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APPENDIX A. Permitting And Submittal Requirements

Appendix A outlines the planning, plan review, and project completion requirements for both sanitary and storm sewer projects and is included in both the Sanitary Standards and the Stormwater Standards. This section is intended to standardize the submittals and clearly outline the minimum requirements. The requirement for a complete submittal package is intended to reduce the overall plan approval processing time.

1. Review and Permitting Requirements

The following is a generalized overview of the District development review and permitting processes. This process may vary from one application, submittal and/or building permit to another and is only shown as a general outline of procedures and processes involved in the review and approval of projects located within the District. To obtain further information on a specific plan review or permit process contact a Development Review staff member. The Developer shall have ultimate responsibility for compliance with all requirements specified in these Sanitary Standards and the District's Regulations. The Developer shall be directly responsible for all administrative requirements including application for service, submittal of all required Plans, bonds and insurance, and payment of fees.

General Plan Review and Approval Process

This subsection describes the most common elements of the general development review process for a typical partition, subdivision, multi-family, commercial or industrial project. Applicants should discuss their project with the District and local planning authority early to understand the review and approval process required for a specific project.

1. **Pre-Application Conference** – The Applicant may elect to meet with the local planning authority, District, and other related departments to discuss the proposed project to better understand the potential requirements. It is best if the Applicant submits a preliminary concept or plan, so the District is better prepared to discuss the proposed development. Contact the local planning authority to schedule the pre-application meeting. The planning authority will invite the District to the meeting.
2. **Service Provider Letter** – Applicants proposing to develop or redevelop property shall obtain a Service Provider Letter from the District prior to submitting the land-use or design review application to the local planning authority.
3. **Water Quality Resource Area Boundary Verification** – If applicable, prior to the District issuing a Service Provider Letter, the local planning authority must approve a WQRA Boundary Verification for vegetated buffer requirements (see the Buffer Standards).
4. **Conditions of Approval** – The local planning authority will process the land use/design review application and route a copy of the application for District review. The District will review the application and submit comments to the local planning authority to be included as conditions.
5. **Jurisdictional Authority**– If the proposed project is outside the service area boundaries of the District, the Developer must petition for annexation to the District. The annexation must be approved by the Board before final occupancy or plat approval. The Applicant shall submit a complete annexation packet to WES prior to any plan approvals by WES.

6. **Pre-Design Meeting** – The Applicant may elect to coordinate a meeting with the local planning authority and/or the District to discuss the project and requirements outlined in the conditions.
7. **Plan Submittal** – Upon land use approval, the Applicant must submit required fees, civil plans and supporting documentation as specified in these standards for plan review and approval.
8. **Other approvals** – Other permits and approvals may be required prior to the District approving the plans (i.e., County, City, State or Federal).
9. **Approved Plan(s)** – Plans and applicable building permit applications will be reviewed, approved, and then signed by an authorized representative of the District. If applicable, it may be necessary to hold a Pre-Construction Meeting with the Developer's Engineer, Contractor, Applicant, District, and other related agency representatives to discuss project requirements, including processes to complete the project as specified in the Sanitary and Stormwater Engineering Agreements.
10. **Construction** – The public sanitary and stormwater management infrastructure shall be constructed under the supervision of the Developer's Engineer as specified in the Sanitary and Stormwater Engineering Agreements.
11. **Construction Completed** – Upon final completion of the construction, the Developer's Engineer will certify the project was constructed in accordance with the approved plans, and the as-built plans are an actual record of what was constructed.

    The following items will be completed and submitted prior to requesting the final inspection of the public sanitary and/or stormwater infrastructure:

    i. All sanitary and/or stormwater infrastructure shall be cleaned of sediment and debris.
    ii. A *Certification of Completion* shall be submitted – Certifies the project was constructed in accordance with the approved plans and District Standards.
    iii. Two paper copies of the as-built drawings shall be submitted.
    iv. If applicable, submit the video testing of the public sanitary and stormwater conveyance piping systems, along with the Contractor's reports for review and approval. The Developer's Engineer shall review the video and reports, and note any deficiencies discovered in the system(s) prior to submitting the items to the District.
    v. Submit a copy of the Developer's Engineer inspection reports.
    vi. Submit Service Connection drawings prepared by the Developer's Engineer (if required).
12. **Final Inspection** – The District will review the required as-built submittals and, if acceptable, will schedule the final field inspection. All repairs and corrections shall be made prior to the District deeming the project complete.
13. **Final As-built Drawings** – When requested by the District, the Developer's Engineer shall submit the corrected final as-built drawings on paper, electronic CAD, and PDF files of the as-built civil construction plan set.
14. **Warranty Surety** – Upon completion of the public sanitary and stormwater final inspection, the Applicant will submit a sanitary and/or stormwater warranty surety in the amount of 25 percent of the actual cost to construct the public infrastructure. The warranty surety will be held for a minimum period of 2 years from the date of completion, or until all the requested system repairs are completed.

15. **Letter of Completion and Acceptance –** Upon final approval of the construction of the public sanitary and stormwater infrastructure, and all of the above noted items have been reviewed and approved by the District, then the District will issue a letter of completion of the stormwater infrastructure, and letter of acceptance of the public sanitary sewer system and/or Public Stormwater System.
16. **Warranty Surety Inspection** – Between 20 and 24 months after issuance of the letter of completion and acceptance, the District will inspect the public facilities at the request of the Owner. The inspection will include all public sanitary and stormwater infrastructure, included the plantings and other related improvements. Once all deficiencies are corrected, the District will issue a warranty surety release letter.

Service Provider Letter Submittal Requirements

The intent of the Service Provider Letter is that, prior to applying for Land Use/Design Review, the Applicant must demonstrate the proposed development is viable in accordance with District Rules and applicable Standards. The Service Provider Letter will only be issued once the Applicant has provided sufficient plans, reports, studies, and agency approvals needed for preliminary review by the District. Based on the preliminary review, the District may require additional information prior to issuance of the letter or as part of the forthcoming land use application. Receipt of the Service Provider Letter does not imply that all District requirements have been met or guarantee that land use approval for the development will be granted.

Applicants must submit the following to the District for review:

- Preliminary plat (if applicable)
- Preliminary proposal for public and private sanitary infrastructure
- Proposed sanitary system layout, including compliance with minimum design standards
- Points of connection to public sanitary sewer system
- Service proposal for upstream properties
- Preliminary Stormwater Management Plan and Drainage Report
- Site assessment and maps
- Proposed storm drainage system and stormwater facilities:
    - Infiltration, detention, and water quality facilities
    - Conveyance System design
    - Point of discharge
    - Emergency overflow pathway
    - Service proposal for upstream properties
- Soils report and analysis
- Drainage area maps
- Infiltration testing results
- Drainage system analysis (upstream and downstream)
- Sizing and conveyance calculations
- Other supporting reports and information (as deemed necessary by the District)

- BMP Sizing Tool calculations
- WQRA Boundary Verification or Natural Resource Assessment
- Preliminary approval for off-site easements
- Offsite mitigation measures for downstream conveyance

Land Use Submittal Requirements

As part of the land use/design review application process, the local planning agency will route applicable sanitary and stormwater plans and reports to District for comment. The Applicant must provide sufficient plans, reports, studies, and agency approvals needed for preliminary review by the District, as including, but not limited to the Service Plan Submittal Requirements, above. The Applicant's materials shall include any additional information or revisions requested by the District with issuance of the Service Provider Letter.

The land use review stage includes WES issuance of 1) a Service Provider Letter, prior to land use application submittal, and 2) land use conditions of approval, following receipt of a complete land use application from the local planning agency.

Plan Review Submittal Requirements

The Developer's Engineer shall submit sufficient supporting information to indicate that the proposed plan design meets all the provisions within these Standards, including the land-use conditions. The submittal information shall include, but not be limited to, the items listed within this section.

Initial/First submittal requirements:

The following is a list of application submittals required by the District for a typical development:

- Water Quality Resource Area (WQRA) Boundary Verification and WQRA Development Permit, submit to the local planning authority as required (see Buffer Standards)
- Complete set of drawings for the Stormwater Management Plan
- Existing conditions
- Infiltration testing
- Proposed on-site storm drainage system and stormwater facilities
- Proposed grading plan
- Existing and proposed off-site improvements
- EPSC Plan
- Details and notes
- Stormwater Management Report that includes:
    - The engineered or BMP Sizing Tool method used to size the stormwater facilities.
    - A Storm Drainage System/Hydrologic and Hydraulic Calculations Report
    - Hydrology and hydraulic calculations with drainage area maps
    - Tributary drainage areas shall be calculated in table form and identified on maps submitted with the report

  - Geotechnical/Geologist Report
    - Infiltration Testing
    - Soils Report
    - Geology Report

Other submittal requirements required by the District as applicable prior to final plan approval.

