



Checklist 5: Field and Design Procedures for Bioretention, Permeable Pavement, Rain Gardens, and Downspout Infiltration Systems

Per ECDC 18.30, all Category 1 projects must comply with Minimum Requirements No. 1 through No. 5, and all Category 2 projects must comply with Minimum Requirements No. 1 through No. 9. If bioretention, rain gardens, permeable pavement, and/or downspout infiltration systems are proposed to meet Minimum Requirement Nos. 5, 6, and/or 7, soil infiltration rates must be measured using approved soil infiltration testing procedures. See the Edmonds Stormwater Addendum (Addendum) Appendix B and Checklist 4.

Bioretention, rain gardens, permeable pavement, and downspout infiltration systems shall be designed in accordance with the Department of Ecology's Stormwater Management Manual for Western Washington (SWMMWW), ECDC 18.30, and the requirements in the Addendum. Because the SWMMWW does not always include clear itemization of project procedural and/or submittal requirements, the City of Edmonds developed the following checklist to aid project proponents and plan reviewers in complying with the applicable SWMMWW requirements. In addition, City-specific requirements (i.e., requirements presented in ECDC 18.30 and the Addendum that are not included in the SWMMWW) are also included in the checklist. For clarity, the checklist headings and subheadings are generally organized according to the SWMMWW structure, though some requirements specific to ECDC 18.30 and the Addendum are included under the SWMMWW headings.

This checklist reflects most, but not necessarily all, of the items that shall be performed by the project proponent, and documented for review by the Engineering Division. It is intended to be used as an aid for developers and plan reviewers by providing a foundation for clear and consistent field and design procedures in the City of Edmonds. However, all items may not be applicable to every project, and all items of concern to this office may not be covered on this checklist. Last, the methods and procedures outlined herein can vary depending on the project. The headings outlined below represent the City's recommended process, though variations are acceptable as long as all of the required information is evaluated and documented.

Applicant:

Application #:

<p>Within each blank cell, enter comment codes as follows:</p> <p>C = Complete R = Revise (i.e., make corrections)</p> <p>N/A = Not Applicable M = Missing (i.e., please include)</p> <p>IC = Incomplete</p>	
	<p>BIORETENTION FIELD AND DESIGN PROCEDURES</p>
1	Soils Report meeting the requirements described in the “Soils Report” section of this checklist. The Soils Report shall be included as part of the required Category 1 or 2 Stormwater Site Plan (see also Addendum Checklists 1 and 2).
	<p>Infiltration Rate (SWMMWW Volume III, Section 3.4; Volume V, BMP T7.30; and Addendum Appendix B)</p>
2	Test hole or test pit explorations should be conducted during mid to late in the wet season (December 1 through April 1).
3	Infiltration testing is performed at the anticipated elevation of the top of the native soil beneath the bioretention area (i.e., at the bottom of the excavated area).
4	Small bioretention cells (bioretention areas receiving water from one or two individual lots or <0.25 acre of pavement or other impervious surface): A single small-scale PIT (or soil grain size analysis, if permitted per Addendum Appendix B and Addendum Checklist 4 ¹) is performed at each potential bioretention site.
5	Large bioretention cells (bioretention areas receiving water from three or more lots or 0.25 acre or more of pavement or other impervious surface): A single small-scale PIT (or soil grain size analysis, if permitted per Addendum Appendix B and Addendum Checklist 4 ¹) is performed every 5,000 square feet of bioretention area. If soil characteristics across the site are consistent, a geotechnical professional may recommend a reduction in the number of tests.
6	Bioretention swales or long, narrow bioretention areas (i.e., one following the road right-of-way): A single small-scale PIT (or soil grain size analysis, if permitted per Addendum Appendix B and Addendum Checklist 4 ¹) is performed every 200 linear feet and within each length of road with varying subsurface characteristics. ²
7	A correction factor is applied to the measured Ksat of the subgrade soils (not the imported bioretention soil mix) to estimate its design (long-term) infiltration rate. Correction factors range from 0.33 – 1 (no correction) and are based on the site variability and number of locations tested (CF _v). See also Addendum Appendix B and Addendum Checklist 4.
	<p>Depth to Groundwater (SWMMWW Volume III, Section 3.4)</p>
8	A soil log or over-excavation of the PIT reveals that there is at least 3 feet of vertical clearance from the lowest elevation of the bioretention soil (or any underlying gravel layer) to the seasonal high groundwater elevation or other impermeable layer if the area tributary to the facility meets or exceeds any of the following thresholds: <ul style="list-style-type: none"> • 5,000 square feet of pollution-generating impervious surface (PGIS) • 10,000 square feet of impervious area • 0.75 acres of lawn and landscape
9	A soil log or over-excavation of the PIT reveals that there is at least 1 foot of vertical clearance from the seasonal high groundwater or other impermeable layer for bioretention systems with a contributing area less than the above threshold.

