

CHAPTER FIVE

DRAWING REQUIREMENTS

I. GENERAL

- A. The Contract drawings shall be prepared under the direct supervision of a Professional Engineer registered in North Carolina. Each drawing sheet shall be signed, sealed and dated.
- B. The drawings shall utilize standard drafting practices and include PWC Standard Symbols and Abbreviations indicated by a legend. The drawings should be produced utilizing an AutoCAD.dwg compatible electronic file using PWC Standard Layering System. Record Drawings shall be provided to PWC in AutoCAD.dwg electronic format, clearly labeled with project name for record keeping purposes.
- C. Since PWC will be scanning all approved plans, blueprints are not acceptable media for reproducible drawings. Blueprint copies are acceptable.

II. TYPICAL DRAWING SET

The typical drawing set shall be arranged in the following sequence:

- Title Sheet
- *Utility Layout Sheet
- *Erosion Control Plan
- *Plan/Profile Sheets
 - Traffic Control Plan
- *Civil Detail Sheets
 - ?? Erosion Control
 - ?? Water
 - ?? Sewer
- Miscellaneous Details
 - ?? Landscaping and Details
 - ?? Structural Plans and Details
 - ?? Electrical Plans and Details
 - ?? Mechanical Plans and Details
 - ?? Plumbing Plans and Details

* Note: These sheets are required on all projects regardless of size.

III. PLAN SHEET REQUIREMENTS (ALL DRAWINGS)

- A. Drawings shall be placed on 24"x 36" vellum, mylar or bond media. Other sizes shall be acceptable, as approved by PWC.
- B. The title sheet shall include the following:
 - a. The Project name and/or Subdivision name and Phase;
 - b. Engineer's name, address and phone number;
 - c. Number of sheets;
 - d. revision block;
 - e. sheet description name; and
 - f. date.

A sample title sheet is contained in Chapter 6 of this Manual.

- C. Provide ½" borders along top, bottom and right margin and a 1½" border along the left side of the sheet.
- D. Plan/Profile sheets for PWC projects should be produced with a plan view horizontal scale of 1"=50' and a vertical scale of 1"=5' for profiles. Other scales may be approved by the PWC as necessary. Plan/Profile sheet stationing shall increase left to right or downstream to upstream. The plan view beginning station shall be aligned with the profile view beginning station. Match lines referencing continuation on other sheets shall be used. Profile view should indicate the centerline profile of the proposed route.
- E. The utility layout sheet shall be produced with a horizontal scale of 1"=100' or larger (i.e., 1"=50') to indicate the new layout/extension and the relationship to other proposed or existing utilities, roadways, and other pertinent structures. The utility layout sheet should show contours and an individual sheet index along the route. Large projects may require several sheets with coordinated match lines.
- F. A reference to the horizontal and vertical datum that the project is based on shall be indicated on the utility layout sheet.
- G. Horizontal and vertical (if applicable) bar scale shown in written and graphical format.
- H. North arrow oriented either to the top or to the left of the sheet where practical.

- I. Existing water and/or sewer lines labeled with size and material, if known.
- J. All existing, or proposed rights-of-way and construction easements accurately located and shown on plans. Lot lines and parcel numbers shall be shown with right-of-way and construction easement widths indicated.
- K. All existing and proposed water, sewer, storm drain lines which cross or run parallel to the sewer or water lines shall be shown with exact horizontal alignment. Subsurface exploration should be performed where potential conflicts exist.
- L. Proposed and existing road and drainage shall be shown.
- M. Road names, state route numbers, and right-of-way widths shall be shown.
- N. Proposed future water/sewer projects shall be shown.
- O. Proposed water/sewer lines shall be shown with adequate reference distances from right-of-way, property boundary, buildings, or other utilities, etc., to provide for proper location of the proposed utility.
- P. Show proposed lot layout or subdivision map.
- Q. Location of existing houses, buildings, fences, wells and other structures affected by construction.
- R. Label bores and/or tunnels to show steel casing/tunnel liner beginning and ending stations and length.
- S. Show topography of the area with two (2) foot contour intervals.
- T. Show wetland delineation and locations.

