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Analysis Procedures for Infiltration BMPs Checklist

This checklist reflects most, but not necessarily all of the items that will be reviewed by the Development Review. It is intended to be used as an aid by us to provide a consistent review of development work in Thurston County. All items may not be applicable in the review of each project and all items of concern to this office may not be covered on this checklist.

Y	N	
		GENERAL PROCEDURES FOR INFILTRATION BMPs
		Step 1: General Site Characterization
		Surface Features Characterization
✓		A general site characterization was performed to identify **Surface Features** such as: • Topography within 500 feet of the proposed facility • Anticipated site use (street/highway, residential, commercial, high-use site) • Location of water supply wells within 500 feet of proposed facility • Location of designated well head protection areas for public water systems and/or 1-, 5-, and 10-year time of travel zones for municipal well protection areas (if available) • Location of steep slopes (>15%) or landslide hazard areas • Location of septic systems in the vicinity of the proposed facility • Locations of areas known to have contaminated soils. • A description of local site geology, including soil or rock units likely to be encountered, the groundwater regime, and geologic history of the site • Analysis of site boring and soil testing and review of any available existing soils information for the site or adjacent sites • Existing runoff flowing into and out of the site, possible flows generated by greater than the 100-year event, and proximity of other stormwater facilities on adjacent properties • Location of any high groundwater hazard areas or wetlands
		Subsurface Characterization
✓		The characterization study documents the following **Subsurface** data such as: • Subsurface explorations (test holes or test pits) to a depth below the base of the infiltration BMP of at least 5 times the maximum design depth of ponded water proposed, but not less than 10 feet below the base of the BMP. However, at sites with shallow ground water (less than 15 feet from the estimated base of the infiltration BMP), if a mounding analysis is necessary, determine the thickness of the saturated zone. • Continuous sampling to a depth below the base of the infiltration BMP of 2.5 times the maximum design ponded water depth, but not less than 10 feet. For large infiltration BMPs serving drainage

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		areas of 10 acres or more, perform soil grain size analyses on layers up to 50 feet deep (or no more than 10 feet below the water table). • If proposing to estimate the infiltration rate using the soil grain size analysis method, obtain samples adequate for the purposes of that gradation/classification testing. At a minimum, one-grain size analysis per soil stratum in each test hole within 2.5 times the maximum design water depth, but not less than 10 feet is conducted. o For BMP IN.01: Infiltration Basins, at least one test pit or test hole per 5,000 square feet of BMP infiltrating surface (in no case less than two per BMP). o For BMP IN.02: Infiltration Trenches, at least one test pit or test hole per 200 feet of trench length (in no case less than two per trench). • In high water table sites, the subsurface exploration sampling need not be conducted lower than 2 feet below the ground water table. • Detailed logs for each test pit or test hole and a map showing the location of the test pits or test holes. Logs include at a minimum: o Depth of pit or hole o Soil descriptions o Depth to water o Presence of stratification • Logs substantiate whether stratification does or does not exist. • A minimum of three groundwater monitoring wells or three hydraulically connected surface or ground water features are used to determine the direction of flow and gradient. One monitoring well may be sufficient if the site professional determines the surrounding site conditions indicate that gradient and flow direction are not critical. • Monitoring has occurred through at least one wet season unless substantially equivalent site historical data regarding ground water levels is available. • If using the Soil Grain Size Analysis Method for estimating infiltration rates: o Complete laboratory testing as necessary to establish the soil gradation characteristics and other properties to complete the infiltration facility design. o At a minimum, conduct one-grain size analysis per soil stratum in teach test hole within 2.5 times the maximum design water depth, but not less than 10 feet. o When assessing
		Soil Testing Data
✓		The characterization study documents the following **Soil Testing Data** for each soil unit encountered should include: • Grain-size distribution (ASTM D422 or equivalent AASHTO specification), if using the grain size analysis method • Visual grain size classification

