.045

H. Invert channels in terminal manholes must be built at a grade of not less than 8.33 percent.

I. At transitions and intersections of sewers larger than 21 inches in diameter, each case must be investigated separately.

J. The pipe diameter of subtrunk sewers must increase continually with the increase in tributary flow. Where steep ground slopes make possible the use of a reduced pipe size and a substantial economy of construction cost can be derived, the pipe size may be reduced, but due hydraulic allowances should be made for head loss of entry, increased velocity and the effect of velocity retardation at the lower end where the flow will be on a flatter slope. Pipe sizes may not be reduced below 12 inches in diameter or the capacity of upstream sewer.

10-0102.9 Sanitary Sewer Pump Systems for Individual Dwellings.

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- A. Private sanitary sewer pump systems for individual dwellings may be permitted if sewer service is not available by gravity flow subject to the following:
1. There is a maximum of one dwelling unit per line/lateral;
 2. The velocity is a minimum of 2 fps.
 3. Where the pump is proposed to be located outside the proposed structure, a low-head grinder pump must be provided where the projected flow is less than 2,000 gpd.
 4. Where the pump is proposed to be located within the structure, an ejector pump may be used;
 5. Either pump system under [§ 10-0102.9A\(3\)](#) and [§ 10-0102.9A\(4\)](#) must be provided with a holding tank and an alarm system.
- B. For properties which in the opinion of the developer, builder and the owner, are not able to be sewered by gravity flow, a plan must be submitted to the [Site Development and Inspections Division, LDS](#), showing the public sanitary sewer system, the sewer profile, the proposed pumping equipment and the required easement. All easements must be recorded before building permits may be issued.
- C. All plats, plans, profiles and documents submitted to the County for approval must show the following notes when a private sanitary sewer pump facility is proposed:
1. The sanitary lateral pipe and pump is a private system and the ownership of same must be vested in the owner of the premises on which the system or portions thereof, are located.
 2. The County is not responsible for operation or maintenance of the private sanitary sewer pump system.
- D. Private sanitary sewer pump facilities may not be located in an unapproved sewer service area unless approved by the [Board](#).
- E. The connection of a private sanitary sewer pump facility to the County sewer system must be made by a 4-inch gravity flow line (one 4-foot section of pipe) at a minimum grade of 1 percent.

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10-0102.10 Current specifications for the construction of sanitary sewer systems are available from [DPWES, Wastewater Management](#).

10-0102.11 Abandonment and Removal of Existing Sewer

- A. An existing sanitary sewer line may not be abandoned or removed until a new line has been installed, has passed the acceptance tests, and the sewer flow has been diverted from the existing line to the new line.
- B. The [Wastewater Collection Division](#) of [DPWES](#) must be notified not less than 24 hours before the sanitary sewer flow is diverted to the new line.
- C. The sanitary sewer easement serving the sewer line to be abandoned or removed must be vacated before bond release and after the sewer flow has been diverted to the new line and the easement associated with such new line has been duly recorded among the land records.
- D. The Director may approve the abandonment in place of unused sanitary sewer lines and manholes. Sanitary sewer lines and manholes to be abandoned in place in lieu of being removed must be treated as follows:
 1. All sewer lines must be filled with grout and the ends plugged with masonry, unless the Director has approved another method.
 2. Sewer manholes must have the cone section removed and be filled to grade with acceptable compacted material.
 3. At the time of vacation of the easement, fee simple title ownership of the abandoned sanitary sewer structures must be conveyed to the property owner on whose real property the sanitary sewer lines and manholes are located and such property owner must assume, and must indemnify the County for all liability and responsibilities therefore and the conveyance and assumption must be duly recorded among the land records.

10-0103 Structural

10-0103.1 General. The structural design of sewers must conform with the methods given in the [ASCE Manual No. 37 for the Design and Construction of Sanitary and Storm Sewers](#) except as modified below.

10-0103.2 Working Strength. The working strength for rigid pipes must be the minimum ultimate 3-edge bearing strength divided by a factor of safety of 1.5.

10-0103.3 Allowable Load. The allowable load must be the working strength times the load factor shown in [Table 10.3](#):

Table 10.3 Allowable Load Factor for Class B Bedding

Type Bedding	Load Factor
Class B	1.9

10-0103.4 Backfill load. Unless more specific data is available, the backfill load must be computed using the following values:

Backfill weight: $w = 130 \text{ lb/ft}^3$ for $k_u = 0.13$

10-0103.5 Live load. Sewers in public streets must be designed for an HS-20 truck loading as specified by [AASHTO](#) for up to 10 feet of cover. Concentrated Load: 16,000 lb., (single dual wheel). Impact Factor: $I = 1.3$, 0 to 1 feet; $I = 1.2$, 1 to 2 feet; $I = 1.1$, 2 to 3 feet.

Length of Pipe: L = length of distributed load area at top of pipe parallel to longitudinal axis of pipe.

10-0103.6 Trench width. The width of trench at or below the top of the pipe may not exceed the widths as shown in [Table 10.4](#):

Table 10.4 Trench Width Required for Pipe Size

Diameter of Sewer in.	Trench Width in.
8 – 16	42
18- 20	44
21	48
24	51
27	55
30	60
33	63
36	69
42	78
48	87
54	96

Table 10.5 Maximum Allowable Depth - Pipe Without Cradle (Class B Bedding)

Pipe Diameter in.	Maximum Trench Width in.	Concrete	Reinforced Concrete			PVC
		C-14 Extra ft.	C-76 Class III ft.	C-76 Class IV ft.	C-76 Class V ft.	SDR 35 ft.
8	42	16	-	-	-	18
10	42	13	-	-	-	18
12	42	-	11	15	18	18
14	42	-	-	-	-	-
15	42	-	11	18	18	18
16	42	-	-	-	-	-
18	44	-	12	18	18	-
20	44	-	-	-	-	-
21	48	-	13	18	18	-
24	51	-	14	18	18	-
27	55	-	15	18	18	-
30	60	-	15	18	18	-
33	63	-	15	18	18	-
36	69	-	15	18	18	-
42	78	-	15	18	18	-
48	87	-	16	18	18	-
54	96	-	17	18	18	-

*NOTE: Any pipe installed at depths exceeding 1 ft. require special approval from the County. Pipe depths exceeding 18 ft. will not normally be permitted due to maintenance requirements. The above chart refers to depths permitted for structural integrity.

10-0103.8 Permitted Materials

- A. Permitted sanitary sewer pipe materials include: Ductile Iron (minimum thickness class 51), Polyvinyl Chloride (minimum PVC DR 25). For pipe materials required where sewer depths exceed 18 feet, refer to [§ 10-0102.5A\(7\)](#).
- B. Other suitable sanitary sewer pipe materials may be used subject to express approval of the [Board](#) and such approval may include reasonable conditions, including a performance and maintenance bond.
- C. Special Installation Details – PVC Pipe
 - 1. Pipe and Fitting Material: PVC sewer pipe and fittings must be DR 25 wall thickness and comply with the requirements in [AWWA](#) C900-16 for PVC water distribution pipe.
 - 2. Joints: Integral bell joint systems must conform to [ASTM](#) D3139. Gaskets must conform to [ASTM Standard](#) F 477.