- Standard Forms
  - Storm System Engineering Agreement
  - Storm System Construction and Engineering Costs Data Sheet
  - Sanitary Sewer Engineering Agreement
  - Sanitary Sewer Construction and Engineering Costs Data Sheet
- Non-Residential Questionnaire Easements/Agreements as applicable
  - Public/Private Sanitary and Stormwater Easements
  - Public/Private Storm Facility Operation and Maintenance Plan/Agreements

Periodically, the District may require additional information to support design assumptions used for sanitary sewer design. When required, the information shall be included on the Plans or submitted in memorandum form to the District. The following may be required:

- Potential size of drainage basin
- Number of potential EDUs

Sanitary Sewer Extension Submittal

The Public Sanitary Sewer Extension submittal shall include all required information along with any other information requested by the District. The required information includes, but is not limited to the following:

- Two sets of complete civil construction Plans.
- Sanitary Sewer Engineering Agreement (form can be found online).
- Construction and Engineering Cost Estimate (form can be found online).
- Sanitary Plan review fees.

All submittals will be reviewed for completeness and the Developer's Engineer will be notified if required information is missing. Upon acceptance of a complete submittal, subsequent project review and approval steps shall be undertaken.

Partition/Subdivision Plat Review and Approval

The Applicant shall submit a preliminary plat to the local planning authority, who will coordinate plat review with the District. The District will only perform an official review of plats received from the local planning authority. The District will review the plat in accordance with the approved Sanitary Plans and Stormwater Management Plans and return comments to the local planning authority. Prior to final plat approval by the District, the Developer shall address the following:

- All associated agreements and easements shall be reviewed and approved by the District. The District will deliver the signed documents to the County Surveyor's Office at the time of plat approval.

- Sanitary and Stormwater Improvements shall be:
  - Fully constructed in accordance with the approved plans, or
  - The Applicant shall obtain a performance surety for all proposed sanitary and stormwater improvements on the approved plan. If the construction work is partially completed, the surety will be based on a status report submitted by the Developer's Engineer.
- Public easement documents shall include a site plan and specify the entitlements within the boundary of the easement.
- Deferred Improvements – In some situations, the responsibility to construct improvements may be deferred to the future Owner of a specific lot. Deferrals are at the discretion of the District and will be reviewed on a case-by-case basis. All deferred improvement(s) shall be fully constructed and completed in accordance with the Rules and applicable Standards, prior to any future occupancy permit approvals by the District. All responsibilities of the future Owner to construct the deferred improvements shall be stipulated in a separate document recorded as a covenant with the plat.
  - Subdivision Plats – Any deferred improvements must be part of a District-approved subdivision improvement plan.
  - Partition Plats – Eligible improvements are limited to Service Connections, Conveyance System, pervious surfaces, and stormwater facilities that either benefit one lot, or are shared facilities. In the case of shared facilities, the deferred improvements will be the responsibility of the first future lot Owner to submit a building permit application.
  - Other related agreements and documents (i.e., Homeowner's Association covenants, conditions and restrictions; maintenance agreements, etc.)

Plan Submittals

This section contains specific information and drawing specifications for submittals made to the District. This section is intended to standardize the submittals and clearly outline the minimum requirements. The requirement for a complete submittal package is intended to reduce the overall plan approval processing time. Plans will not be reviewed until a complete plan has been submitted. A complete plan shall include at a minimum all requirements listed in this section.

a. Specific Sheet Submittal Requirements and Specifications

The following sheets are required as part of a complete plan submittal:

- Title Sheet
- Composite Utility Plan
- Composite Stormwater Management Plan Cover Sheet
- Stormwater and Sanitary Sewer Plans and Profiles
- Grading Plan
- EPSC Plan
- Vegetated Buffer Planting Plan
- Stormwater Management Facility Planting Plan
- Standard and Non-Standard Drawings/Detail Sheets

- Standard and Non-Standard Construction Notes
- All applicable Standard Drawings shall be included on a separate sheet in a clear and legible size.

b. Title Sheet

As a minimum the following information shall be found on the title sheet:

- Index of Sheets.
- Complete legend of symbols used.
- Vicinity Map to a scale of not less than 1 inch = 800 feet showing the project location.
- Site Plan of the entire project showing street ROW and/or subdivision layout.
- Temporary and permanent benchmarks including their descriptions. Total acreage including streets directly served.

c. Composite Utility Plan

The Composite Utility plan shall be scaled to show the entire site on one sheet unless otherwise approved by the District and shall show:

- All proposed sanitary and storm improvements
- All other proposed improvements
- All existing utilities and utilities adjacent to and within 100 feet of the project
- Existing natural or artificial drainage features
- Tract names and numbers
- Property lines with tax lot numbers and addresses
- Street names at a minimum shall be shown

d. Composite Plan Cover Sheet (separate sanitary and storm)

The following information shall be included on the Composite Plan cover sheet:

- The scale shall be scale-appropriate to fit the entire site on one sheet, unless otherwise approved by the District
- Show the appropriate contour lines to demonstrate the overall site topography. Generally, these are 1-, 2-, 5-, or 10-foot contour lines. The topography must extend a minimum of 50 to 100 feet beyond the proposed limits of development
- Show the entire system
- Show the SMFs
- Shade all other utilities not related to sanitary sewer or stormwater drainage systems.
- Show drainageway(s) as existing and/or proposed.
- Show emergency overflow pathway(s) to an acceptable point of discharge.
- Show existing and/or proposed storm drainage and conservation easements.
- Show vegetated buffers and associated sensitive areas.
- Show all site and roadway improvements.

- Show the subdivision, phase lines or plat boundaries.

e. Plan and Profile Views

Plan and profile views shall include the following information:

Plan View

Plan views shall contain as a minimum the following information:

- The scale shall be 1 inch = 50 feet horizontal. Alternative scales may be approved by the District on a case-by-case basis. The scale shall be shown for each plan and profile view.
- Entire sanitary and storm sewers clearly shown and labeled.
- Plan views showing north predominantly to the top or left of each sheet.
- Plan views showing accurate 1- or 2-foot contour lines and extending a minimum of 50 feet to 100 feet beyond the limits of the development. Alternative contour spacing may be approved by the District on a case-by-case basis.
- All proposed extensions of the Conveyance Systems showing mainlines, manholes and Service Connections.
- Manholes identified and stationed to facilitate comparison of the plan view and the profile view.
- Manhole callouts in District format.
- District stationing formats for new lines and manholes.
- Size and type of pipe, backfill material, and location.
- Sanitary/Storm Service Connection tees off the mainline. For each lot being served, show the mainline stationing, pipe size, length, and depth of lateral at end of pipe.
- Public ROW, property, and easement lines.
- Location of water courses, stream and railroad crossings, culverts and storm drains that cross the alignment.
- Subdivision names, roadway names and lot/parcel numbers or tax lot numbers.
- Existing and proposed Sensitive Areas and the required Vegetated Buffer.
- Existing utilities, all manholes, water mains, services, gas mains, underground power, and other utilities and structures, including hydrants, pedestals, signs, mailboxes, light poles, wells, water mains, valves, pumps stations, and blowoff structures, manholes, valves, meter boxes, power poles, handicap ramps, striping, and trees.
- Existing and proposed edge of pavement on both sides of the street, including shoulders, curb, sidewalk, ditch line, culverts, and driveways.
- Plan view including the above items for a minimum distance of 50 feet to a maximum of 500 feet may be required beyond the proposed improvement in order to prevent future improvement conflicts.
- Location and dimensions of all SMFs, including the following:
    - Setbacks from property lines and structures,
    - Facility wall material, if required, and geotextile/waterproofing membrane specifications,

  - Growing medium specifications,
  - Drain rock and filter fabric specifications,
  - All stormwater piping associated with each facility including pipe materials, sizes, slopes, IEs at bends and connections,
  - Ground elevations at catchment locations, channel inverts, top and toe of slope surrounding detention/retention areas,
  - Ground slopes of channel inverts and sides, parking lots, bottoms and sides of facilities and adjacent surroundings,
  - Invert and top or bottom elevations (if applicable) of pipes, catch basins, overflows, manholes or other similar structures.
  - Location of construction fencing used to protect proposed SMFs from compaction and other construction disturbance.
- Location of all drainageways and the 100-year flood plain.
- Show the location and direction of any surface stormwater conveyance path(s).
- Location and detail of all existing facilities on which work is to be performed, i.e., installation, repair, or removal.
- Location and description of all known existing property monuments, including, but not limited to, section corners, quarter corners, donation land claim corners and any other county control monuments.
- Street stationing may be shown on the construction plans, but later removed on the final as-built plans.
- Roof drain connection points shall be shown using the ® symbol.
- Sanitary and storm structures should be easily visible and shown drawn at least 2x the size of the line width and in proportion to the line weight.