Y	N	
		• Percent clay content (including type of clay, if known) • Color/mottling • Variation and nature of stratification If the infiltration BMP will provide Runoff Treatment as well as Flow Control, the soil characterization should also include: • Cation exchange capacity (CEC) and organic matter content for each soil type and strata where distinct changes in soil properties occur, to a depth below the base of the BMP of at least 2.5 times the maximum design water depth, but not less than 6 feet. • For soils with low CEC and organic content, deeper characterization of soils may be warranted.
		Step 2: Site Suitability Criteria for Infiltration Facilities
		Setbacks
✓		The proposed design meets the setbacks for infiltration facilities.
✓		The base of the proposed infiltration basin is equal to or greater than 5 feet above the seasonal high groundwater level, bedrock (or hardpan), or other low permeability layer. A separation down to 3 feet may be considered if the mounding analysis, volumetric receptor capacity, and design of overflow and/or bypass structures are judged by the site professional to be adequate to prevent overtopping and meet all other site suitability criteria.
✓		The proposed infiltration basin is not within a floodplain area or high groundwater flood hazard area.
✓		Infiltration facilities at least 100 feet from drinking water supplies. Higher setbacks may be required if the well serves a public water system and/or DOH requirements apply for locations within the 1, 5, or 10 year time of travel.
✓		If the infiltration facility is an injection well, the facility meets the requirements of the UIC Program, Chapter 173-218 WAC.
✓		The depth of the infiltration facility is no more than 20 feet below the surrounding finished ground elevation where infiltration facilities are located upgradient from a building foundation or basement. May be reduced to 50 feet for infiltration facilities serving a single family residence.
		Groundwater Protection Areas
✓		The infiltration BMP will not cause a violation of groundwater quality standards.
		High Vehicle Traffic Areas
	✓	An oil control BMP is provided upstream of the infiltration BMP.
		Soil Infiltration Rate/Drawdown Time
	✓	For infiltration BMPs used for Runoff Treatment purposes, the measured soil infiltration rate is 9 in/hr or less, or 12 in/hour or less for permeable paving.
✓		For infiltration BMPs designed to provide Runoff Treatment, it is documented that the Water Quality Design Volume can infiltrate through the infiltration BMP surface within 48 hours.
		Depth to Bedrock, Water Table, or Impermeable Layer

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	✓	Infiltration Basins (BMP IN.01) and Infiltration Trenches (BMP IN.02) are ≥ 5 feet above the season high-water mark, bedrock or other low permeability layer.
		Soil Physical and Chemical Suitability for Treatment
✓		The native or engineered soils intended to provide Runoff Treatment meet the soil physical and chemical suitability criteria provided in Volume III, Step 2: Soil Physical and Chemical Suitability for Treatment.
		Seepage Analysis and Control
✓		No adverse effects will be caused by seepage zones on nearby building foundations, basements, roads, parking lots, or sloping sites.
		Cold Climate and Impact of Roadway Deicers
	✓	Mitigation measures are implemented if the infiltration of roadway deicers could cause a violation of groundwater quality standards.
		Step 3: Infiltration Receptor Characterization **Conducted if any of the following conditions are present**
	✓	Proposed facility would pose a risk of flooding or property damage if failure were to occur.
✓		Separation between base of facility and seasonal high groundwater is less than 50 feet AND tributary drainage area contains more than 15,000 square feet impervious surface or ¾ acre total area.
	✓	Separation between base of facility and seasonal high groundwater is less than 50 feet AND on-site soils may not have adequate infiltration capacity (Hydrologic Soils Group C or D [till soils]).
	✓	Separation between base of facility and seasonal high groundwater is less than 50 feet AND there is less than 2 times the minimum setback to a critical area, drainfield, or steep slope (>15%).
		Monitor Groundwater Levels
✓		A minimum of three groundwater monitoring wells were installed per infiltration facility, unless the highest groundwater level is known to be at least 50 feet below the proposed base of the infiltration facility.
✓		Seasonal groundwater levels were monitored at the site during at lest one wet season (December 1 through April 30).
✓		The single wet season observation was normalized to historic groundwater records in the region.
✓		Monitoring wells were installed and monitored in accordance with the following requirements: • Well was screened across the water table. • The maximum screen and sand pack length was 15 feet. • Weekly water level monitoring resulted in a minimum of 16 measurements over 4 months.
		Document Characterization
✓		A geotechnical report (Step 5) included the following information to characterize the infiltration receptor: • The information obtained for groundwater monitoring of the Subsurface Characterization above. • Depth to groundwater and to bedrock/impermeable layers.