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3. Fittings: PVC fittings in sizes from 4” to 12” must be molded in one piece meeting [ASTM D1784](#) and [AWWA C907](#).
4. Installation: PVC pipe and fittings must be installed in accordance with [AWWA C605](#), except as modified in the PFM.
5. In Place PVC Pipe Deflection Testing: Where soil conditions, installation procedures, or TV inspections warrant, manhole to manhole deflection testing may be required at the request of the County. Maximum allowable pipe deflection is 7-1/2 percent.
6. Deflection tests must be accomplished by the use of a multi-arm “go/no go” mandrel. Exact method of testing procedure must be as per [ASTM D3034-85b](#).

D. Special Installation Details – DIP Pipe

1. Ductile Iron Pipe (DIP) must be centrifugally cast for water distribution in accordance with the latest [ANSI A21.51/AWWA C 151](#). Joints must be push-on bell and spigot type in accordance with the latest [ANSI A21.11/AWWA C 111](#). All proposed DIP must have an approved lining to resist corrosion.

10-0103.9 Slope Anchorage. Concrete anchors must be placed on sanitary sewer lines with grades of 20 percent or greater and lines must be ductile iron pipe. (Anchorage must be shown as special detail on plans.) Minimum anchorage is as follows:

- A. Not over 36 feet center to center on grades of 20 percent and up to 35 percent.
- B. Not over 24 feet center to center on grades of 35 percent and up to 50 percent.
- C. Not over 16 feet center to center on grades of 50 percent and over.

10-0103.10 Minimum Permissible Depth

- A. Sanitary sewers installed where subjected to vehicle traffic should generally be placed with a minimum cover of 6 feet.
- B. Sewers at a shallower depth must be protected from loads or effects of traffic on the basis of HS-20 highway loading and its subsequent revisions.
- C. Minimum cover for sewers in rights-of-way with no highway traffic to be 3 feet.

10-0104 Preparation of Plans

10-0104.1 Preliminary Plats. Approval of preliminary plats by the Director, in areas served by sanitary sewers, septic tanks and drain fields, as required by the [Subdivision Ordinance](#), requires the following information:

- A. Proposed locations of sewers (with flow arrows), sewage pumping stations and treatment facilities, with provisions for maintenance access.
- B. Easements must be provided to serve all off-site properties that would drain through the site. These easements must be recorded.

10-0104.2 Construction Drawings. Plans and design analysis for all sewers of the sanitary sewer installation to be installed in a subdivision as prepared by a PE or LS, must be submitted to the [Site Development and Inspections Division, LDS](#), for approval. Such plans must be in conformance with the foregoing design criteria and show the following information:

- A. Plans must be drawn on sheets measuring 24 inches wide by 36 inches long.
- B. A general layout must be provided, showing streets, lots, easements and sanitary sewer location, on-site and off-site. Scale is to be used which will allow all information to be shown on one sheet.
- C. All manholes must be located on the plan and on the profile. Bearings and distances of sewer lines must be shown on the plans no later than the second submission phase of design and review.
- D. In addition to the sewers, the plan must show location of existing structures, houses, the location of proposed or existing underground utilities, curbs, property lines, railroad crossings, culverts, and bridges, which cross the sewer line.
- E. The horizontal scale for profiles must be the same as that used for the plan, but in no case be smaller than 1 inch = 100 feet. The vertical scale may not be smaller than 1 inch = 10 feet.
- F. The sanitary sewer plan view and its corresponding sanitary sewer profile view must be shown on the same sheet. The upper half of the drawing must show the sewer location in plan and the lower half, the profile of the sewer and of the ground surface.
- G. Sewer sizes, manhole numbers and stationing must be shown on the plan and repeated on the profile.

- H. Watertight castings and manhole strapping must be shown where required. Standard castings are required when manholes are within proposed or existing traveled roadways, locking covers are required when manholes are within County maintenance easements, and watertight covers are required when manhole tops are subject to surface water inflow.
- I. Sewer grade, invert elevations at manholes, elevation top of casting, type of pipe, construction bulkhead, location of cradle, etc., and existing and proposed street grades must be shown on the profile.
- J. Vicinity map at a scale not less than 1 inch = 400 feet must be used as a cover sheet for all plans.
- K. Plan approval of any outside agency or jurisdiction involved (i.e., Arlington County, cities of Fairfax and Alexandria and the towns of Herndon, Vienna and Falls Church) must be obtained by the County before plan approval.
- L. Sanitary Sewer General Notes
 - 1. Tapping into existing manholes for a pipe 10 inches or less will be done by coring. Pipe sizes 12 inches in diameter and larger must be done in accordance with [§ 10-0102.5G](#).
 - 2. Line connection to the manhole may be made with an approved flexible sleeve or a short length of pipe with a joint within 2 feet of the inside face of the manhole (see [§ 10-0102.5](#)).
 - 3. A “non-shrink grout” must be used any time grout is applied for sanitary sewer use, excluding inverts and benches.
 - 4. When installing sanitary sewer laterals to a main line sewer, the connection must be 2 feet minimum distance from any pipe joint (center to center). This also applies to the distance between two laterals placed on one section of main line sewer.
 - 5. Rubber plugs must be installed in lift holes. Holes must be filled with a non-shrink grout or mastic on outside face of manhole only.
 - 6. Invert channels in terminal manholes must be built at the same grade as the main line leaving the manhole, but not less than 8.33 percent (see [§ 10-0102](#)).