Profile View

Profile views shall contain as a minimum the following information:

- Plan and profiles on each sheet shall match and line up on at least one edge of the drawing (i.e., profile to show pipe in same direction as the plan view and lined up plan view over profile).
- The scale shall be 1 inch = 50 feet horizontal and 1 inch = 10 feet vertical. Alternative scales may be approved by the District on a case-by-case basis. The scale shall be shown for each plan and profile view.
- Location of existing and proposed manholes and other appurtenances with each manhole numbered and stationed. Manhole numbers to be provided by District, if applicable. Manhole callouts shall be in the District format. The benchmark used as a basis for vertical control in the design shall be referenced on the plans.
- The location and elevation of an approved benchmark shall be shown on the plans or, if not within the proposed area of work, shall be referenced by number and location. Elevations shall be based on the NGVD88 datum if the project is within ½-mile of a County benchmark. A conversion factor to relate the existing connection point elevations to the plan elevations and benchmark.

- Grid lines using the horizontal and vertical scale.
- Existing and proposed ground and/or pavement surface with elevations noted at critical points.
- Sanitary/Storm lines shall be labeled with the name of the mainline centered under the profile view in large bold letters.
- Sanitary/Storm lines shall be labeled with the pipe size, material, slope (as a %), length and type of backfill between manholes.
- Nonstandard manholes must be labeled with the type (i.e., tamperproof, drop, flat top, etc.).
- Railroad, culvert, ditch, or stream crossings with elevations of the ditch or streambed and casing details.
- All existing and proposed storm, water, and any other crossing utility lines greater than 6 inches in diameter.
- Non-standard SMFs and appurtenances shall show a typical cross-section with dimensions.

f. Grading Plan

Projects requiring grading and/or fill activities will require the submittal and approval of grading plans prior to the beginning of such operations. The District will review the grading plan in the context of the overall Stormwater Management Plan. Generally, an additional grading permit and/or approval are required by the local authority or State agency governing such activities. It is the responsibility of the Applicant to obtain all necessary permits and approvals prior to beginning any grading activity.

Grading plan views shall contain as a minimum the following information:

- Total land area and proposed Disturbed Area,
- Existing topography and impervious area,
- Proposed topography and impervious area,
- 1-, 2-, or 10-foot contour intervals (as applicable),
- Elevations of all existing and proposed streets, alleys, utilities, sanitary and stormwater sewers, and existing buildings and structures,
- Natural or artificial drainageways,
- Limits of flood plains (as applicable),
- Existing and proposed slopes, terraces, or retaining walls,
- All existing and proposed SMFs, drainage structures and/or features, and devices used to protect these areas during construction,
- All stormwater structures/features on-site, upstream, and downstream of the site,
- EPSC Plan (as applicable),
- Drainage calculations when required,
- Drainage easements when required,
- Geotechnical report (if applicable),

- Any other supporting documentation necessary to evaluate the existing and/or proposed site conditions for stormwater management.

g. Erosion Prevention and Sedimentation Control Plan

The general process and requirements for EPSC Plans is outlined in the Stormwater Standards. For specific details on erosion control BMP measures and applications see the **Erosion Prevention and Sediment Control Planning and Design Manual** adopted by the District. A link to this manual can be found on the District website.

If a 1200-C or 1200-CN Permit is required, the EPSC Plan shall meet the requirements of the 1200-C Program, in addition to the following list:

- The total acreage of the site and the total acreage of the proposed Disturbed Area.
- Adjacent offsite drainage patterns indicated by arrows.
- Contours at 2-foot intervals. Where slopes exceed 15 percent, contours may be shown at 5-foot intervals.
- North arrow.
- Existing and proposed structures for the project site.
- Existing and proposed access location for the project site.
- Existing project boundaries, rights-of-way, easements, and jurisdictional boundaries clearly identified by note, symbol, or key.
- Adjacent streets with street names and ROW boundaries.
- Capacity and condition of existing drainage facilities, including roadside or other drainage ditches, that transport surface water onto, across, or from the project site.
- Existing Sensitive Areas, vegetated corridors, and water quality and quantity facilities. For natural drainage features, show direction of flow, drainage hazard areas, and the 100-year floodplain.
- Clearing and grubbing limits.
- Proposed ground contours.
- For multi-phase projects, phasing of any EPSC work clearly indicated on the plan.
- Details of proposed EPSC BMPs.
- EPSC Plan to include a key signifying BMP measure used and placement on EPSC Plan.
- When sedimentation ponds are proposed, at least one cross section detail shall be shown.
- Vegetation/permanent site stabilization measures.
- If submitted independently of the full project plans, a cover sheet with the proposed name of the development, the name and address of the Applicant and Developer, the name and address of the Developer's Engineer, and the land use case file number from the local planning authority.

h. Vegetated Buffer Planting Plan

If restoration of a Water Quality Resource Area or vegetated buffer is required in the **Stormwater Standards**, a plan addressing the requirements shall be submitted.

The construction plans and specifications shall include:

- Water Quality Resource Area and required vegetated buffer boundaries.
- The limits of any approved, temporary construction encroachment.
- Orange construction fencing noted at vegetated buffers as well as at encroachment limits during construction.
- Permanent type fencing and signage at the development and the vegetated buffer boundary noted and details shown.
- Conservation easement documents prepared and easement area shown on the plan.
- Site preparation plan and specifications, including limits of clearing, existing plants, and trees to be preserved, and methods for removal and control of invasive, non-native species, and location and depth of topsoil and or compost to be added to re-vegetation area.

Planting plans and specifications shall include the following information:

- Planting table that documents the common name, scientific name, distribution (planting zone, spacing, and quantity), condition and size of plantings, and installation methods for plant materials listed.
- Mulching rates.
- Plant tagging for identification noted.
- Plant protection methods.
- Seeding mix, methods, rates, and areas delineated.
- Irrigation plan and specifications, including identification of water source, watering timing and frequency, and maintenance of the system.
- Maintenance schedule, including responsible party and contact information; dates of inspection (minimum three per growing season and one prior to onset of growing season); and estimated maintenance schedule (as necessary) over the two-year monitoring period.
- “Good” rated corridor notes (i.e., invasive species removal shall be replanted with native vegetation).
- Access points for installation and maintenance, including vehicle access if available.
- Standard drawing details (north arrow, scale bar, property boundaries, project name, drawing date, Developer’s Engineer and Owner).

i. **Stormwater Management Facility Planting Plan**

The Stormwater Management Facility Planting Plan shall include planting information for each SMF based on requirements of the **Stormwater Standards**.

Planting plan specifications and plans must address all elements that ensure plant survival and overall SMF functional success. At a minimum, landscape specifications and plans must include:

- A planting plan that indicates existing vegetation to be preserved; protective construction fencing; the location of all landscape elements; and the size, species, and location of all proposed plantings. The plant species should be selected and placed in accordance with proper delineation and location of moisture zones where appropriate.

