



Protecting Seattle's Waterways

Appendix C

On-Site Stormwater List BMP Infeasibility Criteria

CITY OF SEATTLE
STORMWATER MANUAL

AUGUST 2017



Note:

Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

This appendix provides infeasibility criteria for use in evaluating BMPs to meet the On-site Stormwater Management Requirement using the On-Site List approach (SMC, Section 22.805.070.D.2) to manage new and replaced hard surfaces. Refer to *Volume 1, Section 5.2.2*, to determine which On-site BMPs require evaluation for a project. Evaluation is based on project type, discharge location, and other criteria. Step-by-step instructions for using the On-site List Approach are provided in *Volume 3, Section 3.3.1*.

Prior to evaluating On-site BMPs, review the site design consideration in *Volume 1, Chapter 7 - Site Assessment and Planning* to conserve natural areas, retain native vegetation, reduce impervious surfaces, and integrate stormwater controls into the existing site layout to the maximum extent feasible. The Infeasibility Criteria provided below apply to BMPs if the area proposed for the BMP is the only available area for the BMP, after all reasonable efforts to regrade the site and allow for alternative placement of the BMP have been made.

When using the On-site List approach, an On-site BMP is considered infeasible if an infeasibility criteria in Tables C.1 through C.4 is met.

Table C.1. On-site List Infeasibility Criteria: All Dispersion and Infiltration BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
All BMPs	<ul style="list-style-type: none"> • Installation requires removal of an existing tree. To use this infeasibility criterion, the tree must be in good health and meet minimum size requirements: deciduous trees must have trunks at least 1.5 inches in diameter measured 6 inches above the ground, and evergreen trees must be at least 4 feet tall. In addition, the existing tree must be in an area that will be protected throughout construction. • Where BMP installation is prohibited per Regulations for Environmentally Critical Areas (SMC Chapter 25.09). 	
All Dispersion BMPs	<ul style="list-style-type: none"> • A licensed professional (as defined in <i>Appendix D, Section D-1</i>) recommends dispersion not be used anywhere within project site due to reasonable concerns of erosion, slope failure, or flooding (requires a signed and stamped written determination based on site-specific conditions from a licensed professional). • The dispersion flow path area does not provide positive drainage. • The dispersion flowpath area is within a landslide-prone area (SMC, Section 25.09.080). • The dispersion flowpath area is within 100 feet of a contaminated site or landfill (active or closed). • The dispersion flowpath area is in a steep slope area (SMC, Section 25.09.020) or within a setback to a steep slope area (calculated as 10 times the height of the steep slope to a 500 foot maximum setback). • The dispersion flowpath area is within 10 feet of a proposed or existing septic system or drainfield. 	

Table C.1 (continued). On-site List Infeasibility Criteria: All Dispersion and Infiltration BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
All Infiltration BMPs	<p>The following criteria each establish that the BMP is infeasible but only if based on an evaluation of site-specific conditions and documented within a signed and stamped written determination from a licensed professional (as defined in <i>Appendix D, Section D-1</i>):</p> <ul style="list-style-type: none"> • Infiltration is not recommended due to reasonable concerns about erosion, slope failure, or flooding. • The area available for siting would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, pre-existing structures, or pre-existing road or parking lot surfaces or subgrades. • The area available for siting would threaten shoreline structures such as bulkheads. <p>The following criteria each establish that the BMP is infeasible, without further justification, though some criteria evaluation require professional services:</p> <ul style="list-style-type: none"> • Evaluation of infiltration is not required per the “Infiltration Investigation Map”. • The area available for siting does not allow for overflow conveyance to an approved point of discharge per <i>Section 4.3.2</i>. • The area available for siting is within a steep slope area or land-slide prone area (or setback) (refer to <i>Volume 3, Section 3.2</i>). • The area available for siting does not meet the minimum horizontal setback requirements (refer to <i>Volume 3, Section 3.2</i>). • The area available for siting does not meet the minimum vertical setback requirements (refer to <i>Volume 3, Section 3.2</i>, and <i>Appendix D</i>). • Infiltration is restricted due to contaminated soil or groundwater (refer to <i>Volume 3, Section 3.2</i>). 	

Table C.2. On-site List Infeasibility: Category 1 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Full Dispersion	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Dispersion BMPs” (Table C.1) apply. • The site has less than a 65 to 10 ratio of the native vegetation area to the impervious area. • The minimum native vegetation flowpath length is less than 100 feet. 	
Infiltration Trenches	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. • Field testing indicates potential infiltration trench site(s) have a measured underlying soil infiltration rate less than 5 inches per hour (<i>Volume 3, Section 5.4.2</i>). • Where the site cannot be reasonably designed to locate a catch basin between the infiltration trench and point of connection to the public system. 	
Drywells	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. • Field testing indicates potential drywell site(s) have a measured underlying soil infiltration rate less than 5 inches per hour (<i>Volume 3, Section 5.4.3</i>). • Where the site cannot be reasonably designed to locate a catch basin between the drywell and point of connection to the public system. 	