<p>Within each blank cell, enter comment codes as follows:</p> <p>C = Complete R = Revise (i.e., make corrections)</p> <p>N/A = Not Applicable M = Missing (i.e., please include)</p> <p>IC = Incomplete</p>	
	<p>Groundwater Mounding Analysis (SWMMWW Volume III, Section 3.4.2)</p> <p><i>Applies to bioretention areas with drainage areas exceeding 1 acre.</i></p>
10	If a single bioretention area serves a drainage area exceeding 1 acre, and has less than 15 feet depth to seasonal high ground water or other low permeability stratum (as measured from the bottom of the infiltration basin or trench), a groundwater mounding analysis is performed. (See also SWMMWW Volume III, Section 3.3.8, Step 10.)
11	Final design infiltration rate determined using an analytical ground water model to investigate the effects of the local hydrologic conditions on facility performance. (Use MODRET or an equivalent subject to approval by the City.)
	<p>RAIN GARDEN FIELD AND DESIGN PROCEDURES (SWMMWW Volume III, Section 3.4)</p>
12	Soils Report meeting the Category 1 Stormwater Site Plan Soils Report requirements described in the “Soils Report” section of this checklist.
	Infiltration Rate
13	Test hole or test pit explorations should be conducted during mid to late in the wet season (December 1 through April 1).
14	A single small-scale PIT (or soil grain size analysis, if permitted per Addendum Appendix B and Addendum Checklist 4 ¹) is performed at each potential rain garden site.
15	Infiltration testing is performed at the anticipated elevation of the top of the native soil beneath the rain garden area (i.e., at the bottom of the excavated area).
	Depth to Groundwater
16	A soil log or over-excavation of the PIT reveals that there is at least 1 foot between the bottom of the lowest elevation of the rain garden soil (or any underlying gravel layer) and the seasonal high groundwater or an underlying impermeable/low permeable layer.
	<p>PERMEABLE PAVEMENT FIELD AND DESIGN PROCEDURES (SWMMWW Volume III, Section 3.4)</p>
17	Soils Report meeting the requirements described in the “Soils Report” section of this checklist. The Soils Report shall be included as part of the required Category 1 or 2 Stormwater Site Plan (see also Addendum Checklists 1 and 2).
	Infiltration Rate
18	Test hole or test pit explorations should be conducted during mid to late in the wet season (December 1 through April 1).
19	Infiltration testing is performed in the soil profile at the estimated bottom elevation of base materials for the permeable pavement. If no base materials (e.g., a pervious concrete sidewalk), the testing is performed at the estimated bottom elevation of the pavement.