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7. Ram-Nek Plastic Gasket, or approved equal, must be used under all types of manhole frames not subject to HS-20 loading.
8. Manhole frames subject to HS-20 loading must be set in an approved non-shrink grout.
9. Products which meet or exceed the performance of Ram-Nek Plastic Gasket must be used on the outside of the joint on all manholes between the manhole frame and cone section to provide a water-tight seal.
10. No dry mix concrete is allowed in conjunction with the installation of sanitary sewers.
11. Concrete, polypropylene or high-density polyethylene adjustment rings must be used when adjustment to the precast manhole top elevation exceeds 2 inches per [Plate 29-10](#). External chimney seals must be provided when using adjustment rings. Non-shrink grout with full bearing metal or masonry shims may be allowed for final slope adjustment. Total adjustment must not exceed 12 inches.
12. Invert channels for sanitary sewer may be precast or built in the field. The invert channel must be smooth and circular in shape, conforming to the adjacent sewer pipe section. Changes in direction of flow must be made with a smooth curve maintaining the same diameter as the adjacent pipe. Changes in size and grade of the channels must be made gradually and evenly. The benches of the manhole must be built with a slope of 12:1 to 6:1 from manhole wall to the midpoint of pipe. The invert channel depth must be 1/2 times the diameter of the pipe (see [§ 10-0102](#)).
13. When installed under roadways, and/or easements planned for future roadways, backfill must be compacted to not less than 95 percent of maximum density, in accordance with [VDOT](#) specifications, Sections 200, 302, 303, and 520. When installed in easements not planned for future development, backfill must be compacted to not less than 85 percent of the theoretical maximum density, unless otherwise specified in accordance with [VDOT](#) specifications, Section 520.
14. Grading of easement areas must comply with the lines and grades indicated on the approved plans. In general, all trenches and subgrade of easements should be compacted to equal density of surrounding ground.
15. Final grade around trees in sanitary sewer easements and work areas must conform to the Urban Forester's requirements as contained in [§ 12-0000 et seq.](#)

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16. Lateral connections to sanitary sewer lines must not be permitted within 5 feet of the outside wall of a terminal manhole. A manufactured “Y” must be used for all connections within the first 10 feet.
17. After all utilities, including curb and gutter have been installed, the [Site Development and Inspections Division](#) will request the [Wastewater Collection Division \(WWCD\)](#) to make a TV inspection of the sewer. Minimum preparation for TV inspection of outfall sewer requires that:
 - a. Suitable access must be provided for TV equipment to be driven to each manhole.
 - b. All manholes and lines must be cleaned before TV inspection.
 - c. All bulkheads in the area to be TV inspected must be removed 48 hours before TV inspection, and replaced 48 hours following the inspection (pending RUP approval).

10-0104.3 Application for Sewerage Service

- A. Before approval of construction drawings can be made, all off-site sanitary sewer easements must be obtained and recorded.
- B. When sewers are to be served by the County’s integrated sewerage system, an “Application for Sewerage Service Requiring an Extension of Existing Facilities” must be executed by the owner or developer and approved by the Director.

10-0104.4 Bulkheads

- A. The objective of bulkheads is to eliminate extraneous water and debris from entering an active sewer system during various stages of construction and before the issuance of a RUP or Non-RUP.
- B. Bulkheads must be constructed of approved brick and cement mortar to withstand the water pressure and to provide a watertight seal.
 1. Expansion plugs may be used in lieu of bulkheads where only one manhole is constructed.
 2. An expansion plug may be used in lieu of bulkhead where PVC pipe is used.

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- C. When sewer lines are ready for inspection via TV, bulkheads and expansion plugs must be removed after the lines are cleared of debris, and pumped down, not more than 48 hours before the TV inspection request.
- D. Following completion of the TV inspection, bulkheads must be replaced within 48 hours, unless RUPs, or Non-RUPs have been issued, and the sewer will be placed immediately in service.

10-0104.5 Building Laterals

- A. In subdivisions where the sanitary street sewer mains are being installed by the developer, the developer also must install a lateral or extension from the sanitary sewer main to a minimum of 20 feet beyond the property line or within 5 feet of the minimum yard requirement, whichever distance is less, for Single-Family Detached lots, and to a minimum of 5 feet beyond the property line or sanitary sewer easement, whichever distance is greater, for Single-Family Townhouse lots in accordance with [Plates 18-10](#) and [19-10](#). This extension is to receive the building sewer for each lot.
 - 1. Such extensions must be shown on the sewer plans submitted to and approved by the Director and the extension must be installed in the exact location as shown on the plan.
 - 2. These laterals must be constructed as specified in the [USBC](#).
 - 3. The lateral must enter the sanitary sewer through a manufactured “Y,” “T” or approved sewer saddle placed in the sanitary sewer by the developer at the exact location for proper alignment with the lateral.
 - 4. The lateral must be laid at the grades provided in the [USBC](#).
 - 5. House lateral connections to manholes must be restricted to the following:
 - a. Houses on cul-de-sacs from which a plumbing connection would require a circuitous route to connect to the sewer line.
 - b. Collector line encased in concrete or of ductile iron.
 - c. Invert elevations of house lateral connections at manhole wall must conform to [§ 10-0102.5H](#).
 - 6. The laterals and saddles must be inspected and tested by [DPWES](#) along with and at the same time inspections are being made for the installation of the sanitary sewer.

7. After a building is connected through a lateral to the sanitary sewer, the lateral must become a part of the building, and the owner of the premises will be responsible for the operation and maintenance of the entire building sewer between the building and the street sewer as set forth in [§ 65-6-5](#) of the Code.
- B. Construction drawings for developments where these laterals are to be installed must show the following information:
 1. Station of branch, length and direction of lateral, pipe size and percent of grade must be shown on the plan.
 2. Station of branch and invert elevation and finished ground elevations at end of lateral must be shown on profile.
 - C. Cut sheets must show the station of the branch, length and grade of the lateral, invert elevation of end of the lateral and cut from hub to invert.
 - D. Inspection: No additional allowance for infiltration must be made for laterals.

10-0104.6 As-built drawings

- A. As-built drawings must be submitted to the Director as a condition precedent to the acceptance of the facilities.
- B. As-built drawings must be:
 1. Prepared on Mylar reproducibles, with the plan and the corresponding profile on the same sheet.
 2. Prepared showing the as-built facilities as actually built. The deed book and page numbers of all easements must be shown on the applicable plan and profile sheet.
 3. Prepared by a PE or LS.
 4. Prepared showing, in addition to the information required on the construction drawings, deflection angles or bearing and distance between manholes. For all subdivisions on the [Virginia coordinate system](#), coordinates of all manholes along the subtrunk and trunk facilities must also be provided. When the as-built information differs from the approved construction plans, a design analysis for the existing conditions may be required.

10-0104.7 Certificate to Operate

- A. No Residential Use Permit (RUP) or Non-RUP will be issued where a building is hooked to a new sanitary sewer line until an acceptance test and TV inspection indicates that construction conforms to the specifications and criteria.
- B. Structural damages to pipe (i.e., holes, crushed or slipped joints), discovered as a result of TV inspection, will require replacement of the affected pipe segment.

10-0104.8 Final Approval/Acceptance into the County system. Final approval for the satisfactory compliance with the provisions of the “Application for Sewerage Service” will not be given until all site work is complete and the as-built plan is submitted to and approved by the Director.

10-0105 Acceptance Tests. An acceptance test must be specified for all gravity sewer lines. The test may be a water test, an air test, or a vacuum test.

10-0105.1 Where water testing is used (infiltration or exfiltration), the leakage outward or inward may not exceed 100 gallon/inch of nominal pipe diameter per mile per day maximum for any section of the system including manholes.