- A plant list or table that includes botanic and common names; size at time of planting; quantity; spacing; type of container; evergreen or deciduous; and other information related to the facility-specific planting in accordance with landscape industry standards. Also include the square footage of each plant zone and the numbers and types of each plant required and provided in each zone.
- A soil analysis for the SMF growing medium (required for all public facilities and may be required for private facilities. A soil analysis is not required for single-family residential sites). The source of the growing medium must be provided. The location of all stockpiles must be indicated on plans, and erosion protection measures included on the EPSC Plan.
- The method of temporary irrigation to be used for the plant establishment period.
- Stormwater Management Facility Planting Plan shall also include all areas requiring protective construction fencing to shield the area from construction traffic and compaction.

j. Landscape Plan

Landscape plans for publicly maintained SMFs shall be prepared, stamped with the seal of, and signed by, a Landscape Architect, registered in the State of Oregon. Plans for privately maintained SMFs do not require the involvement of a Landscape Architect. Landscape Plans shall include the following a detailed landscape plan, at a scale of 1 inch equals 20 feet shall be provided for each landscaped SMF. This plan may be combined with the grading plan. The landscape plan shall include the following:

- Existing vegetation to be preserved and protective construction fencing.
- Areas of SMFs to be designated with construction fencing to protect from construction traffic and compaction.
- Final ground contours at a minimum of a 2-foot contour interval.
- Location of top and toe of slope.
- Limits of embankment designed to impound water.
- Location of all drainage structures as well as any other piped utilities in the vicinity.
- Limits of areas to receive amended topsoil and growing medium.
- A plant list or table, including botanic and common names, size at time of planting, quantity, spacing, type of container, evergreen or deciduous, and other information related to the facility-specific planting, in accordance with landscape industry standards.
- Location of stockpiles (erosion protection measures must be shown on the EPSC Plan).
- Method of temporary irrigation to be used for the establishment period.
- Location of maintenance access, as applicable.

k. Standard Drawings/Detail Sheets

The construction plans shall include a sheet containing all the standard details applicable to a specific project.

The purpose of the District Standard Drawings and Details is to provide basic information as a convenience to those who use them in their designs. These drawings and details are also intended to communicate design standards and practices to the Developer’s Engineer.

Detailed drawings shall be included with all construction plans where Standard Drawings do not apply. If a standard drawing, such as a manhole, must be modified to fit existing, or unique conditions, the modified detailed drawing shall be shown on the plan and profile sheet. When appropriate, due to required detail complexity, a separate detail sheet shall be used.

Standard Drawings are available for use on development projects and cannot be modified by designers on a project-by-project basis. It is the responsibility of the Developer's Engineer to incorporate these drawings as originally intended.

Non-standard detail drawings shall be the responsibility of the Developer's Engineer to demonstrate that site conditions require a non-typical device or structure and submit the specifications and supporting documentation to the District for approval. All non-standard details shall be shown on the Stormwater Management Plan.

Stormwater Management Facility Detail sheets are included in the **Stormwater Standards**. A link to additional Standard Details can be found on the District website.

l. General Sanitary/Stormwater Construction Notes

General construction notes required on the plans can be found on the District website or provided upon request. These general construction notes shall be included on the sanitary and Stormwater Management Plans. These notes are required, and the design professional may include other applicable notes they deem necessary.

m. General Sheet Submittal Specifications and As-built Requirements

The following subsections outline general submittal specifications for sheet size, scales, north arrow, text, labeling callout, and title block specification requirements.

Sheet Dimension Requirements

Construction plans shall be clear and legible and submitted on blue-line paper 22 by 34 inches or 24 by 36 inches in size with a 1½-inch clear margin on the left edge and ½-inch margins on all other edges.

Title Block

Located on the bottom edge or at the right side of the drawing, showing the project name, drawing name/type, completed modification date table, the submittal date, drawing number, Developer's Engineer's name, address and official stamp, the Developer/Owner's name and address and where applicable, the name of the plat of subdivision and/or name of development.

Drawing Scale Requirements

The following general layout guideline shall be used:

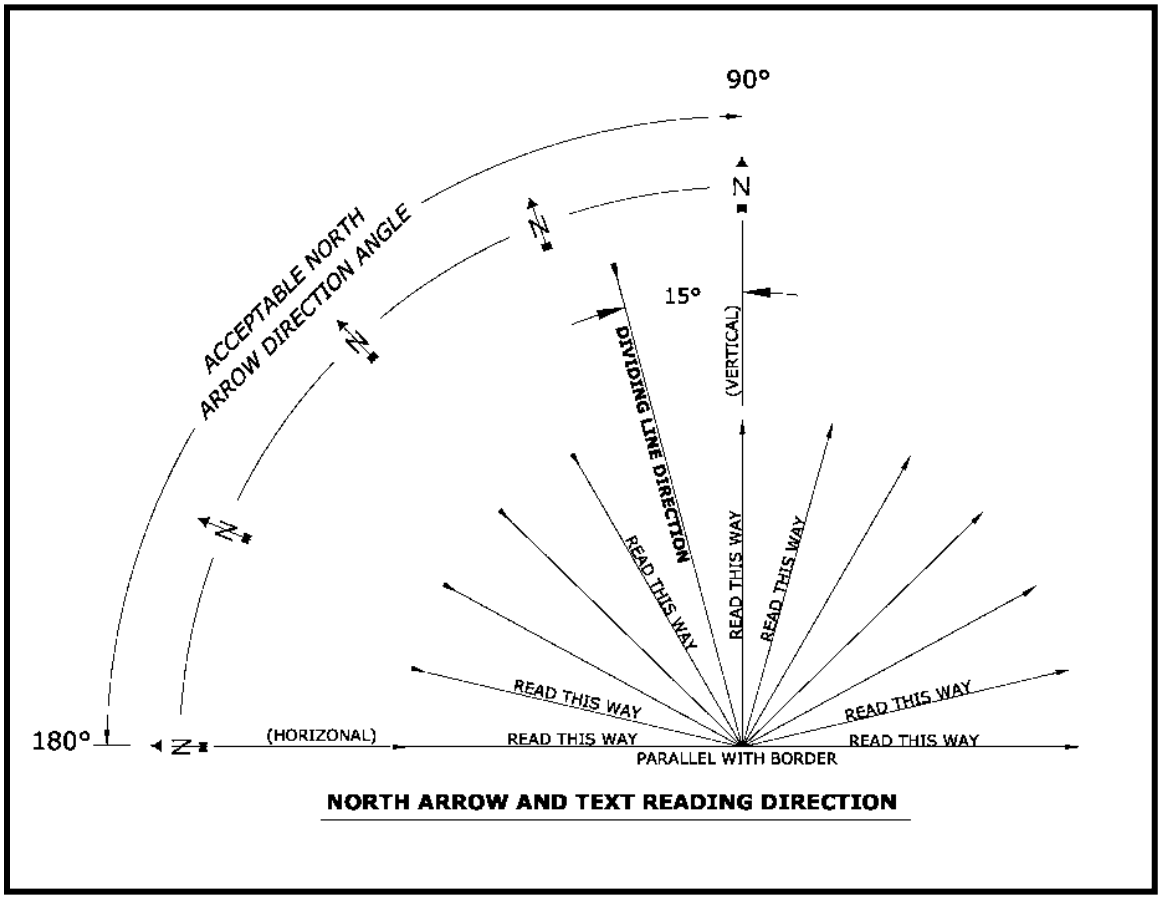
- Plan and Profile sheets shall be 1 inch = 50 feet horizontal and 1 inch = 10 feet vertical. The District may approve alternative scales on a case-by-case basis.
- Each sheet shall include a bar scale with text.

North Arrow Requirements

Each sheet shall include a north arrow. Each separate view on each sheet shall have its own north arrow. The north arrow in each view should face the top (VERTICAL) on the sheet if possible. It is acceptable to align the north arrow off vertical if the project does not fit vertically facing north; it can be rotated counterclockwise as much as 90 degrees.

For acceptable north arrow angle directions see **Figure 5**.

Figure 5. North Arrow and Text Reading



Lettering/Text Requirements

- Text Rotation
  - Text should be readable from either the bottom or right edge of the sheet. For acceptable text reading direction, see **Figure 5**.
- Lettering Size and Style
  - Lettering Size
    - The minimum lettering size shall be eight-hundredths (0.08) of an inch high for existing items and a minimum lettering size shall be ten-hundredths (0.10) of an inch high for new items. Items shall be legible and reproducible.
  - Lettering Style

- Standard text styles should be used. All lettering should be upper case.

Labeling Requirements

- Sanitary and storm structures, proposed and existing, shall be labeled on each sheet.
- All street names are to be labeled in each model space window.
- All tax lots and easements within the development and surrounding area pertaining to the project shall be clearly labeled.
- Non-standard storm structures (e.g., Flat Top Manhole) shall be labeled with the unique structure type after the structure name.