IV. TITLE SHEET (Sample Included in Chapter Six - Drafting and CADD Standards)

- A. Project name and/or Subdivision name and Phase, if applicable.
- B. Title block information
- C. Sheet Index with sheet numbers.

V. UTILITY LAYOUT SHEET

- A. Legend of sanitary sewer, water, and other utilities, structures; either proposed or existing.
- B. Vicinity/location map with site clearly indicated.
- C. Construction Notes
- D. Overall plan of the water and/or sewer extension layout, indexed to sheet numbers.
- E. Existing utilities to include water and/or sewer labeled with size and material type, if known.
- F. "Composite" of all information contained in the plan view of the individual plan/profile sheets.

VI. PLAN/PROFILE SHEETS (Sample included in Chapter Six - Drafting and CADD Standards)

A. WATER PLAN/PROFILE SHEET

- a. Show all fittings, fire hydrants, and valves including sizes and station number. Label each appurtenance.
- b. Restrained joint pipe beginning and ending station numbers and lengths.
- c. Fire hydrant locations shall comply with design guidelines. Show fire hydrant assembly station, location and flange elevation.
- d. All potential conflicts with storm sewers and other utility lines shall be shown.
- e. Vertical clearance requirements shall be shown at all crossings of other utilities. Horizontal clearance requirements shall be shown (i.e., 10 feet between water and sewer mains).
- f. All water lines shall have a minimum of 3.5 feet of cover, or are otherwise protected as required.
- g. Blow-off stations and locations shall be shown and labeled at the end of all lines.
- h. All water services shall be shown with a station number and finished curb grade.
- i. Show all types of and methods of connection to the existing mains.
- j. Main location relative to back of curb, edge of pavement or right-of-way.

- k. Water line stubs for future extensions are to be installed five (5) feet beyond the edge of proposed pavement. Horizontal alignment and profile, if applicable, are to be shown on the construction plans.
- l. Wetlands shall be shown as delineated by an experienced professional.

B. SEWER PLAN/PROFILE SHEET

- a. Proposed manholes and structures shall be labeled with station number, size or diameter, rim elevation, invert elevation of all connecting pipes, coatings, and type of ring and cover. Provide appropriate watertight manhole ring and cover with venting on plan where required. Show existing shelf elevations.
- b. Proposed interior drop structures with invert elevation (5 foot diameter manhole required to 12-inches above drop structure tee).
- c. When connecting to an existing manhole, show invert elevation, top of manhole elevation, alignment of existing line, size existing line, and type of construction of existing manhole (i.e. brick masonry or precast concrete).
- d. Profiles for gravity sewer shall clearly indicate the planned slope of each reach of line given in percent slope. The length between manhole centerlines shall be used to calculate pipe slope.
- e. The length of each reach of gravity sewer shall be clearly indicated on the drawings. This length shall be the manhole centerline-to-centerline length as measured horizontally and shall not exceed 425 feet unless approved by PWC.
- f. Show size of proposed main and type of material for all reaches of sewer, including changes in pipe material for clearance requirements.
- g. Sanitary sewer lateral station number, cleanout invert elevation and finish grade shall be shown. Indicate if the lot requires a grinder pump.
- h. Bearings and distances between manholes or deflection angles for horizontal alignment changes shall be shown unless no deflection is planned (i.e., straight through manholes).
- i. Show proposed and existing sewer main flow directions.
- j. Show 100-year flood elevation and boundary, if applicable.