- A. Where the exfiltration test is used, the line must be subjected to a minimum of 4 feet of head, or head to the top of the manhole, whichever is the lesser, above the crown of the pipe at the upstream manhole of the section being tested.
- B. The infiltration test is allowed only when it can be shown that the hydrostatic head outside the pipe is a minimum of 4 feet above the crown of the pipe for the entire length of the pipe being tested.

10-0105.2 Where air testing is used, test methods and acceptability criteria must be in accordance with the appropriate [ASTM](#) specifications. Air testing must generally be acceptable for all types of pipe materials.

- A. If air testing is used, the manholes must be tested by exfiltration.
 - 1. Inflatable stoppers must be used to plug all lines into and out of the manhole being tested.
 - 2. The stoppers must be positioned in the lines far enough from the manhole to ensure testing to those portions of the lines not air tested.

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3. The manhole must then be filled with water to a level of 4 feet above the top of the pipe. A 24-hour soak is allowed.
 4. Leakage may not exceed ½ gallon per hour. Manholes suspected to be of poor quality, jointing or construction practices by the engineer must be tested to the top of the manhole.
- B. The contractor must furnish weirs, stand pipes, pipe plugs, water, pressure gauges, stop watches, air compressor, hose and such materials and assistance as required to perform these tests. All acceptance tests must be conducted by the contractor in the presence of an inspector from the [Site Development and Inspections Division, LDS](#).
 - C. Acceptance tests may not be made until the sanitary sewer, manholes and required building laterals, as shown on approved street plans, have been installed, the sewer trenches backfilled to a minimum of 6 feet of finished grade and compacted.
 - D. All sanitary sewers, including manholes, must be inspected before acceptance testing, and any water leakage into the system sufficient to constitute any noticeable trickle or dribble, first must be corrected and eliminated before undertaking the acceptance test.
 - E. Wherever it has been necessary to construct underdrains or place gravel under pipe lines in order to dewater the trench during construction of the sewers, the acceptance test may not be made until any pumps (which have been used in the dewatering process) have been disconnected.
 - F. The contractor must schedule all acceptance tests with the [Site Development and Inspections Division, LDS](#), at least two County working days in advance.
 1. Each section of completed sewer must be tested.
 2. The sewers must be tested from manhole to manhole.
 3. No sewers or building lateral connections shall be excluded from this testing procedure.

10-0105.3 Low Pressure Air Testing Procedure:

- A. The contractor must thoroughly clean and remove all debris, silt, earth, or other material from the sewer before acceptance testing. The pipe may be flushed with water or cleaned by mechanical means. None of this water or debris is allowed to enter the existing sewer.

- B. Test plugs must be supplied and installed by the contractor within the pipe at each manhole or at suitable locations to test a section of the pipe. Each plug must be securely braced as necessary.
- C. If the pipe to be tested is expected to be below the ground water table, the contractor must either:
 - 1. Install a small diameter perforated vertical pipe from the invert elevation of the sewer to the surface before backfilling, or
 - 2. Insert a pipe probe by boring or driving into the backfill material adjacent to the invert elevation of the pipe, and determine the depth of the ground water level above the pipe invert immediately before acceptance testing the sewer.
- D. All gauge pressures in the test will be increased by the amount of this back pressure due to ground water submergence over the end of the probe. In no case may the starting test pressure exceed 9 psi. See [Table 10.6](#) for correlation of ground water height to psi.

Table 10.6 Correlation of Vertical Feet of Water to Pressure in PSI

Equivalent PSI	Height of Ground Water Above Pipe Invert ft.
0.43	1
0.87	2
1.30	3
1.73	4
2.17	5
2.60	6
3.03	7
3.47	8
3.90	9
4.34	10
4.77	11
4.98	11.5
-	-
-	-

For anything above 11.5 VF, allow maximum 5.0 psi.

NOTES:

1. Table based on 1 vertical ft. water = 0.4335 psi.

2. The appropriate psi allowance for average vertical feet of ground water must be added to the base starting pressure of 4.0 psi, but in no case may the resulting starting pressure be more than 9.0 psi.

3. Interpolate for decimals of a foot of water.

- E. The contractor must add air slowly to the portion of the pipe under test until the internal air pressure is raised to 4 psi greater than the average back pressure of any ground water above the invert of the pipe.
- F. As a safety precaution, no one is allowed in a manhole after the air pressure is increased in the sewer line. If the [Site Development and Inspections Division](#) inspector suspects that the test plug may be leaking, the pressure first must be relieved before any adjustments are made to eliminate air leakage at the plug. The contractor may precoat the plug with a soap solution to check the plugs for leakage.
- G. The contractor must allow the air temperature to stabilize for at least 2 minutes with the pipe subjected to an internal pressure of 4 psi greater than the average ground water back pressure by adding only the amount of air required to maintain this pressure.
- H. If the internal air pressure decreases, the time required for the pressure drop from 3-½ to 3 psi greater than the average ground water back pressure will be observed and recorded. This time interval will be compared with the

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established standards in accordance with the approved table of time and length for various diameters of sewer ([Table 10.7](#) and [10.8](#)).

Table 10.7 Air Test Table – Minimum Holding Time in Minutes Required for Pressure Drop From 3.5 to 3.0 PSI

LENGTH OF LINE IN FEET	PIPE DIAMETER IN INCHES												
	4	6	8	10	12	15	18	21	24	27	30	33	36
	25	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3
50	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	23.3	25.5
75	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	19.2	21.2	24.3	28.8
100	2.8	4.2	5.7	7.1	8.5	10.6	12.7	14.8	17.0	21.6	26.8	32.2	38.5
125	2.8	4.2	5.7	7.1	8.5	10.6	12.7	16.3	21.2	27.0	33.3	40.1	48.2
150	2.8	4.2	5.7	7.1	8.5	10.6	14.3	19.6	25.5	32.6	40.1	48.3	57.6
175	2.8	4.2	5.7	7.1	8.5	11.6	16.7	22.8	29.7	37.9	46.7	56.2	67.3
200	2.8	4.2	5.7	7.1	8.5	13.3	19.1	26.1	34.0	43.3	53.5	64.4	77.0
225	2.8	4.2	5.7	7.1	9.5	15.0	21.5	29.4	38.2	48.7	60.1	72.3	86.7
250	2.8	4.2	5.7	7.4	10.6	16.7	24.0	32.6	42.5	54.0	66.9	80.5	96.1
275	2.8	4.2	5.7	8.1	11.7	18.3	26.3	35.9	46.7	59.6	73.5	88.4	105.8
300	2.8	4.2	5.7	8.9	12.7	20.0	28.7	39.1	51.0	65.0	80.3	96.6	115.5
350	2.8	4.2	6.6	10.4	14.9	23.4	33.4	45.7	59.5	75.7	93.7	112.7	134.6
400	2.8	4.2	7.6	11.9	17.0	26.7	38.2	52.2	68.0	86.6	107.1	128.8	154.0
450	2.8	4.8	8.5	13.4	19.1	30.0	43.0	58.7	76.5	97.4	120.5	144.9	173.1
500	2.8	5.3	9.5	14.9	21.2	33.3	47.8	65.3	85.0	108.3	133.9	161.0	192.5

NOTES:

1. Air Test Table based on Ramseier's Equation $T = 0.085 DK/Q$; $Q = 0.0010 \text{ ft}^3/\text{minute}^3$.
2. For testing 4-inch laterals with sewer main, add 2.8 minutes to appropriate sewer main test time.