Plan and Profile Views-Structure and Pipe Callouts

Plan View Leader Line Requirements (see **Figure 6** and

Figure 7)

- Leader lines must angle off horizontal and vertical planes from the center point of the structure in plan view. Horizontal and vertical leader lines are acceptable in profile view.
- Leader lines should have an arrow.
- The leader line arrow should touch the edge of the symbol and point to the center of the structure.

Figure 6. Accepted Leader Practice

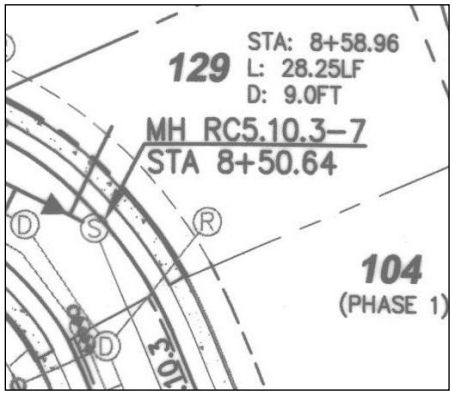
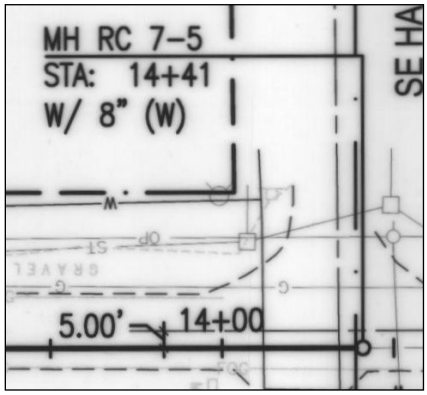


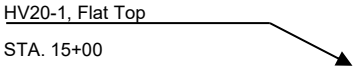
Figure 7. Not Accepted Leader Practice



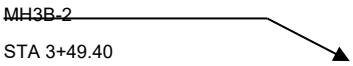
General Sanitary/Storm Structure Callouts in Plan and Profile Views

Street stationing and other related information is allowed on the construction plans; however, this must be removed on the accepted as-built plans.

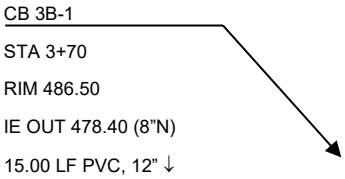
Plan View–Non-Typical Manhole Callout:



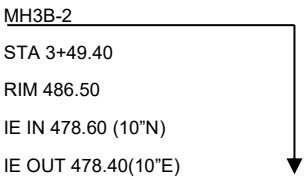
Plan View–Manhole Callout:



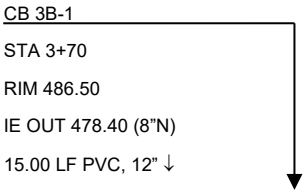
Plan View–Catch Basin and Other Structures:



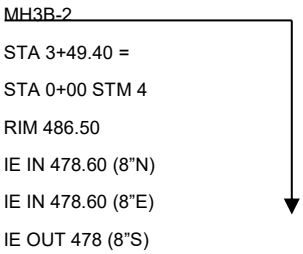
Profile View–Manhole Callout:



Profile View–Catch Basin and Other Structures:



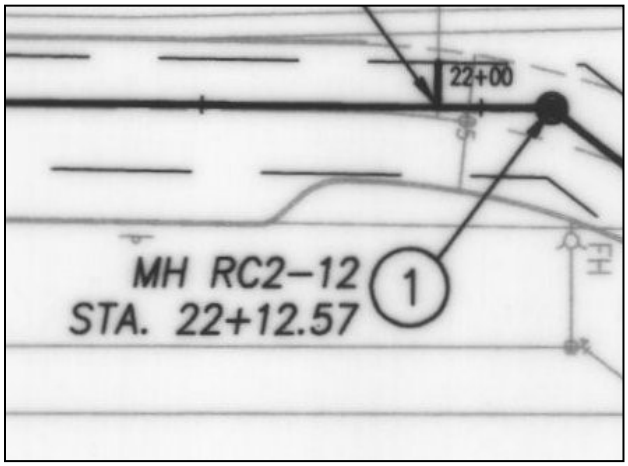
Profile View–Manhole Callout with Multi IE IN:



Reference Balloons

In general, note reference balloons are not allowed. The District will determine the type and format of all callouts on the final as-built drawings if notes are included. If reference balloons are used on construction drawings then the structure name callout must precede the number as shown below in **Figure 8**.

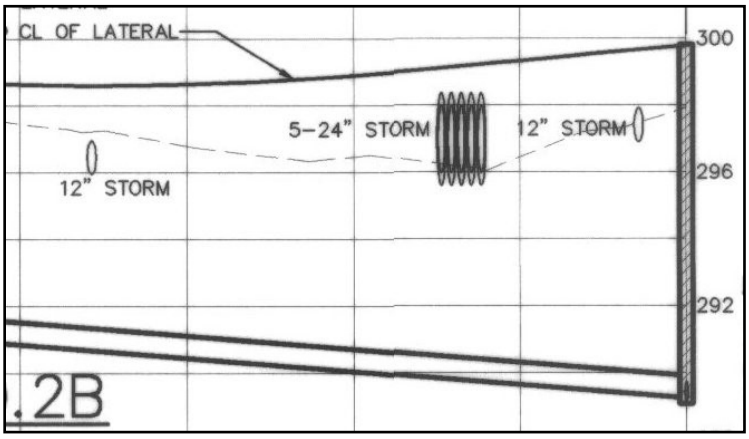
Figure 8. Reference Balloon



Utility Crossings

Show and label all storm, sanitary, waterline, gas and all other utilities that are 6 inches or larger that cross the pipeline alignment in the profile view. Utility invert and crown elevations may be required if they are in close proximity to a proposed storm line. See **Figure 9**.

Figure 9. Utility Profile



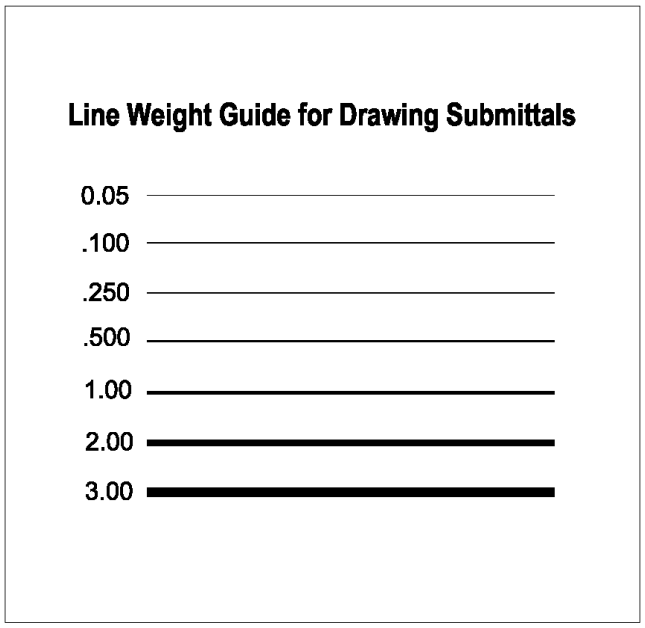
n. Plan and Profile View Sheet Specifications

Plan and Profile Views shall contain the following information:

- Follow the Line Weight Guide for Drawing Submittals, **Figure 10**
- Screening layers during plotting will not be permitted for any line types on plots except for widely spaced hatching. Screening lines are not allowed on as-built record drawings.

- The primary structures and pipes (storm) shall appear **BOLD** and stand out against all other background features in both the plan and profile views, i.e., only the applicable conveyance lines and appurtenances should appear bold on submittals.

Figure 10. Line Weight Guide



Plotted Line Widths:

Lines shall be plotted in millimeters and widths and plotted at 1 inch = 50 feet in model space and 1:1 in paper space. The line widths should be plotted the thickness of the lines as illustrated in Figure 10.

Screening of line weights is prohibited for illustration of line weights. Solid gray lines may be used in place of screening lines.

Plan View:

The plan and profile showing the proposed mainline extensions and Service Connections shall have a line weight of 3.00 millimeter (mm) (black). The sanitary or storm in the background shall have a width of 1.00 mm.

Existing contour lines in the plan view may be drawn as a dashed or solid line type; black or gray; between 0.250-0.500 mm in weight.