Table C.3. On-site List Infeasibility Criteria: Category 2 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Rain Gardens	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. • In the right-of-way, the longitudinal road slope exceeds 4 percent. • The rain garden would have a linear geometry with a longitudinal slope greater than 8 percent. • The minimum bottom width of the rain garden (12 inch average) cannot be met due to, but not limited to: encroachment within the critical root zone of an existing tree(s) or minimum setbacks to structures, utilities, or property lines. • The infiltration area is within the minimum vertical or horizontal clearance from utilities, according to clearances required by the utility owner. • Field testing indicates soils have a measured underlying soil infiltration rate less than 0.3 inches per hour. 	
Infiltrating Bioretention Facilities	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. • The infiltrating bioretention facility would have a linear geometry with a longitudinal slope greater than 8 percent. • The minimum bottom width of the infiltrating bioretention facility (2 feet for facilities with vertical sides and 18 inch average for facilities with sloped sides) cannot be met due to, but not limited to: encroachment within the critical root zone of an existing tree(s) or minimum setbacks to structures, utilities, or property lines. • The infiltration area is within the minimum vertical and horizontal clearance from utilities, according to clearances required by the utility owner. • Field testing indicates soils have a measured underlying soil infiltration rate less than 0.3 inches per hour. • Field testing indicates soils have a measured underlying soil infiltration rate less than 0.6 inches per hour and an underdrain cannot be installed per the design criteria. • The facility with an underdrain would route underdrained water to a nutrient-critical receiving water. • In the right-of-way, installation requires a vertical walled facility. 	
Rainwater Harvesting	<ul style="list-style-type: none"> • Project lacks non-pollution-generating roof from which to harvest rainwater. • Non-potable water demand is insufficient to meet the On-site Performance Standard per modeling conducted in accordance with Volume 3, <i>Section 5.5.1.6</i>. • Installation is not economically feasible based on reasonable consideration of financial cost (e.g., roof area is less than 20,000 sf or the ratio of roof area to average daily rainwater demand is less than 10,000 square feet/gpm) (refer to Appendix H). Documentation is required. 	

Table C.3 (continued). On-site List Infeasibility Criteria: Category 2 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Permeable Pavement Facilities	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. <p>The following criteria each establish that the BMP is infeasible but only if based on an evaluation of site-specific conditions and a written recommendation from a licensed professional (as defined in <i>Appendix D, Section D-1</i>):</p> <ul style="list-style-type: none"> • Infiltrating or ponding water below pavement area would compromise adjacent pavements. • Fill soils are used that can become unstable when saturated. • The permeable pavement design does not provide sufficient strength to support heavy loads in areas with “industrial activity” as identified in 40 CFR 122.26(b)(14). <p>The following criteria each establish that the BMP is infeasible, without further justification, though some criteria require professional services:</p> <ul style="list-style-type: none"> • The subgrade slope exceeds 6 percent after reasonable efforts to grade. • The permeable pavement wearing course slope exceeds 6 percent after reasonable efforts to grade. • For projects in the right-of-way, the permeable pavement surface area would be less than 2,000 square feet of contiguous pavement and the project discharges to: <ul style="list-style-type: none"> ○ A designated receiving water body, or ○ A combined system, or ○ A capacity constrained system which does not drain to a creek wetland or small lake. • The anticipated mature tree spread (based on tree species) would overhang more than 50 percent of permeable pavement area. • The pavement is over a structure, such as, but not limited to: parking garages, box culverts, and bridges. • The pavement is subject to long-term excessive sediment deposition (e.g., construction and landscaping material yards). • Underlying soils are unsuitable for supporting traffic loads when saturated (e.g., a residential access road has a California Bearing Ratio of 5 percent or less). • Field testing indicates soils have a measured underlying soil infiltration rate less than 0.3 inches per hour. • Pavement is replacing an existing pollution-generating hard surface in the right-of-way. • The street type is classified as arterial or collector rather than local access. Refer to RCW 35.78.010, RCW 36.86.070, and RCW 47.05.021. Note: This infeasibility criterion does not extend to sidewalks and other non-traffic bearing surfaces associated with the collector or arterial. 	