- k. Show pipe class beginning and ending stations for deeper cuts.
- l. Show all conflicts with water mains with either material changing to ductile iron pipe or show required NCDENR vertical and horizontal clearances.
- m. Indicate where VCP or PVC pipe is replaced with ductile iron where there is less than three (3) feet of cover or where otherwise required.
- n. Provide proper detail for all aerial creek crossings.
- o. Label all easement types, widths, and special conditions where applicable.
- p. Show wetland delineation and location in respect to proposed utility.

VII. DETAIL SHEETS

A. GENERAL

- a. Use PWC Standard Details.
- b. Do not modify PWC Standards without PWC written approval.

VIII. RECORD DRAWINGS CHECKLIST

A. GENERAL

At completion of the project, and all testing has been completed in accordance with PWC requirements, the Water Resources Engineering Department will request, in writing, that the Engineer prepare and submit a set of record drawings for review. For the initial submittal, providing PWC with the contractor's marked up set is acceptable. Once the record drawings are reviewed and approved by PWC, the Engineer will be requested to submit final record drawings. The Engineer shall submit one (1) set of reproducible (bond or vellum) drawings, a digital file (in AutoCAD format), and the Engineer's Certification to PWC. Upon receipt of these items, PWC will activate services for public use.

Samples of the Engineer's Certification are included in Chapter 7 of this Manual.

B. DRAWING REQUIREMENTS

- a. North Carolina registered Professional Engineer seal and signature required on each plan sheet.
- b. Drafter's initials and date of record information is required on each sheet.
- c. Record Drawings completed in ink.
- d. On each sheet, label the type and class of pipe installed.
- e. Label bores and tunnels to show steel casing/tunnel liner type, size, and thickness. Show beginning and ending stations.
- f. Mark through and redraw manholes, valves, fire hydrants, etc., when the as-built location deviates more than 10 feet horizontally from the location indicated on the plans.
- g. Temporary erosion control measures shall not be shown.

C. SEWER REQUIREMENTS

- a. Mark through the design information and indicate the actual:
 - i. manhole pipe inverts and rim elevations.
 - ii. distance between manholes on the plan view.
 - iii. distance between manholes on the profile.
 - iv. location of all sewer laterals by station.

D. WATER REQUIREMENTS

- a. Mark through the design information and indicate the actual:
 - i. Stationing of all valves, bends, hydrants, fittings, air releases, etc
 - ii. Stationing of fire hydrants – show station for tee, valve, and hydrant.
 - iii. Location of all water services by station along the centerline of the water main or street.
 - iv. Location of concrete blocking where applicable.
 - v. Location by station and type of restrained joint pipe and/or fittings.

IX. STANDARD CHECKLIST

The following checklist is being provided as a reference to the Design Engineer. This checklist contains items that the PWC Water Resources Engineering Department looks for during plan reviews and failure to include items on the checklist can result in delays to approving the plans.