Profile View:

Profile view of the proposed system mainline shall be drawn at a line weight of 2.00 mm. Other utilities shown in the background shall be drawn at a line weight of 0.500 mm in either black or gray.

Existing sanitary/storm lines shall be shown in the profile view as a dashed black or a gray line in a line weight of 1.00 mm.

Other associated line specifications for plan and profile views:

Profile view gridlines:

- Primary – 0.250 mm/black
- Secondary – 0.050 mm/black
- Tax lots, parcels, property, and easement lines – 1.00 mm/black
- Roadway improvements – 0.500 mm/black
- All other utilities – 0.250 mm/black or gray
- Subdivision or plat boundary – 2.00 mm/black or gray

As-Built Submittal Requirements

The District requires the sanitary and storm plans shall be as-built prior to the acceptance of the project. As-built drawings are necessary to assure the project was constructed per the approved plans and/or meet the requirements of these Standards. The Developer's Engineer of record is responsible for record keeping, inspection, and preparation of the as-built drawings. Final as-built drawings will be submitted in the following manner, paper(s), CAD files and PDF files.

a) Survey requirements

The following Public Sanitary System structures shall be surveyed, and the as-built elevation and location shall be noted on the final as-built drawings:

i. I.E. ins, outs and rim elevations of the:

- Point of connection, existing downstream manholes, and structures,
- Dead end manholes, cleanouts, and structures,
- Any manhole or structure that may be extended in the future,
- Any substantial change in the approved plans that deviate more than 0.250-feet in elevation or alignment.
    - A table listing the Service Connections for each building lot noting the mainline stationing, the measurement in linear feet of the location of the Service Connection from the center of the upstream and downstream manholes, pipe size, pipe length, and pipe depth at the property line crossing.
    - Show alignment changes, slope changes, IE changes, pipe size changes and changes in construction materials.
    - Measured depth from existing ground surface of all storm, sanitary, waterline and utilities that cross the pipeline alignment in profile.
    - Type of pipe, backfill material and location.

b) Paper As-built Drawing Requirements

As-built drawings shall contain, at a minimum, the following information:

- For all publicly maintained systems and all public and private detention and SMFs, the Developer's Engineer shall submit certified as-built plans and profile drawings.
- Each page shall be stamped by the Developer's Engineer and stated in writing that it is an as-built drawing.

- Show final pipe alignment, slope, pipe size, and pipe material type in the appropriate view.
- Indicate areas of rock removal not completed by standard backhoe, i.e., splitter or blasting.
- As-built drawings and electronic drawings shall become the unencumbered property of the District and are public records that may be distributed as the District deems necessary.
- Two (2) sets of full sized “Draft” as-built drawings on blue-line shall be submitted to the District for review and redline mark-up prior to final paper, electronic file format submittal, and PDF files.
- The final as-built drawings shall be black-line drawings on paper. High quality plotting preferences must be used so the paper, when photocopied and/or scanned, is capable of being reproduced with all details legible at an archival quality.
- On the applicable Plan View sheet show a table listing the following information for each sanitary and/or storm Service Connection; mainline stationing, measurement in linear feet of the location of the Service Connection from the center of the upstream and downstream manholes, pipe size, pipe length, and pipe depth of the service lateral at the property line.
- Street stationing and information not related to the storm system construction is not allowed on the as-built plans; however, this information is acceptable on the construction plans.
- Remove all hatching associated with material type.
- The subdivision name shown in the title block shall match the name shown on the plat.

c) CAD Requirements for As-Built Drawings

General Requirements:

- AutoCAD electronic files must be compatible with the AutoCAD version the District is currently running.
- Standard fonts, shapes and line types are required.
- All drawings are to be plotted in paper space at a scale of 1:1.
- For specific line weight requirements see **Figure 10**.
- Show the project boundary in **BOLD** type.
- All manholes, catch basins, fire hydrants, valves, meters, etc. are to be inserted as blocks. All blocks are to be created on layer 0.
- Not allowed are blocked x-refs and preferences or permissions set, so that the District cannot access each layer individually.
- All drawings are to be seamless and drawn in model space.
- Drawings are NOT to be rotated off of world coordinate bases.
- Drawings are to be delivered purged of all unused layers, blocks, line types, and styles.
- The drawing files saved to disk shall be ready to plot when opened and be the same dated file used to plot the paper as-built.
- SoftDesk point files are not requested and should not be transmitted. Combination files are acceptable.
- The final as-built drawing files are to be saved under one file folder. All drawings, x-refs, plot files, images, text, and shape files are to be in this one file folder.

- Only pertinent files are to be submitted in this project folder. NO revisions, SoftDesk files, log times, or miscellaneous DWGs are to be submitted.
- Before approval will be given, the digital file and hard copy will be evaluated to verify that they are the identical drawings and to make sure all required and only necessary files are included.
- The electronic as-built drawings shall be submitted along with a completed "As-built Release of Liability Form" and all contents shall become the property of the District.
- Provide the CAD as-built project drawings in digital data and saved to compact disk or flash drive for transmittal to the District.
- Use of a self-extracting PKZIP file format is acceptable. Use of compressed file(s) is allowed only if the decompression program is included.

Disks Labeling Requirements:

- Title of project
- The District (WES Log#) project file number
- Specify contents of the disk (DWGs)
- Name of the Developer's engineering firm submitting the files
- The project completion date.

d) PDF File Requirements for As-Built Drawings

AutoCAD electronic files must be compatible with AutoCAD version the District is currently running.

As-built drawings and electronic drawings shall become the unencumbered property of the District and are public records that may be distributed as the District deems necessary.

The PDF files shall represent an exact copy of the paper as-built drawings.

General Conditions for Performance And Warranty Surety

The District may require the Applicant to submit a surety, cashier's check, or irrevocable letter of credit from an acceptable financial institution to guarantee performance or warranty in completion of the improvements required by these standards. Upon default, the District may draw upon the surety or available funds to complete the remaining work or remedy violations. The different types of acceptable surety are listed below.

a) Surety – Types of Acceptable Guarantees

Surety shall be provided only through State regulated surety companies while assignment or commitment of savings or loan proceeds shall be through State regulated financial institutions. Cash Acknowledgment is a cash surety held directly by the District.

b) Surety Forms

All sureties shall be submitted with forms provided by the District or other authority having jurisdiction to permit or regulate the activity. All sureties are subject to review and approval by the District's legal department.

c) Performance Surety

The Applicant shall provide a Performance Surety acceptable to the District prior to recording of the plat for residential developments or the issuance of building permits for commercial or industrial developments, if the required public improvements are not completed and/or accepted by the District.

The following conditions shall be met prior to acceptance of the Performance Surety:

- The Performance Surety shall be in the amount of 125 percent of the Developer's Engineer's cost estimate for all approved but uncompleted sanitary and stormwater improvements, including landscaping requirements. The Developer's Engineer's cost estimate for the required improvements will be approved by the District.
- Nothing herein shall limit the Owner's responsibility for repair and maintenance to the amount of the surety.

The following conditions shall be met prior to release of the Performance Surety:

- All improvements must be completed as shown on the approved plans and accepted by the District in accordance with the Rules, Regulations, and Standards.
- A warranty surety shall be provided to the District prior to release of the Performance Surety.

If the Applicant fails to comply with the conditions of approval and the approved plans, the District may call upon the Performance Surety to complete the improvements according to the approved plans.

At the end of the surety period when all conditions are satisfied, the residual surety amount shall be released.

d) Warranty Surety

In general, the Warranty Surety is posted by the surety principal to the District to ensure the principal will maintain, repair, replace and be responsible for damage to the improvements for a period of 2 years following the date the District deems the improvements complete and a letter of completion and/or acceptance is issued.

The following conditions shall be met prior to acceptance of the Warranty Surety:

- The Warranty Surety shall be in the amount of 25 percent of the actual constructed cost for all constructed sanitary, stormwater, and vegetated buffer vegetated buffers are covered in the warranty bond improvements. The Developer's Engineer's cost data sheet will be approved by the District.
- The Warranty Surety shall be in favor of the District and be issued for a minimum two-year period from the date of completion of the sanitary or storm system.
- Nothing herein shall limit the Owner's responsibility for repair and maintenance to the amount of the surety.
- Upon notification from the District, the principal shall, within 30 days complete corrective measures to the satisfaction of the District.
- The District may perform emergency work without notice to the principal or surety.
- All work performed by the District due to the nonperformance of the principal or in response to an emergency shall be reimbursed to the District within 30 days of invoice.