Table C.3 (continued). On-site List Infeasibility Criteria: Category 2 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Permeable Pavement Facilities (continued)	<ul style="list-style-type: none"> • Streets that receive more than very low traffic volumes, and areas having more than very low truck traffic. Streets with a projected average daily traffic volume of 400 vehicles or less are very low volume roads (AASHTO, 2001)(U.S. Dept. of Transportation, 2013). Areas with very low truck traffic volumes are streets and other areas not subject to through truck traffic but may receive up to weekly use by utility trucks (e.g., garbage, recycling), daily school bus use, and multiple daily use by pick-up trucks, mail/parcel delivery trucks, and maintenance vehicles. Note: This infeasibility criterion does not extend to sidewalks and other non-traffic bearing surfaces. • The pavement area is defined as a “high use site” in SMC, Section 22.801.090. • In areas with “industrial activity” as identified in 40 CFR 122.26(b)(14). • Where the risk of concentrated pollutant spills is more likely, including, but not limited to, gas stations, truck stops, and industrial chemical storage sites. • In areas where routine, heavy roadway applications of sand occur in frequent snow zones to maintain traction during weeks of snow and ice accumulation, including sidewalks within 7 feet of driving lanes with sand application. • Where runoff from unstabilized erodible areas would occur without presettling. • The areas contributing runoff to the permeable pavement facilities exceed the maximum run-on limits: <ul style="list-style-type: none"> ○ Pollution-generating impervious surfaces (e.g., roadways, parking lots) exceed the maximum run-on area ratio of 2:1 ○ Non-pollution generating impervious surfaces (e.g., roofs, sidewalks) and stabilized pervious surfaces exceed the maximum run-on area ratio of 5:1 	

Table C.3 (continued). On-site List Infeasibility Criteria: Category 2 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant																		
Permeable Pavement Surfaces	<ul style="list-style-type: none"> • One or more of the infeasibility criteria provided for permeable pavement facilities apply. (Note, however, that for permeable pavement surfaces, the infeasibility criteria for “All Infiltration BMPs” are not applicable). • Field testing indicates soils have a measured underlying soil infiltration rate less than 0.3 inches per hour (Note: field infiltration tests are not required for permeable pavement surfaces, but must be used to demonstrate infeasibility). • The site is a contaminated site or abandoned landfill. • Installation is within 10 feet of an underground storage tank or connecting underground pipes. (Applicable to tanks used to store petroleum products, chemicals, or liquid hazardous wastes). • Run-on from an adjacent impervious area is greater than 10 percent of the permeable pavement surface area. • A licensed professional (as defined in <i>Appendix D, Section D-1</i>) recommends permeable pavement not be used anywhere within the project site due to reasonable concerns of erosion, slope failure, or flooding (requires a signed and stamped written determination based on site-specific conditions from a licensed professional). • Based on subsurface investigation ^a, groundwater or hydraulically-restrictive layer is too shallow per the following Minimum Vertical Separation table. <table border="1" data-bbox="381 1039 1187 1413"> <thead> <tr> <th colspan="4" data-bbox="381 1039 1187 1087">Permeable Pavement Surfaces</th> </tr> <tr> <th data-bbox="381 1087 643 1276" rowspan="2">Season</th> <th data-bbox="643 1087 852 1276" rowspan="2">Minimum Investigation Depth (ft) ^b</th> <th colspan="2" data-bbox="852 1087 1187 1165">Minimum Vertical Separation, ft^a</th> </tr> <tr> <th data-bbox="852 1165 987 1276">Ground-water</th> <th data-bbox="987 1165 1187 1276">Hydraulically -Restrictive Layer</th> </tr> </thead> <tbody> <tr> <td data-bbox="381 1276 643 1346">Wet Season (November – March)</td> <td data-bbox="643 1276 852 1346">2</td> <td data-bbox="852 1276 987 1346">1</td> <td data-bbox="987 1276 1187 1346">1</td> </tr> <tr> <td data-bbox="381 1346 643 1413">Dry Season (April – October)</td> <td data-bbox="643 1346 852 1413">3</td> <td data-bbox="852 1346 987 1413">2</td> <td data-bbox="987 1346 1187 1413">1</td> </tr> </tbody> </table> <p data-bbox="427 1423 1166 1501">^a Subsurface investigation is not required for permeable pavement surfaces, but subsurface investigation must be performed to demonstrate infeasibility due to lack of vertical separation.</p> <p data-bbox="427 1514 1187 1635">^b The minimum investigation depth and vertical separation shall be measured from the bottom of the BMP. The bottom of the BMP is defined as the deepest portion of proposed BMP where water is expected to move into the underlying soil (i.e. at the aggregate subbase or Water Quality Treatment Course (if required)).</p>	Permeable Pavement Surfaces				Season	Minimum Investigation Depth (ft) ^b	Minimum Vertical Separation, ft ^a		Ground-water	Hydraulically -Restrictive Layer	Wet Season (November – March)	2	1	1	Dry Season (April – October)	3	2	1	
Permeable Pavement Surfaces																				
Season	Minimum Investigation Depth (ft) ^b	Minimum Vertical Separation, ft ^a																		
		Ground-water	Hydraulically -Restrictive Layer																	
Wet Season (November – March)	2	1	1																	
Dry Season (April – October)	3	2	1																	