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		• Seasonal variation of groundwater table based on well water levels and observed mottling of soils. Including an estimated seasonal high groundwater level and estimated maximum high groundwater level taking into account historical and seasonal groundwater table fluctuations. • Existing groundwater flow direction and gradient. • An estimate of the volumetric water holding capacity of the infiltration receptor soils. • Consideration of the potential for both unconfined and confined aquifers, or confining units, at the site that may influence the proposed infiltration facility as well as the groundwater gradient. • An assessment of the ambient groundwater quality (if it is a concern). • Horizontal hydraulic conductivity of the saturated zone. • Approximation of the lateral extent of the infiltration receptor. • Impact of the infiltration rate and proposed added volume form the project site on local groundwater mounding, flow direction, and water table; and the discharge point or areas of the infiltrating water determined by hydrogeologic methods. • State whether the location is suitable for infiltration and recommend a method for estimating the design infiltration rate.
		Mounding Analysis
✓		**Mounding analysis** must be conducted if BOTH the following conditions are present: • Separation between base of facility and seasonal high groundwater is less than 15 feet, AND • Tributary drainage area is greater than ¾ acre or there is greater than 15,000 square feet impervious surface contributing to the facility.
	✓	**Mounding analysis** may also be required by the Administrator if: • Hydrologic Soil Group C or D soils with an estimated infiltration rate of less than 0.5 inches/hour • Potential impact to downstream properties and/or critical areas is high as a result of facility failure • Urban environment (>4 units per acre) • Facility is within 100-feet of steep slope (>15%) with soils having less than 1 inch/hour infiltration rate • When soils work indicate there may be a perched low permeability layer above the water table
✓		The geotechnical professional obtained acceptance from the County for the mounding analysis approach prior to initiating the study. The proposal includes the methodology, approach, software program, input data, calibration requirements, and output format for the mounding analysis.
✓		The results of the mounding analysis was reported as part of the Infiltration Receptor Characterization and includes the following determinations:

Y	N	
		• A minimum of separation of at least 3 feet to seasonal high groundwater will be maintained from the bottom of the facility with mounding. • There will be no breakout of groundwater to the surface in the vicinity of the project as a result of mounding. • A minimum separation to groundwater from the estimated lowest elevation of any basement, building foundation, road, or other structure will be at least 3 feet. • There will be no intrusion of the groundwater mound into existing or proposed drainfield or reserve area and there will be no greater than a 6-inch increase in groundwater elevation beneath any septic drainfield or reserve area as a result of groundwater mounding. • The increase in groundwater elevation at the property boundaries of the project will not result in impacts to adjacent property owners.
		Step 4: Determine Method of Analysis
	✓	Typically use the Simple Method for the following types of sites (subject to County approval): • For small facilities serving short plats or commercial developments less than one acre of contributing area • High infiltration capacity soils (NRCS [SCS] soil types A or B) • Other infiltration facilities performing successfully at nearby locations • No septic systems, drinking water wells, steep slopes, or other sensitive features within 500 feet • Low risk of flooding and property damage in the event of clogging or other failure of the infiltration system
✓		Typically use the Detailed Method for the following types of sites (subject to County approval): • Low infiltration capacity soils (NRCS [SCS] soil types C or D) • History of unsuccessful infiltration facility performance, or no history of successful infiltration performance at nearby locations • A large contributing drainage area (greater than 1 acre) • Shallow groundwater levels (less than 50 feet to seasonal high groundwater) • High risk of flooding in the event of clogging or other failure.
		Step 5: Conduct Simple or Detailed Analysis
		Determine Design Infiltration Rate – Simplified Approach
	✓	The design (long-term) infiltration rate of the native soils was estimated using the simplified approach in accordance with Volume III, Step 5 of the Site Suitability and Analysis Procedures.
		Determine Design Infiltration Rate – Detailed Approach
✓		The design (long-term) infiltration rate of the native soils was estimated using the detailed approach in accordance with Volume III, Step 5 of the Site Suitability and Analysis Procedures.
		Prepare Geotechnical Report

Y	N	
✓		A geotechnical report was prepared and documented the requirements described above for completing the Surface Features Characterization, Subsurface Characterization, Soil Characterization, Evaluation of Site Suitability Criteria, Infiltration Receptor Characterization (if required), and Mounding Analysis (if required).
		Design Criteria
		Sizing Infiltration BMPs
✓		The Western Washington Hydrologic Model (WWHM), MGSFlood, or other approved continuous runoff model was used to size the infiltration BMP by routing the inflow runoff file through the proposed infiltration BMP. See Volume III, General Design Criteria for Infiltration BMPs, Sizing Infiltration BMPs.
✓		Overflows from the infiltration BMP comply with the performance standard they are designed to meet.
		Treatment Prior to Infiltration BMPs
✓		A basic treatment BMP as described in Volume I or pretreatment BMP as described by BMP WP.05: Presettling Basins and Pretreatment precedes all infiltration BMPs.
		Construct the BMP and Conduct Performance Testing
✓		For infiltration basins, the project engineer performs a minimum of two falling head percolation tests.
✓		For infiltration trenches, the project engineer performs a minimum of two performance tests. The type of performance test depends on the specific facility and site constraints, and is determined by the project engineer on a case-by-case basis and approved by the County prior to testing.
✓		Notify the County of the scheduled infiltration testing at least two working days in advance of the test.
✓		If the tests indicate the facility will not function as designed, notify the County immediately of such results.