<p>Within each blank cell, enter comment codes as follows:</p> <p>C = Complete R = Revise (i.e., make corrections)</p> <p>N/A = Not Applicable M = Missing (i.e., please include)</p> <p>IC = Incomplete</p>	
Depth to Groundwater	
29	Site-specific test indicates there is 12 inches or more of permeable soil from the proposed bottom (final grade) of the infiltration system to the seasonal high groundwater table or other impermeable layer.
CATEGORY 1 STORMWATER SITE PLAN SOILS REPORT (SWM Volume I, Section 3.1.1; Addendum Chapter 7 and Checklist 1)	
30	In support of the requirements of Minimum Requirement No. 5, includes a Soils Report prepared by: a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program); a locally licensed on-site sewage designer; or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington.
31	Soil surveys, soil test pits, soil borings, or soil grain analyses sufficient to identify underlying soils on the site. Soil testing should occur between December 1 and April 1.
32	Includes the results of saturated hydraulic conductivity (Ksat) testing to assess infiltration capability and the feasibility of rain gardens, bioretention, and permeable pavement.
33	Includes the results of saturated hydraulic conductivity (Ksat) testing to assess infiltration capability and the feasibility of rain gardens, bioretention, and permeable pavement (see Addendum Appendix B and Addendum Checklist 4: Methods for Determining Infiltration Rates).
34	Includes the results of testing for a hydraulic restriction layer (groundwater, soil layer with less than 0.3 in/hr Ksat, bedrock, etc.) under possible sites for a rain garden, bioretention area, or permeable pavement. Testing with a monitoring well or an excavated pit must extend to a depth at least 1 foot below the estimated bottom elevation of a rain garden/bioretention excavation and at least 1 foot below the subgrade surface of a permeable pavement. This analysis should be performed in the winter season (December 21 through March 21). Site historical information and evidence of high groundwater in the soils can also be used.
35	For downspout infiltration systems, identifies the limits of any outwash type soils (i.e., those meeting USDA soil texture classes ranging from coarse sand and cobbles to medium sand) versus other soil types and include an inventory of topsoil depth. Any evidence of high groundwater level, such as mottling, is noted.
CATEGORY 2 STORMWATER SITE PLAN SOILS REPORT (SWMMWW Volume I, 3.1.1; Addendum Chapter 7 and Checklist 2)	
36	The Soils Report is prepared and stamped by a professional soil scientist certified by the Soil Science Society of America (or equivalent program), professional engineer, a licensed geologist, an engineering geologist, or a hydrogeologist registered in the State of Washington.
37	Soils Report prepared meeting the requirements outlined in Addendum Checklist 2, and including BMP-specific information listed below where applicable.

Within each blank cell, enter comment codes as follows:	
C = Complete	R = Revise (i.e., make corrections)
N/A = Not Applicable	M = Missing (i.e., please include)
IC = Incomplete	
38	Includes the results of testing for a hydraulic restriction layer (groundwater, soil layer with less than 0.3 in/hr Ksat, bedrock, etc.) under possible sites for a bioretention area or permeable pavement. Testing with a monitoring well or an excavated pit must extend to a depth at least 3 feet below the estimated bottom elevation of a bioretention excavation and at least 1 foot below the subgrade surface of a permeable pavement. This analysis should be performed in the winter season (December 21 through March 21). Site historical information and evidence of high groundwater in the soils can also be used.
39	For downspout infiltration systems, identifies the limits of any outwash type soils (i.e., those meeting USDA soil texture classes ranging from coarse sand and cobbles to medium sand) versus other soil types and include an inventory of topsoil depth.
40	Where required for bioretention (see above), documents of the results of groundwater mounding analyses and the impacts of mounding on the design infiltration rate.
	¹ Small-scale and large-scale PITs are required to determine feasibility of bioretention, permeable pavement, and rain gardens. The Soil Grain Size Analysis methods outlined in SWMMWW Volume III, Section 3.3.6; Addendum Appendix B; and Addendum Checklist 4 may be used to determine infiltration rate of underlying soils (for outwash soils only), but may not be used to determine infeasibility.
	² If the site subsurface characterization, including soil borings across the development site, indicates consistent soil characteristics and depths to seasonal high groundwater conditions, the number of test locations may be reduced to a frequency recommended by a geotechnical professional.

Reviewer: _____

Review Date: _____

Reviewer Phone #: _____

Reviewer Comments: