

SECTION 5 - DRAWING GUIDELINES

5.1 General Requirements

- 5.1.01** Drawings are provided for the use of the County.
- 5.1.02** Original drawings signed and sealed by the engineer of record are the only legal documents.
- 5.1.03** Half-size drawings referred to in these Standards refer to 11 inch x 17 inch media.
- 5.1.04** Preliminary submittals shall have a stamp in the lower right of the drawing area with “PRELIMINARY” and the stage of completion of the submittal shown as a percent.
- 5.1.05** Electronic copies of drawings may be submitted for information in .pdf or .tif format. Plans may not be submitted for review in electronic format. Each drawing shall be a separate electronic file.

5.2 Drawing Organization and Format

5.2.01 Drawing Organization

- A. Drawings shall consist of the following types of sheets assumed to be arranged in the order listed:
 - (1.) Cover Sheet.
 - (2.) Index Sheet (if necessary).
 - (3.) Plan Sheets.
 - (4.) Plan and Profile Sheets.
 - (5.) Standard Sheets and Special Details.
 - (6.) Erosion and Sediment Control Details/Environmental Site Assessment.
- B. Projects consisting of only structures may not require plan and profile sheets, and projects for construction of gravity sewers, force mains, or water lines may not require the use of plan sheets except for special details.

5.3 Drafting Conventions

5.3.01 Standard Symbols

- A. Standard Symbols used for drawings are to be similar to those shown on Drawing D-50-1 and D-50-2. When Standard Symbols are not used, a Symbol Key will be included on the Cover Sheet or Index Sheet.
- B. Each plan shall have a north arrow located to the upper right or upper left of the plan view and shall be oriented correctly.

5.3.02 Standard Symbols - Proposed Facilities

- A. Symbols shall be as shown above except that solid lines shall be used for pipes.

5.3.03 Layers and Line Weights

- A. Entities in drawings shall be drawn “By Layer” for color and line type.
- B. Name Layers using a logical layering system with all entities on their appropriate layers.
- C. Line weight for existing water and sewer facilities shall be no heavier than 0.020 inch.
- D. Line weights for proposed water and sewer facilities shall be no lighter than .024 inches.
- E. Line weights for existing and proposed water and sewer facilities shall be of sufficient difference in widths from other plan features as to clearly delineate and distinguish water and sewer facilities from those other plan features.

5.3.04 Text and Dimensions

- A. Text, Dimensions and Notes/Lettering shall be consistent and clear with a minimum height of .09375 (3/32) inches with a minimum line weight of .010 inches.
- B. The larger type (view titles, subtitles, and etc.) shall have proportionately wider line widths.

5.4 Drawing Quality Standards

- A. All drawings shall be clear and legible and suitable for scanning.
- B. All plans submitted for review shall comply with the minimum format and quality control requirements of the DPU Standards. Plans which do not substantially meet these criteria will not be accepted for review.

- C. Plans submitted for review shall be direct prints or copies from the original reproducible or file. Photocopies or reproductions will only be accepted for information or preliminary review purposes.
- D. Text shall be open so that it is readable when drawings are reduced to half size. All drawings must be capable of producing legible second generation prints after being reduced to half size.
- E. The contrast of the printed material shall be high, with blank areas being as white as possible, and all information being as dark as practicable, while remaining clear and distinct.
- F. Shading and/or hatching, such as on plan views for paving, shall not be used on the drawings where it will hide any information when the drawing is photocopied or scanned.
 - (1.) Shading with a pencil or using dark film on original reproducibles will not be accepted.
 - (2.) For areas that need to be identified or highlighted, stippling or cross hatching may be used provided no other information is hidden.
- G. Screening is not recommended but, if needed, shall be sufficiently dark to be clearly visible when reduced to half-size and copied.
- H. It is the intent of these Standards that all submitted plans will be scanned for archiving. If there is any question regarding plan legibility, the plan will be scanned and acceptability determined upon printing of the scanned image at one-half size.