Table C.4. On-site List Infeasibility Criteria: Category 3 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Sheet Flow Dispersion	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Dispersion BMPs” (Table C.1) apply. • The area to be dispersed (e.g., driveway, patio) exceeds a slope of 15 percent. • The minimum vegetated flow path for sheet flow dispersion cannot be met. Note: A 10 foot flowpath is required to disperse runoff from a contributing flow length of up to 20 feet. An additional 10 feet of flow path is required for each additional 20 feet of contributing flow path or fraction thereof. Refer to <i>Volume 3, Figure 5.5</i>. • The flowpath does not meet the minimum horizontal setback requirements to property lines, structures and other flowpaths (refer to <i>Volume 3, Section 5.3.5</i>). 	
Concentrated Flow Dispersion	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Dispersion BMPs” (Table C.1) apply. • There are no concentrated flows to disperse. • The minimum dispersion trench length of 10 feet cannot be met. • The vegetated flow path for the dispersion trench is less than 25 feet • The vegetated flow path for a rock pad is less than 50 feet. • Greater than 700 square feet of surface area drains to the BMP. • The flowpath does not meet the minimum horizontal setback requirements to property lines, structures and other flowpaths (refer to <i>Volume 3, Section 5.3.6</i>). 	
Splashblock Downspout Dispersion	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Dispersion BMPs” (Table C.1) apply. • There are no downspouts. • The vegetated flowpath is less than 50 feet. • Greater than 700 square feet of surface area drains to the BMP. • The flowpath does not meet the minimum horizontal setback requirements to property lines, structures and other flowpaths (refer to <i>Volume 3, Section 5.3.3</i>). 	
Trench Downspout Dispersion	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Dispersion BMPs” (Table C.1) apply. • There are no downspouts. • The minimum dispersion trench length of 10 feet for every 700 square feet of drainage area cannot be met. • The vegetated flowpath is less than 25 feet. • The flowpath is within the setbacks to property lines, structures and other flowpaths (refer to <i>Volume 3, Section 5.3.4</i>). 	

Table C.4 (continued). On-site List Infeasibility Criteria: Category 3 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Non-Infiltrating Bioretention	<ul style="list-style-type: none"> • The minimum bottom width of the non-infiltrating bioretention facility (2 feet) cannot be met due to, but not limited to: encroachment within the critical root zone of an existing tree(s), minimum setbacks to structures / utilities, or project limits/planting strip too small. • Minimum vertical and horizontal clearances from utilities are unachievable as required by utility owner. • The facility would route underdrained water to a nutrient-critical receiving water. 	
Vegetated Roof Systems	<ul style="list-style-type: none"> • Project does not include a roof. • Roof design has a slope less than 1 degree (0.2:12) or greater than 10 degrees (2:12). • Installation is not economically feasible based on reasonable consideration of financial cost (refer to <i>Appendix H</i>). Documentation is required. 	
Single Family Residential (SFR) Cisterns	<ul style="list-style-type: none"> • Project does not include non-pollution generating surfaces. • The SFR cistern would be within restricted setbacks 	

Table C.5. On-site List Infeasibility Criteria: Category 4 BMPs.

BMP	On-site List Infeasibility Criteria	Additional Information from Applicant
Perforated Stub-out Connections	<ul style="list-style-type: none"> • One or more of the infeasibility criteria for “All Infiltration BMPs” (Table C.1) apply. • The location for the perforated pipe portion of the system is under impervious or heavily compacted (e.g., driveways and parking areas) surfaces. • The minimum perforated stub-out length of 10 feet per 5,000 square feet of contributing roof area cannot be met. • Where the site cannot be reasonably designed to locate a catch basin between the perforated stub-out and point of connection to the public system. 	
Newly Planted Trees	<ul style="list-style-type: none"> • The mature height, size, and/or rooting depth is not compatible with Medium and Large trees listed in the current Seattle Master Tree List. 	