WATER RESOURCES ENGINEERING PLAN REVIEW CHECKLIST

General Requirements

- ☒☒ Plans should be on 24" x 36" paper
- ☒☒ Originals must be reproducible and digital drawing furnished in a DWG format.
- ☒☒ Provide datum reference and elevation.
- ☒☒ A vicinity map needs to be shown on the utility cover sheet.
- ☒☒ Contour lines shall be provided
- ☒☒ Erosion Control Plan to be included in plans and permit obtained if more than 1 acre is disturbed
- ☒☒ Show all, underground utilities paralleling or crossing mains in plan and profile
- ☒☒ Lot Numbers
- ☒☒ Lot Frontage if commercial
- ☒☒ PIN on Lot (if applicable)
- ☒☒ Project name the same on each sheet and match the permit applications?
- ☒☒ Does the project require an annexation petition or agreement and has it been verified with Jimmy Teal?
- ☒☒ Is an off-site easement required? If so, has an easement map been submitted?
- ☒☒ Are all the permit applications and submittal checklists completed properly?
- ☒☒ Is a DOT encroachment required? If so, has an encroachment map been submitted?
- ☒☒ Is a railroad encroachment required? If so, has the appropriate application been submitted?
- ☒☒ Provide wetland delineation (if applicable).
- ☒☒ Can the water and/or sewer be extended across the parcel to serve others? Check GIS for topo and location of existing services.
- ☒☒ If a lift station is proposed, is the lift station located and sized to serve additional developments (i.e., a regional lift station)?
- ☒☒ All manhole data (stations, rims and inverts), all sewer main data (lengths, diameters, materials, direction of flow, and slopes) and all water main data (diameter and materials) must be shown on all plan and profile sheets.
- ☒☒ Are there discrepancies between the plan, profile, and utility sheets (i.e., lengths and/or slopes not matching)?
- ☒☒ All water and sewer laterals, meters and cleanouts (with top and invert elevations) must be shown on all plan views. Unless special circumstances dictate otherwise, meters and cleanouts must be centered on the front property line of a residential lot, and spaced approximately 18-inches apart.
- ☒☒ Indicate stations for all valves, tees, fire hydrants, cleanouts, manholes, catch basins, bends, angles, etc.
- ☒☒ Label material, size, and class of new and existing (if known) water, sewer and storm utilities.
- ☒☒ Water and sewer mains shall include distances and angles or bearings based on NAD 83 or NVGD 88
- ☒☒ If a bore and jack is required on a project, the end of the encasement pipe should extend a minimum of 3 feet past the existing, or known future, edge-of-pavement.
- ☒☒ Are the final (County approved) street names shown on the plans?
- ☒☒ No 90° bends, on water mains or sewer force mains.
- ☒☒ Are all the necessary and up to date details incorporated?
- ☒☒ Are all separation requirements met or ductile iron pipe utilized?

Sewer Requirements

- ☒☒ Is the sewer ductile iron from MH to MH for those lines between houses?

- ☞☞ Is the sewer ductile iron MH to MH or only 1 transition to PVC in other locations?
- ☞☞ Verify that the easement widths are appropriate – 20 feet for less than 10 feet in depth, 30 feet for greater than 10 feet in depth.
- ☞☞ Is there access to the sewer lines behind houses? If not, request a 20-foot access easement.
- ☞☞ Are the sewer laterals 4 to 6 feet deep?
- ☞☞ Have the pipe lengths, slopes and inverts been checked?
- ☞☞ The angle between the outgoing sewer main and the incoming sewer main shall be a minimum of 90°.
- ☞☞ Manhole rims to be 12-inches above 100-year flood elevation
- ☞☞ Show cleanouts 18-inches inside the easement line where applicable (if a blanket easement applies, is there a note on the plans?).

Water Requirements

- ☞☞ If a bore and jack is required, the carrier pipe (for water) shall be restrained joint
- ☞☞ Can the water main be looped?
- ☞☞ If there is a bank of meters, is the 2-inch main looped?
- ☞☞ Are there any services past the last gate valve?
- ☞☞ Has justification been requested or provided for those meters greater than 1.5 inches?
- ☞☞ Are the gate valves at street intersections located adjacent to the turning radii?
- ☞☞ Blow-offs at the end of water mains (typically on cul-de-sacs), must be located at a property corner, with the most expeditious conveyance of surface drainage in mind.
- ☞☞ Placement and spacing of in-line valves (valves should be placed to have no more than 20 to 25 customers out of water if a main break occurs).
- ☞☞ Locate a gate valve on the main near a fire hydrant.

Backflow Requirements

- ☞☞ Are the backflow devices labeled and specific to the type of device needed?
- ☞☞ For commercial projects, lateral and meter sizes, as well as BFP size, type, make and model are required.
- ☞☞ A backflow prevention device will be required on all fire laterals installed, including exterior fire hydrants, if the length of the lateral is greater than 100 feet (measured from the tap to the furthest fire hydrant).
- ☞☞ Approval is required of type, model, installation, and testing by PWC's System Protection Department
- ☞☞ Is the use of the line specified (i.e., fire, domestic, irrigation)?