- If the principal fails to reimburse the District in 30 days, the District may demand payment from the Surety.
- The warranty period may be extended, if the required improvements show any signs of failure during a final warranty release inspection.

The following conditions shall be met prior to release of the Warranty Surety:

- The Owner or Developer shall perform a thorough cleaning of all sanitary and stormwater improvements.
- The District shall make a determination of final completion in conformance with the approved plans, specifications, and District standards as well as conduct a final warranty surety inspection of all sanitary and stormwater improvements, including landscaping in any SMF and vegetated buffer. If more than 20 percent of the total area within a SMF or Vegetated Buffer is not in compliance with the approved plans, then the vegetated plantings will be replanted and/or repaired to meet the requirements of the approved plans. If replanting of the SMF or Vegetated Buffer is required, then an additional 1-year warranty surety in the amount of 25% of the cost of replanting all of the effected vegetated planting areas shall be required. The additional 1-year warranty surety will be renewed annually until the vegetated plantings are acceptable to the District.
- Any deficiencies resulting in non-acceptance of the work permitted shall be identified in writing on a final punch list and presented to the Developer's Engineer and/or Permittee with a date named for correction and completion. Upon correction of the noted deficiencies and the determination that all work is in conformance with District Standards, the work will be deemed complete and all sureties shall be released.

2. Infiltration Testing Requirements

To properly size and locate SMFs, it is necessary to characterize the soil infiltration conditions at the location of the proposed facility. All projects that require a SMF shall evaluate existing site conditions and determine if the site's infiltration rate is adequate to support the proposed SMF. The following sections provide the approved methods for testing infiltration and setting the design infiltration rate. District staff may require additional testing on a case-by-case basis.

Basic Method – Open Pit Test

The Basic Method – Open Pit Test (Basic Method) is applicable only to projects on private property with less than 10,000 sf of new or redeveloped impervious area. The results of infiltration testing shall be documented on the Basic Method Form. The Basic Method cannot be used for projects that have known downstream conveyance problems.

The intent of the Basic Method is to determine whether or not the local infiltration rate is adequate (0.5-inches/hour) to support a SMF that infiltrates. It is recommended but not required that the Basic Method infiltration test is conducted by a licensed professional.

1. Conduct one test for each proposed SMF. The test should be where the facility is proposed or within the direct vicinity.

2. Excavate a test hole to the depth of the bottom of the infiltration system, or otherwise to 4 feet. The test hole can be excavated with small excavation equipment or by hand using a shovel, auger, or posthole digger.

3. If a layer hard enough to prevent further excavation is encountered, or if noticeable moisture/water is encountered in the soil, stop, measure, and record this depth from the surface. Proceed with the test at this depth.

4. Fill the hole with water to a height of about 6 inches from the bottom of the hole (or to one-half the maximum depth of the proposed facility) and record the exact time. Check the water level at regular intervals (every 1 minute for fast-draining soils to every 10 minutes for slower-draining soils) for a minimum of 1 hour or until all of the water has infiltrated. Record the distance the water has dropped from the top edge of the hole.

5. Repeat this process two more times, for a total of three rounds of testing. These tests should be performed as close together as possible to portray the soil's ability to infiltrate at different levels of saturation accurately. The third test provides the best measure of the saturated infiltration rate.

6. For each test pit required, submit all three testing results with the date, duration, drop in water height, and conversion into inches per hour.

If the results of the Basic Method show an infiltration rate greater than 0.5-inches per hour, the Applicant can proceed with SMF design that uses infiltration. If the Applicant would like to use an infiltration rate for design purposes, a Professional Method Infiltration Test shall be conducted.

Professional Method

The Professional Method shall be used for all public and private developments with more than 10,000 sf of new or redeveloped impervious area. The Professional Method may be required by the District a public and private development of any size with known downstream conveyance problems. The qualified professional shall exercise judgment in the selection of the infiltration test method.

Testing Criteria

Testing shall be conducted or observed by a qualified professional. This professional shall be a PE, Registered Geologist, or Certified Engineering Geologist licensed in the State of Oregon.

The location and depth of the test shall correspond to the facility location and depth.

Infiltration testing should not be conducted in engineered or undocumented fill.

Boring logs shall be provided as supporting information with infiltration and depth to groundwater tests.

All testing data shall be documented in the project submittals. The submittals shall demonstrate that the proposed facilities are sized appropriately for the tested infiltration rates.

Depth and Location of Required Tests

Infiltration tests shall be performed at the base of the proposed facility.

If a confining layer, or soil with a greater percentage of fines, is observed during the subsurface investigation to be within 4 feet of the bottom of the planned infiltration system, the testing shall be conducted within that confining layer.

Tests shall be performed in the immediate vicinity of the proposed facility. Exceptions can be made to the test location provided the qualified professional can support that the strata are consistent from the proposed facility to the test location.

For relatively deep stormwater facilities, a hollow stem auger with an electronic measuring tape can be used, provided there is an adequate seal between the auger and the native soil.

Factors of Safety

Table 18 lists the recommended factors of safety to be applied to field-obtained infiltration rates for use in stormwater system design. To obtain the infiltration rate used in design, divide the infiltration rate measured in the field by the factor of safety. The factor of safety used in design should be chosen by collaboration between the geotechnical engineer or geologist overseeing the infiltration testing and the civil engineer designing the stormwater management system.

Determination of the factor of safety shall include consideration of project specific conditions such as soil variability, testing methods, consequences of system failure, complexity of proposed construction, and other pertinent conditions. The design infiltration rate after applying the safety factor shall not exceed 100 in/hr for non-vegetative facilities, such as drywells or infiltration chambers. Vegetated facilities with growing media shall be designed at a maximum infiltration rate of 6.0 in/hr through the growing media.

Table 18. Infiltration Rate Safety Factors

Test Method	Recommended Correction Factors
Encased Falling head	3
Open Pit Falling Head	2
Double-Ring Infiltrometer	Public Facilities: 1 Private Facilities: 2

Open Pit Falling Head Procedure

The open pit falling head procedure is based on the EPA Falling Head Percolation Test Procedure (Onsite Wastewater Treatment and Disposal Systems Design Manual, EPA/625/1-80-012, 1980). The test is performed in an open excavation and therefore is a test of the combination of vertical and lateral infiltration.

1. Excavate an approximately 2-foot by 2-foot-wide hole into the native soil to the elevation of the proposed facility bottom. The test can be conducted in a machine-excavated pit or a hand-dug pit using a shovel, posthole digger, or hand auger. If smooth auguring tools or a smooth excavation bucket is used, scratch the sides and bottom of the hole with a sharp-pointed instrument, and remove the loose material from the bottom of the test hole.
2. A 2-inch layer of coarse sand or fine gravel may be placed to protect the bottom from scour and sloughing.
3. Fill the hole with clean water a minimum of 1 foot above the soil to be tested and maintain this depth of water for at least 4 hours (or overnight if clay soils are present) to presoak the native material.
4. Percolation rate measurements shall be made after 15 hours and no more than 30 hours after the soaking period begins. It is important that the soil be allowed to soak for a sufficiently long period of time to allow the soil to swell if accurate results are to be obtained. Any soil that sloughed into the hole during the soaking period shall be

removed and the water level shall be adjusted to 6 inches above the added gravel (or 8 inches above the bottom of the hole).