5.5 Construction Drawings - General

- A. All construction drawings shall be on sheets 24 inch x 36 inch.
- B. Plans shall be drawn to a scale which will permit all necessary information to be plainly shown.
- C. The cover sheet shall contain the Owner's name, suitable title and project description in large, distinctive letters, a vicinity map drawn on a scale of 1 inch equals 2,000 feet to indicate the general vicinity of the contemplated construction, an index to the plan sheets and the signed seal of the design engineer responsible for the design. The vicinity map shall include the north arrow, project street address, and scale.
 - (1.) The POD or Subdivision Cover Sheet shall be used for those plan review processes.
- D. An index map shall be prepared for sewer line, sewage force main and water line projects. The index map shall be to a scale no smaller than 1 inch equals 600 feet and provide a graphical scale (bar scale). The index map shall show all proposed utility construction with ties to existing utilities. The lines of proposed construction, together with proposed utility structures, shall be indexed to the drawings to indicate the extent of coverage on each drawing, or, in the case of structures, to the group of drawings involved.

- E. Where proposed sewer facilities tie to existing sewer facilities, the plans shall show equality in elevations whenever elevations do not match those shown in the County Sewer Map. County Sewer Map elevations shall be designated as "C.S.M." and shall be for County information only.
- F. Plan sheets, as well as Plan and Profile Sheets, shall show horizontal, vertical, and topographical data as required by these Standards.
- G. All plans shall bear a suitable title showing the name of the municipality, sewer district, and institution or other Owner and shall show the scale in feet, a graphical scale (bar scale), the north arrow, the date, and the name of the appropriate licensed professional. Each plan sheet shall bear the same general title identifying the overall project, and each shall be numbered. Each sheet shall bear the Engineer's seal and be appropriately signed. Appropriate subtitles shall be included on the individual sheets.
- H Drawings shall include the current Henrico County Standard Water and Sewer Notes (Form F-11).
- I Horizontal scale in Plan and Profile Sheets shall be no smaller than 1 inch equals 100 feet. The vertical profile scale shall be no smaller than 1 inch equals 10 feet. The plan and profile shall be drawn to the same horizontal scale.
- J Show all existing water mains and sewer mains.
- K All known existing structures and utilities, both above and below ground, which might interfere with the proposed construction, particularly water mains, sewer mains, gas mains, storm drains, utility service lines, power and telephone conduits, etc. shall be shown in plan and profile.
- L The Engineer shall provide bench marks in accordance with either (1) or (2) below. The location of bench marks shall be shown on the construction drawings. Benchmarks shall be set by a licensed land surveyor.
 - (1.) Bench marks shall be set no more than 500 feet apart along the lines of construction but outside the limits of construction.
 - (2.) A bench mark shall be set at the downstream end of the project but outside the limits of construction with temporary bench marks set at each manhole. Any benchmarks or temporary bench marks disturbed by construction activities shall be reset if requested by the DPU Construction Division Director. A note to this effect shall be provided on the plans.
- M Each Plan sheet shall have three crosses (×) labeled with Northing and Easting coordinates which are tied to Henrico County GIS System horizontal control.
- N. Identify all off-site easements required and label Deed Book and Page Number.
- O. Reference the asset identification number for applicable water and sewer node at the tie-in for the project location.

- P. Show the location of erosion control devices on the plans. These devices shall be in conformance with the Erosion and Sedimentation Control Handbook for Henrico County.
- Q. Show the 100-year flood plain boundary and elevation on plan view. Show all stream crossings with elevations of the streambed and normal and 100 year flood elevations on the profile.
- R. Label water and sewer information for all water and sewer mains, structures, fittings, etc on the plan and profile. Data or reference tables are not allowed.
- S. Engineer shall include the location of all Electronic Markers on plans submitted for approval.
- T. Locations of all Electronic Markers shall be shown on the as-built drawings.

5.6 Construction Drawings - Gravity Sanitary Sewers

In addition to the other requirements of Section 5, the plans and profiles shall show:

- A. Manhole stationing, pipe size, pipe material, bearings, direction of flow, deflection angles, pipe grade (slope), and distance between center lines of manholes.
- B. All manholes shall be numbered in an established manner on the plan and correspondingly labeled in the profile. Identify drop manholes. Clearly show the top and invert (both influent, and effluent) elevations for each manhole.
- C. Ground surface elevations of the pipe centerline.
- D. The plans shall indicate the following information to provide for service to the elevation of the connection as follows:
 - (1.) Lowest sewered existing structure elevation.
 - (2.) Low ground corner of structure with first floor service only.
 - (3.) Ground level at building line on unoccupied parcel.
 - (4.) The elevation and location of any existing structure to be sewered shall be clearly shown. The street address of existing house(s) shall be shown.
- E. The engineer shall state that all sewers are sufficiently deep to serve the lowest elevation of each home with a gravity service installed at 1/4" per foot except where otherwise noted on plan.
- F. Water mains shall be shown, and profiles shall indicate points where crossings occur, clearly indicating vertical clearance between utilities.
- G. All stream crossings with elevations of the streambed and normal and 100 year flood elevations.

- H. Details of all sewer joints or cross sections requiring special construction such as concrete encasement.
- I. Sewer or water lines not to be owned by the County shall be identified as "Private."
- J. Provide a table to address the raising or lowering of existing manholes to finished grade. This table should include:
 - (1.) Existing top elevation;
 - (2.) Proposed top elevation;
 - (3.) Amount of modification requires, i.e., vertical feet of raising or lowering;
 - (4.) Proposed method of adjusting each manhole;
 - (5.) Phase of construction each manhole modification is to be done..

Note that a maximum of 12” adjustment may be done utilizing precast riser rings to raise frame and cover. For additional height adjustment, new precast manhole riser, cone section, and frame and cover must be installed. Decreasing manhole depth must be done by removal and replacement of precast manhole sections. Repaver rings shall not be used to adjust new or reconstructed manholes to grade.

5.7 Construction Drawings - Sewage Pumping Stations and Force Mains

In addition to the other requirements of Section 5, the plans and profiles shall show:

- A. Drawings and specifications shall be of such quality and contain sufficient details so that no misunderstanding may reasonably arise as to the extent of the work to be performed, the materials to be used, the equipment to be installed, or the quality of the workmanship. Manufacturers of major items of equipment shall be specifically approved. No deviation from the approved manufacturers will be permitted.
- B. Provide proposed pumping station equipment layout and capacities including provisions for future pumps.
- C. Drawings shall include mechanical details, electrical line diagrams and instrumentation and controls plans.
- D. Drawings for pumping stations shall include a site plan drawn to a scale of not smaller than 1 inch equals 20 feet and shall contain existing and proposed contours on a 2 foot contour interval. The boundaries of the site shall be clearly shown on the site plan and shall have permanent monuments installed in the field prior to completion of construction.
- E. Drawings for pumping stations shall be drawn on a scale of not less than 1/4" equals 1' - 0". Drawings required clarifying construction details shall be drawn on an appropriately larger scale.
- F. Drawings for force mains shall show stationing, pipe size, bearings, direction of flow, deflection angles, and curve data.

- G. Profiles for force mains shall show the ground line, force main profile, underground utility lines, and structures that might affect force main depth. It shall also show areas where additional depth will be required, any required vertical curve data, and locations of all relief valves and appurtenances. All crossings of existing and proposed water mains shall be shown to clearly indicate vertical clearance between utilities.
- H. Details shall be shown for all blocking, pipe restraints, and relief valves.
- I. Test borings and groundwater elevations.

5.8 Construction Drawings - Water Distribution Facilities

In addition to the other requirements of Section 5, the plans and profiles shall show:

- A. Drawings for water lines shall show stationing, pipe size and material, bearings, and curve data to adequately define the water line location. Water line dimensions including distances to structures, right-of-way, face of curb, edge of pavement, and property lines shall be shown.
- B. The drawings shall also show all fire hydrant and water service connections. Fire hydrants and water services over 1 inch in size shall be shown in plan and profile views which are labeled by stations.
- C. Profiles shall be provided for all water lines. Grades shall be calculated and shown on the profiles.
 - (1.) Show all air, air/vacuum relief valves, fire hydrants, and blow-off locations.
 - (2.) Show location and length of all restrained joint pipe.
- D. Water lines shall be referenced by distances from right-of-way lines, buildings, and other utilities.
- E. Blocking and/or restraint details.
- F. Current Henrico County Water and Sewer Notes (Form F-11), Material Notes (Form F-6), and Estimated Material Quantities shall be shown on the plans.
- G. All drawings for water mains crossing sewers, force mains, or other utilities shall show points where crossings occur. Crossings shall be shown in both Plan and Profile. The Profile shall clearly indicate vertical clearance between utilities.
- H. Meter sizing form, backflow prevention details, and Fire Flow (ISO) calculations shall be shown on the plans.
- I. All fittings, including valves, bends, tees, etc., shall be shown on the plan and profile.

J. The location of all electronic marker balls shall be shown on the drawings