Table 10.8 Correlation – Tenths of Minutes to Seconds

MINUTES	.1	.2	.3	.4	.5	.6	.7	.8	.9
SECONDS	6	3.6	18	24	30	36	42	48	54

- I. Pipe which fails to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the approved tables is deemed to have failed to pass the low-pressure air test and is unsatisfactory for acceptance by the [Site Development and Inspections Division](#) inspector. Any sewer or house connection that fails to pass this test must be repaired by the contractor. Following corrections, the sanitary sewer must be tested again in accordance with the enumerated procedures.
- J. For accuracy and safety precautions, air tests must be limited to the diameters of pipe and lengths of pipe indicated in the air test table of time, [Table 10.7](#).

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- K. Pressure gauges used in the air test procedure must have a minimum 4-inch diameter face, a range of 0 to 10 psi, must be calibrated in divisions of 0.10 psi, and have an accuracy of plus or minus 1 percent.
- L. For air testing pipes of larger diameter than 36 inches, a thorough visual inspection is required and all joints must be tested with a special joint testing device such as the Cherge "Jointester" System, or approved equal. Testing procedure must be as recommended by the approved joint tester manufacturer.

10-0105.4 Infiltration Testing:

- A. Infiltration testing must be permitted when the section of pipe being tested is subjected to a minimum hydrostatic head of 4 feet for the total length of the line under test.
- B. The allowable leakage permitted is 100 gal./in. nominal pipe diameter per mile per day with a maximum allowable leakage of 4,800 gpd/mi. When infiltration tests are proposed, the methods of determining this flow must be approved by the [Site Development and Inspections Division, LDS](#), before performance of the test.

10-0105.5 Exfiltration Testing:

- A. All service laterals, stubs and fittings into the sewer lines being tested should be properly capped or plugged, and carefully braced to resist the thrust actions developed by the internal water pressure.
 - 1. In preparing the blocking of plugs or end caps, it is extremely important to recognize that the 5 feet to 10 feet of head in the standpipe will exert considerable thrusts against the plugs or caps.
 - 2. For example, a 10-foot head will generate a total force of 215 pounds against an 8-inch plug.
 - 3. Further consideration must be given to the fact that greater pressures will be developed in the downstream portion of the line, due to lower elevations, than in the upper reaches of the sewer line.
- B. A tapped plumber's type plug is inserted and tightened in the inlet pipe of the downstream manhole to which the water supply connection is made for filling the pipe (see [Plate 24-10](#)).
- C. The upper manhole is plugged and securely tightened for connection to the standpipe. The standpipe is then placed in this manhole and connected to the

tapped plug. The standpipe must be capable of handling from 5 feet to 10 feet of water head to determine the tightness and soundness of the sewer line, as specified and directed by the inspector.

- D. Water is introduced into the line at the downstream (lower) manhole until the standpipe in the upstream manhole has been completely filled.
 - 1. By filling the line from the lowest level, the air in the line is easily pushed ahead and finally expelled through the standpipe at the upper end of the test section.
 - 2. Care must be taken to minimize entrapped air which will give distorted test results.
 - 3. The rate of drop in the standpipe may be quite rapid until the air has been expelled.
- E. After filling with water, the line must be allowed to stand for a minimum of 3.6 hours before beginning the test. During this time, some water absorption into the manhole structures and asbestos cement sewer pipe will take place. After the water absorption has stabilized, the water level in the standpipe is checked and water added if necessary.
- F. The test is now ready to begin. The drop in the standpipe is measured and recorded over a 10-minute period. To verify the first results, a second 10-minute test is suggested. This will also verify whether a stable condition exists in the line.
- G. The measured drops in the standpipe are converted to leakage in terms of gal./in. of nominal pipe diameter per mile per day, the acceptable method of recording leakage.
- H. Caution must be taken about conducting exfiltration tests on sewer lines laid on steep grades.
 - 1. Consideration must be given to the downstream portion of the system to prevent excessive pressure in these lower lines. For these installations and where the upstream manholes are very deep, it is not advisable to fill the standpipe or manhole to the top when performing the test.
 - 2. Tables showing allowable exfiltration rates in a 3-inch standpipe are provided in [Tables 10.9](#) through [10.15](#).

10-0105.6 Where vacuum testing is used, the test method and acceptability criteria must be in accordance with [ASTM C-3.644](#).

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**Table 10.9 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
8" Diameter**

	LENGTH OF SPUR IN FEET, 4" DIAMETER															
	LENGTH OF MAIN LINE IN FEET – 8" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.07	.14	.21	.29	.36	.43	.50	.57	.64	.72	.79	.86	.93	1.00	1.07	1.15
25	.11	.18	.24	.32	.39	.46	.53	.60	.67	.75	.82	.89	.96	1.03	1.10	1.18
50	.14	.21	.28	.36	.43	.50	.57	.64	.71	.79	.86	.93	1.00	1.07	1.14	1.22
75	.18	.25	.31	.39	.46	.53	.60	.67	.74	.82	.89	.96	1.03	1.10	1.17	1.25
100	.21	.28	.35	.43	.50	.57	.64	.71	.78	.86	.93	1.00	1.07	1.14	1.21	1.29
125	.25	.32	.38	.46	.53	.60	.67	.74	.81	.89	.96	1.03	1.10	1.17	1.24	1.32
150	.28	.35	.42	.50	.57	.64	.71	.78	.85	.93	1.00	1.07	1.14	1.21	1.28	1.36
175	.32	.39	.46	.54	.61	.68	.75	.82	.89	.97	1.04	1.11	1.18	1.25	1.32	1.40
200	.36	.43	.49	.57	.64	.71	.78	.85	.92	1.00	1.07	1.14	1.21	1.28	1.35	1.43
225	.39	.46	.53	.61	.68	.75	.82	.89	.96	1.04	1.11	1.18	1.25	1.32	1.39	1.47
250	.43	.50	.56	.64	.71	.78	.85	.92	.99	1.07	1.14	1.21	1.28	1.35	1.42	1.50
275	.46	.53	.60	.68	.75	.82	.89	.96	1.03	1.11	1.18	1.25	1.32	1.39	1.46	1.54
300	.50	.57	.63	.71	.78	.85	.92	.99	1.06	1.14	1.21	1.28	1.35	1.42	1.49	1.57