5. In sandy soils with little or no clay, soaking is not necessary. If after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.
6. The measurements should be made with reference to a fixed point. A lath placed in the test pit prior to filling or a sturdy beam across the top of the pit are convenient reference points. The tester and excavator should conduct all testing in accordance with OSHA regulations.
7. Measure the water level to the nearest 0.01-foot (1/8-inch) at 10-minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all of the water has drained. At no time during the test is the water level allowed to rise more than 6 inches above the gravel.
8. Successive trials shall be run until the measured infiltration rate between two successive trials does not vary by more than 5 percent. At least three trials shall be conducted. After each trial, the water level is readjusted to the 12-inch level. Enter results into the **Infiltration Test Data Table** provided at the end of this section as **Table 19**.
9. The results of the last water level drop are used to calculate the tested infiltration rate. The final rate shall be reported in inches per hour. See the calculation following the **Infiltration Test Data Table** provided at the end of this section.
10. For very rapidly draining soils, it may not be possible to maintain a water head above the bottom of the test pit. If the infiltration rate meets or exceeds the flow of water into the test pit, conduct the test in the following manner:
    a. Approximate the area over which the water is infiltrating.
    b. Using a water meter, bucket, or other device, measure the rate of water discharging into the test pit.
    c. Calculate the infiltration rate by dividing the rate of discharge (cubic inches per hour) by the area over which it is infiltrating (square inches).
11. Upon completion of the testing, the excavation shall be backfilled

Encased Falling Head Test Procedure

The encased falling head procedure is based on a modification of the EPA Falling Head Percolation Test Procedure (Onsite Wastewater Treatment and Disposal Systems Design Manual, EPA/625/1-80-012, 1980). The most significant modification is that this test is performed with a 6-inch casing that is embedded approximately 6 inches into the native soil. The goal of this field test is to evaluate the vertical infiltration rate through a 6-inch plug of soil, without allowing any lateral infiltration. The test is not appropriate in gravelly soils or in other soils where a good seal with the casing cannot be established.

1. Embed a solid 6-inch-diameter casing into the native soil at the elevation of the proposed facility bottom (see **Figure 11**). Ensure that the embedment provides a good seal around the pipe casing so that percolation will be limited to the 6-inch plug of the material within the casing. This method can also be applied to testing within hollow stem augers, provided the driller and tester are reasonably certain that a good seal has been achieved between the soil and auger.

2. A 2-inch layer of coarse sand or fine gravel may be placed to protect the bottom from scour and sloughing.

3. Fill the pipe with clean water a minimum of 1 foot above the soil to be tested and maintain this depth for at least 4 hours (or overnight if clay soils are present) to presoak the native material.

Percolation rate measurements shall be made after 15 hours and no more than 30 hours after the soaking period begins. It is important that the soil be allowed to soak for a sufficiently long period of time to allow the soil to swell if accurate results are to be obtained. Any soil that sloughed into the hole during the soaking period shall be removed and the water level shall be adjusted to 6 inches above the added gravel (or 8 inches above the bottom of the hole).

In sandy soils with little or no clay, soaking is not necessary. If after filling the hole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.

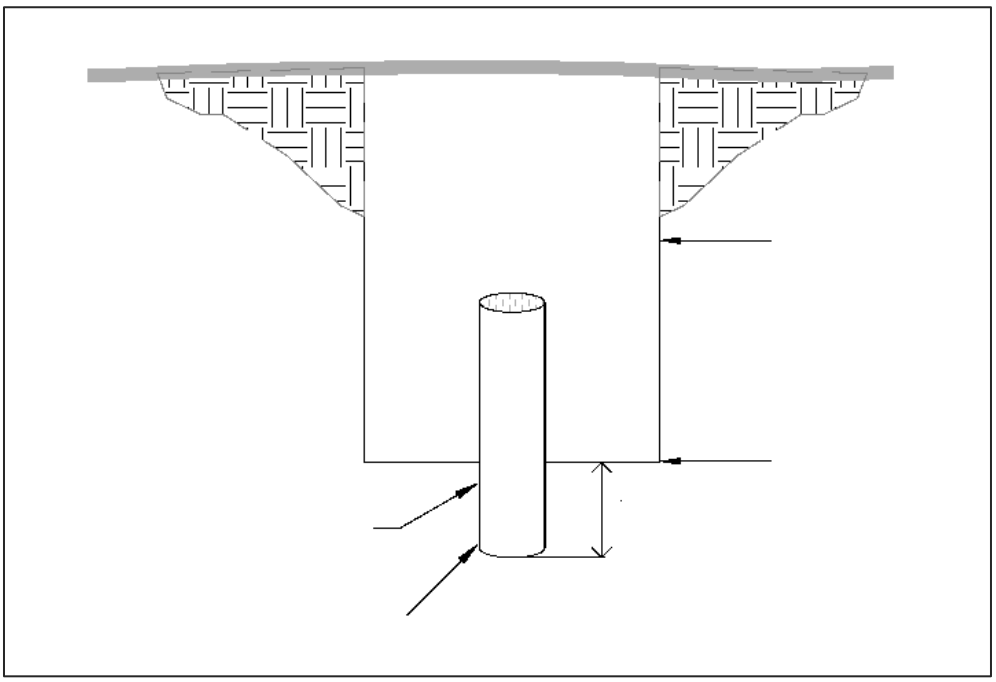
4. To conduct the first trial of the test, fill the pipe to approximately 6 inches above the soil and measure the water level to the nearest 0.01-foot (1/8-inch). The level should be measured with a tape or other device with reference to a fixed point. The top of the pipe is often a convenient reference point. Record the exact time.

5. Measure the water level to the nearest 0.01-foot (1/8-inch) at 10-minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all of the water has drained. The infiltration test is continued until the measured infiltration rate between two successive trials does not vary by more than 5 percent. At least three trials shall be conducted. After each trial, the water level is readjusted to the 6-inch level. Enter results into the **Infiltration Test Data Table** provided at the end of this section. At no time during the test is the water level allowed to rise more than 6 inches above the gravel.

6. The result of the last water level drop is used to calculate the tested infiltration rate. The final rate shall be reported in inches per hour.

7. Upon completion of the testing, the casings shall be immediately pulled, and the test pit shall be backfilled.

Figure 11. Encased Falling Head



Double Ring Infiltrometer Test

The double-ring infiltrometer test procedure shall conform with ASTM 3385-94. The test is performed within two concentric casings embedded and sealed to the native soils. The outer ring maintains a volume of water to diminish the potential of lateral infiltration through the center casing. The volume of water added to the center ring to maintain a static water level is used to calculate the infiltration rate. The double-ring infiltrometer is appropriate only in soils where an adequate seal can be established.

This test may be difficult to perform where the tested soil strata are in a pit since careful regulation of the static volumes is necessary.

Reporting Requirements

In addition to the information required by the state for a signed and stamped Geotechnical Engineering Report, the following information shall be included in the project's submittals.

1. Infiltration results in inches per hour.

2. Location and depth of excavation. The excavation should be deep enough to verify that there is a 5-foot separation between the final depth of the facility (rock gallery) and the seasonal high groundwater or soil layer that could reduce the infiltration rate.

3. Summary and discussion of infiltration testing, including number of tests, amounts of water used in each test (inches, gallons, etc.), and time of each test. Testing is required to show that an accurate rate was achieved.

4. Discussion of how the test was performed:

- Open pit (size of area)
- Encased falling head

    - Pipe type and size
    - Embedment depth
- Double-ring infiltrometer
    - Pipe type and size
    - Embedment depth

5. **Table 19**. Infiltration Test Data Table provided at the end of this appendix.
6. Soil types with depth.
7. Groundwater observations: seasonal high groundwater level estimation.

Table 19. Infiltration Test Data Table

Location:	**Date:**	**Test Hole Number:**
Depth to bottom of hole:	**Diameter of hole:**	**Test Method:**
Tester's Name: **Tester's Company:**		**Tester's Contact Number:**

Depth, feet	**Soil Texture**

Time	**Time interval, minutes**	**Measurement, feet**	**Drop in water level, feet**	**Percolation rate, inches per hour**	**Remarks**

Figure 12. Infiltration Test Data Table Example

Infiltration Test Data Table Example

Location: Lot 105, Low Point Heights Subdivision	**Date:** 6/28/2010	**Test Hole Number:** 3
Depth to bottom of hole: 57 inches	**Diameter of hole:** 0.5 feet	**Test Method:** Encased falling head
Tester's Name: C.J. Tester **Tester's Company:** Tester Company		**Tester's Contact Number:** 555-1212

Depth, feet	Soil Texture
0-0.5	Black Topsoil
0.5-1.0	Brown SM
1.0-2.2	Brown ML
2.2-5.1	Brown CL

Time	Time interval, minutes	Measurement, feet	Drop in water level, feet	Percolation rate, inches per hour	Remarks
9:00	0	3.75	-		Filled with 6"
9:20	20	3.83	0.08		
9:40	20	3.91	0.08	2.88	
10:00	20	3.98	0.07	2.52	
10:20	20	4.04	0.06	2.16	
10:40	20	4.11	0.07	2.52	
11:00	20	4.17	0.06	2.16	
11:20	20	4.225	0.055	1.98	
					Adjusted to 6" level for Trial #2