**Table 10.10 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
10" Diameter**

	LENGTH OF SPUR IN FEET, 4" DIAMETER															
	LENGTH OF MAIN LINE IN FEET – 8" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.09	.17	.26	.35	.44	.53	.62	.71	.80	.89	.98	1.07	1.16	1.25	1.34	1.43
25	.12	.20	.29	.38	.47	.56	.65	.74	.83	.92	1.01	1.10	1.19	1.28	1.37	1.46
50	.16	.24	.33	.42	.51	.60	.69	.78	.87	.96	1.05	1.14	1.23	1.32	1.41	1.50
75	.19	.27	.36	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53
100	.23	.31	.40	.49	.58	.67	.76	.85	.93	1.03	1.12	1.21	1.30	1.39	1.48	1.57
125	.26	.34	.43	.52	.61	.70	.79	.88	.97	1.06	1.15	1.24	1.33	1.42	1.51	1.60
150	.30	.38	.47	.56	.65	.74	.83	.92	1.01	1.10	1.19	1.28	1.37	1.46	1.55	1.64
175	.34	.42	.51	.60	.69	.78	.87	.96	1.04	1.14	1.23	1.32	1.41	1.50	1.59	1.68
200	.37	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71
225	.41	.49	.58	.67	.76	.85	.94	1.03	1.12	1.21	1.30	1.39	1.48	1.57	1.66	1.74
250	.44	.52	.61	.70	.79	.88	.97	1.06	1.15	1.24	1.33	1.42	1.51	1.60	1.69	1.78
275	.48	.56	.65	.74	.83	.92	1.01	1.10	1.18	1.28	1.37	1.46	1.55	1.64	1.73	1.81
300	.51	.59	.68	.77	.86	.95	1.04	1.13	1.22	1.31	1.40	1.49	1.58	1.67	1.76	1.86

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**Table 10.11 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
12" Diameter**

LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 12" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.10	.21	.32	.42	.53	.64	.75	.85	.96	1.07	1.18	1.28	1.39	1.50	1.61	1.71
25	.13	.24	.35	.45	.56	.67	.78	.88	.99	1.10	1.21	1.31	1.42	1.53	1.64	1.74
50	.17	.28	.39	.49	.60	.71	.82	.92	1.03	1.14	1.25	1.35	1.46	1.57	1.68	1.78
75	.20	.31	.42	.52	.63	.74	.85	.95	1.06	1.17	1.28	1.38	1.49	1.60	1.71	1.81
100	.24	.35	.46	.56	.67	.78	.89	.99	1.10	1.21	1.32	1.42	1.53	1.64	1.75	1.85
125	.27	.38	.49	.59	.70	.81	.92	1.02	1.13	1.24	1.35	1.45	1.56	1.67	1.78	1.88
150	.31	.42	.53	.63	.74	.85	.96	1.06	1.17	1.28	1.39	1.49	1.60	1.71	1.82	1.92
175	.35	.46	.57	.67	.78	.89	1.00	1.11	1.21	1.32	1.43	1.53	1.64	1.75	1.86	1.96
200	.38	.49	.60	.70	.81	.92	1.03	1.13	1.24	1.35	1.46	1.56	1.67	1.78	1.89	1.99
225	.42	.53	.64	.74	.85	.96	1.07	1.17	1.28	1.39	1.50	1.60	1.71	1.82	1.93	2.03
250	.45	.56	.67	.77	.88	.99	1.10	1.20	1.31	1.42	1.53	1.63	1.74	1.85	1.96	2.06
275	.49	.60	.71	.81	.92	1.03	1.14	1.24	1.35	1.46	1.57	1.67	1.78	1.89	2.00	2.10
300	.52	.63	.74	.84	.95	1.06	1.17	1.27	1.38	1.49	1.60	1.70	1.81	1.92	2.03	2.13

**Table 10.12 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
15" Diameter**

LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 15" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.13	.26	.40	.53	.67	.80	.94	1.07	1.20	1.34	1.47	1.61	1.74	1.88	2.01	2.14
25	.16	.29	.43	.56	.70	.83	.97	1.10	1.23	1.37	1.50	1.64	1.77	1.91	2.04	2.17
50	.26	.33	.47	.61	.83	.87	1.01	1.14	1.27	1.41	1.54	1.68	1.81	1.94	2.08	2.21
75	.30	.36	.50	.63	.77	.90	1.04	1.17	1.30	1.44	1.57	1.71	1.84	1.98	2.11	2.24
100	.33	.40	.54	.67	.81	.94	1.08	1.21	1.34	1.48	1.61	1.75	1.88	2.01	2.15	2.28
125	.37	.43	.57	.70	.84	.97	1.11	1.24	1.37	1.51	1.64	1.78	1.91	2.05	2.18	2.31
150	.41	.47	.61	.74	.88	1.01	1.15	1.28	1.41	1.55	1.68	1.82	1.95	2.08	2.22	2.35
175	.44	.51	.65	.78	.92	1.05	1.19	1.32	1.45	1.59	1.72	1.86	1.99	2.12	2.26	2.39
200	.48	.54	.68	.81	.95	1.08	1.22	1.35	1.48	1.62	1.75	1.89	2.02	2.16	2.29	2.42
225	.51	.58	.72	.85	.99	1.12	1.26	1.39	1.52	1.66	1.79	1.93	2.06	2.19	2.33	2.46
250	.55	.61	.75	.88	1.02	1.15	1.29	1.42	1.55	1.69	1.82	1.96	2.09	2.23	2.36	2.49
275	.58	.65	.79	.92	1.06	1.19	1.33	1.46	1.59	1.73	1.86	2.00	2.13	2.26	2.40	2.53
300	.62	.68	.82	.95	1.09	1.22	1.36	1.49	1.62	1.76	1.89	2.03	2.16	2.30	2.43	2.56

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**Table 10.13 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
18" Diameter**

LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 18" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.16	.32	.48	.64	.80	.96	1.12	1.28	1.45	1.61	1.77	1.93	2.09	2.25	2.45	2.57
25	.19	.35	.51	.67	.83	.99	1.15	1.31	1.48	1.64	1.80	1.96	2.12	2.28	2.48	2.60
50	.23	.39	.55	.71	.87	1.03	1.19	1.35	1.52	1.68	1.84	2.00	2.16	2.32	2.52	2.64
75	.26	.42	.58	.74	.90	1.06	1.22	1.38	1.55	1.71	1.87	2.03	2.19	2.35	2.55	2.67
100	.30	.46	.62	.78	.94	1.10	1.26	1.42	1.59	1.75	1.91	2.07	2.23	2.39	2.59	2.71
125	.33	.49	.64	.81	.97	1.13	1.29	1.45	1.62	1.78	1.94	2.10	2.26	2.42	2.62	2.74
150	.37	.53	.69	.85	1.01	1.17	1.33	1.49	1.66	1.82	1.98	2.14	2.30	2.46	2.66	2.78
175	.40	.56	.72	.88	1.04	1.20	1.36	1.52	1.69	1.85	2.01	2.17	2.33	2.49	2.69	2.81
200	.44	.60	.76	.92	1.08	1.24	1.40	1.56	1.73	1.89	2.05	2.21	2.37	2.53	2.73	2.85
225	.48	.64	.80	.96	1.12	1.28	1.44	1.60	1.77	1.93	2.09	2.25	2.41	2.57	2.77	2.89
250	.51	.67	.83	.99	1.15	1.31	1.47	1.63	1.80	1.96	2.12	2.28	2.44	2.60	2.80	2.92
275	.55	.71	.87	1.03	1.19	1.35	1.51	1.67	1.84	2.00	2.16	2.32	2.48	2.64	2.84	2.96
300	.58	.74	.90	1.06	1.22	1.38	1.54	1.70	1.87	2.03	2.19	2.35	2.51	2.67	2.87	2.99

**Table 10.14 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
21" Diameter**

LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 21" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.18	.37	.56	.75	.94	1.12	1.31	1.50	1.69	1.88	2.06	2.25	2.44	2.63	2.82	3.00
25	.21	.40	.59	.78	.97	1.15	1.34	1.53	1.72	1.91	2.09	2.28	2.47	2.66	2.85	3.03
50	.25	.44	.63	.82	1.01	1.19	1.38	1.57	1.76	1.95	2.13	2.32	2.51	2.70	2.88	3.07
75	.28	.47	.66	.85	1.04	1.22	1.41	1.60	1.79	1.98	2.16	2.35	2.54	2.73	2.92	3.10
100	.32	.51	.70	.89	1.08	1.26	1.45	1.64	1.83	2.02	2.20	2.39	2.58	2.77	2.96	3.14
125	.35	.54	.73	.92	1.11	1.29	1.48	1.67	1.86	2.05	2.23	2.42	2.61	2.80	2.99	3.17
150	.39	.58	.77	.96	1.15	1.33	1.52	1.71	1.90	2.09	2.27	2.46	2.65	2.83	3.03	3.21
175	.43	.62	.81	1.00	1.19	1.37	1.56	1.75	1.91	2.13	2.31	2.50	2.69	2.88	3.07	3.25
200	.46	.65	.84	1.03	1.22	1.40	1.59	1.78	1.97	2.16	2.34	2.53	2.72	2.91	3.10	3.28
225	.50	.69	.88	1.07	1.26	1.44	1.63	1.82	2.01	2.20	2.38	2.57	2.76	2.95	3.14	3.32
250	.53	.72	.91	1.10	1.29	1.47	1.66	1.85	2.04	2.23	2.41	2.60	2.79	2.98	3.17	3.35
275	.57	.76	.95	1.14	1.33	1.51	1.70	1.89	2.08	2.27	2.45	2.64	2.83	2.92	3.21	3.39
300	.60	.79	.98	1.17	1.36	1.54	1.73	1.92	2.11	2.30	2.48	2.67	2.86	2.95	3.24	3.40

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Table 10.15 Water Test Table
Allowable Drop in 3" Stand Pipe Per 10 Minutes
24" Diameter

LENGTH OF SPUR IN FEET, 4" DIAMETER																
	LENGTH OF MAIN LINE IN FEET – 24" DIAMETER															
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
0	.21	.42	.63	.85	1.07	1.28	1.50	1.71	1.93	2.14	2.36	2.57	2.79	3.00	3.22	3.43
25	.24	.45	.67	.88	1.10	1.31	1.53	1.74	1.96	2.17	2.39	2.60	2.82	3.03	3.25	3.46
50	.28	.49	.71	.92	1.14	1.35	1.57	1.78	2.00	2.21	2.43	2.64	2.86	3.07	3.29	3.50
75	.31	.52	.74	.95	1.17	1.38	1.60	1.81	2.03	2.24	2.46	2.67	2.89	3.10	3.32	3.53
100	.35	.56	.78	.99	1.21	1.42	1.64	1.85	2.07	2.28	2.50	2.71	2.93	3.14	3.36	3.57
125	.38	.59	.81	1.02	1.24	1.45	1.67	1.88	2.10	2.31	2.53	2.74	2.96	3.17	3.39	3.60
150	.42	.63	.85	1.06	1.28	1.49	1.71	1.92	2.14	2.35	2.57	2.78	3.00	3.21	3.43	3.64
175	.46	.67	.89	1.10	1.32	1.53	1.75	1.96	2.18	2.39	2.61	2.82	3.04	3.25	3.47	3.68
200	.49	.70	.92	1.13	1.35	1.55	1.78	1.99	2.21	2.42	2.64	2.85	3.07	3.28	3.50	3.71
225	.53	.74	.96	1.17	1.39	1.60	1.82	2.03	2.25	2.46	2.68	2.89	3.11	3.31	3.54	3.75
250	.56	.77	.99	1.20	1.42	1.63	1.85	2.06	2.28	2.49	2.71	2.92	3.14	3.35	3.57	3.78
275	.60	.81	1.03	1.24	1.46	1.67	1.89	2.10	2.32	2.53	2.75	2.96	3.18	3.39	3.61	3.82
300	.63	.84	1.06	1.27	1.49	1.70	1.92	2.13	2.35	2.56	2.78	2.99	3.21	3.42	3.64	3.85

10-0000 SEWAGE AND SOLID WASTE DISPOSAL

10-0200 INDIVIDUAL SEWAGE (SEPTIC) DISPOSAL SYSTEMS

10-0201 **Design of System.** Design of individual sewage (septic) disposal systems must comply with [Fairfax County Health Department](#) requirements.

10-0300 SOLID WASTE AND RECYCLING SYSTEM

10-0301 **Applicability.** The provisions of [Chapter 109.1](#) (Solid Waste Management) of the Code related to collection, storage, recycling and disposal of solid waste apply to all residential and nonresidential properties. This requires that the developer of each project provide for solid waste and recycling systems (i.e., separation, storage and collection) and indicate on the plans how this is to be accomplished.

10-0302 **References.** The technical requirements for solid waste and recycling systems are contained in [Chapter 109.1](#) of the Code and the accompanying guidance document, “Recycling Program Requirements” incorporated into [Chapter 109.1](#) by reference in accordance with [Section 109.1-1-1](#).

10-0302.1 *Mixed Paper and Cardboard* means flattened corrugated cardboard, magazines, catalogues, envelopes, office paper, brochures, phone books, junk mail, food boxes (such as cereal and cracker boxes), shoe boxes, and any other clean paper product without food residue.

10-0302.2 *Principal Recyclable Material (PRM)* is the recyclable material that comprises the largest quantity by weight in the waste stream.

10-0302.3 *Recycling* means the process of separating a material from the waste stream with the intent of diverting it from disposal as solid waste.

10-0302.4 *Recycling System* is the means by which recyclable materials are separated from the waste stream at the point of generation, and may include the means of delivering source-separated materials to a recycling center or Materials Recovery Facility.

10-0302.5 *Solid Waste* is any material defined as solid waste in [9 VAC 20-81-95](#) *et seq.* of Virginia’s Solid Waste Management regulations.

10-0302.6 *Source Separation* is the process of removing recyclable materials from the waste stream at the point where the material is generated. For residential material, the source is considered the household and contiguous residential property such as lawns or yards. For commercial material, the source is considered the commercial premises in which business is conducted and contiguous property such as storage yards.

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- 10-0302.7 *Waste Stream Quantity* means the total weight of solid waste disposed plus the total weight of materials recycled from the waste stream. “*Combined waste stream quantity*” refers to the aggregate waste stream of all tenants and/or occupants of a business property or complex.
- 10-0302.8 *Yard Waste* means the organic fraction of municipal solid waste that consists of grass clippings, leaves, and brush arising from general landscape maintenance. Yard waste also includes similar materials collected from nonresidential landscape maintenance, such as maintenance of streets, parks and recreational areas. Yard waste does not include any materials arising from tree removal, land clearing, or development activities.
- 10-0303 Recycling for Residential Properties (including condominiums and apartments)**
- 10-0303.1 Occupants of single-family attached and detached dwelling units must source-separate cans, bottles (plastic, metal and glass), yard waste, mixed paper and cardboard. No specific design requirements are applied to the design of such structures for trash and recycling.
- 10-0303.2 Owners of multifamily dwelling units holding a valid construction permit on or after July 1, 2007, must provide a recycling system for their residents to source-separate cans, bottles (plastic, metal and glass), mixed paper and cardboard.
- 10-0304 Recycling for Nonresidential Properties (all uses not included in [§ 10-0303](#) above)**
- 10-0304.1 Owners of nonresidential properties must provide a recycling system for their tenants, occupants, employees, and vendors to recycle, at a minimum, the establishment’s mixed paper and cardboard.
- 10-0304.2 Owners of nonresidential properties that generate an annual total waste stream of 100 tons or more, or have an annual average occupancy of 200 persons or more, are required to provide a recycling system for the establishment’s Principal Recyclable Material (PRM), in addition to mixed paper and cardboard. If a material from the list below is the PRM, it must be recycled in addition to mixed paper and cardboard: Ferrous scrap metal; Non-ferrous scrap metal; Used motor oil; Container glass; Aluminum or tin cans; Cloth; Automobile bodies; Plastic; Clean wood; Brush, leaves, grass, and other arboreal materials.
- 10-0304.3 Owners of nonresidential properties which generate mixed paper and cardboard as their PRM need only recycle those materials as determined by the [Division of Solid Waste Collection and Recycling](#).

10-0305 Waste Stream Calculation Worksheet and Statement

- 10-0305.1 The owner/developer of any multifamily or nonresidential property must submit a Waste Stream Calculation Worksheet, on the standardized form provided by the [Division of Solid Waste Collection and Recycling, DPWES](#) before site plan approval. The worksheet must include an estimate of the combined annual waste stream quantity for the project and describe the method(s) by which recyclable materials are to be separated from the waste stream. The purpose of estimating the quantity of trash and recycling is to ensure that adequate space is allocated to collect and store these materials.
- 10-0305.2 A statement must be added on the cover sheet of all site plans specifying the type of development (multifamily, single-family or townhouse, nonresidential), materials being recycled and the location of the dedicated space for collection of trash and recyclables.

10-0306 Design Standards and Guidelines

- 10-0306.1 Project designers must designate on the site plan the location of the pad to accommodate trash and recycling. The designated pad must be constructed of a material that is able to withstand the proposed load (concrete is recommended). Areas 30 feet in front of the pads should also be reinforced to withstand the weight of the collection vehicle. In instances when site constraints prohibit total concrete surfacing, a concrete service pad extending 13 feet in front of the enclosure must be provided to withstand the pressure of the front wheels of the vehicle while dumping.
- 10-0306.2 Access to collection and storage areas must be by internal travelways and parking areas within a site. No collection device may be accessed directly from a public street, and no backing movement from an internal collection device may encroach into any street. Parking areas should allow for a circular through movement wherever possible to avoid back-up movements. Where a circular through movement is not possible, maneuvering space in front of any dumpster must be provided. Back-up and turnaround space must have a minimum width of 15 feet and a depth of 30 feet.
- 10-0306.3 All collection and storage areas must be designed to provide positive drainage, be accessible to collection equipment, public health inspectors, and County fire and solid waste inspection personnel. In addition, exterior storage containers and equipment must comply with [Chapters 62](#) (Fire Protection), [46](#) (Health or Safety Menaces), [109.1](#) (Solid Waste) and [112](#) (Zoning Ordinance) of the Code.
- 10-0306.4 Containers may not be placed in required transitional screening yards, tree save areas, designated open space area, floodplain or RPA. Containers may not be

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located in any area where they will block sidewalks, trails, required parking spaces, loading spaces or be located within any street. Screening must be provided in accordance with the [Zoning Ordinance](#).

- 10-0306.5 Trash and recycling containers must be placed adjacent to each other in the enclosure or in the same central storage area. The capacity for the trash and recycling containers and their storage areas must be adequate to accommodate the volume of materials as projected on the [Waste Stream Calculation Worksheet](#) with a frequency of collection not less than once per week.
- 10-0306.6 The designated pad for side by side dumpsters for collection and storage of trash and recyclable materials should be 22 feet wide x 10 feet long in accordance with [Plate 28-10](#). Additional space to accommodate additional containers, compactor equipment and/or storage areas for cardboard bales and pallets must be provided as needed. Alternative pad configurations may be approved by the Director in keeping with the purpose and intent of [§ 10-0300](#).
- 10-0306.7 Areas designated for trash and recycling containers for multi-family properties should generally be located within 200 feet walking distance of the building to be served unless otherwise approved by the Director.
- 10-0306.8 Minimum required vertical clearances for front-end loading vehicles collecting trash or recyclables stored in side by side dumpsters are 24 feet overhead and 10-foot width of clear opening.
- 10-0306.9 Required vertical clearances for safe access by roll-off trucks used to pull stationary compactor units and roll-off boxes at loading docks are 18 feet overhead for entry of the truck only, 24 feet when the truck hoist is raised with a rectangular box container and 11-foot width of clear opening. A minimum of 65 feet must be provided for the safe unloading/loading of container.
- 10-0306.10 Required vertical clearance for safe access by rear-loading refuse vehicles collecting trash or recyclables set out in roll-out carts, trash and recycling storage collection areas is 14 feet overhead and 10-foot width of clear opening.