

Infiltration Feasibility and Testing Training

Photo by John Skelton



City of Seattle

SDCI Training

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INFILTRATION FEASIBILITY AND TESTING

- Volume 3, Section 3.2 (Determine Infiltration Feasibility)
- Appendix D (Subsurface Investigation and Infiltrating Testing for Infiltration BMPs)
- Simple Test Checklist (minor revisions from 2016)

www.seattle.gov/Documents/Departments/SDCI/Forms/SimpleInfilTestChecklist.pdf

- Pilot Infiltration Test Checklist (minor revisions from 2016)

www.seattle.gov/Documents/Departments/SDCI/Forms/StormwaterPITChecklist.pdf

INFILTRATION FEASIBILITY AND TESTING

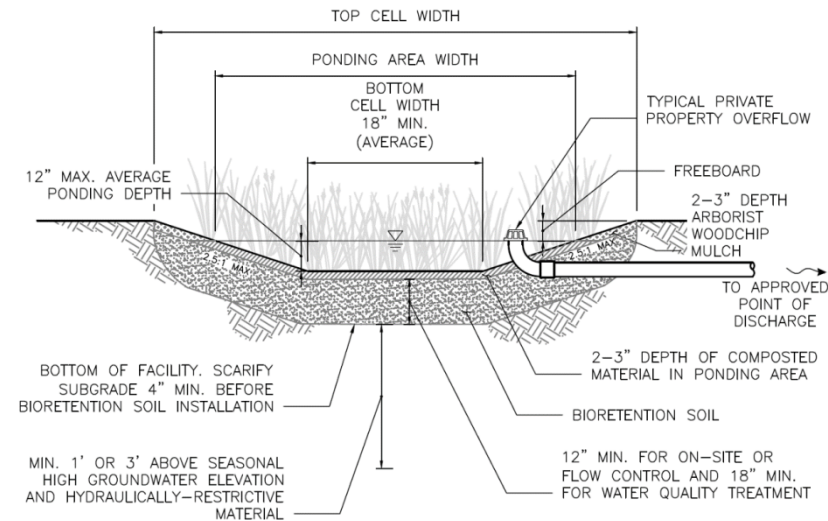
Investigation
and Testing



Design



Construction



INFILTRATION FEASIBILITY AND TESTING

Volume 3, Section 2.5 (Infiltration BMPs)

BMP	On-site	Flow Control	Water Quality	Conveyance	Reference
Infiltration trenches ^a	✓	✓	✓ ^{b, c}		Section 5.4.2
Drywells ^a	✓	✓			Section 5.4.3
Infiltrating bioretention	✓ ^d	✓ ^d	✓ ^c	✓ ^e	Section 5.4.4
Rain gardens	✓ ^f			✓ ^e	Section 5.4.5
Permeable pavement facilities	✓	✓	✓ ^{c, g}		Section 5.4.6
Perforated stub-out connections	✓ ^f				Section 5.4.7
Infiltration basins	✓ ^h	✓	✓ ^b		Section 5.4.8
Infiltration chambers/ vaults	✓ ^h	✓	✓ ^b		Section 5.4.9

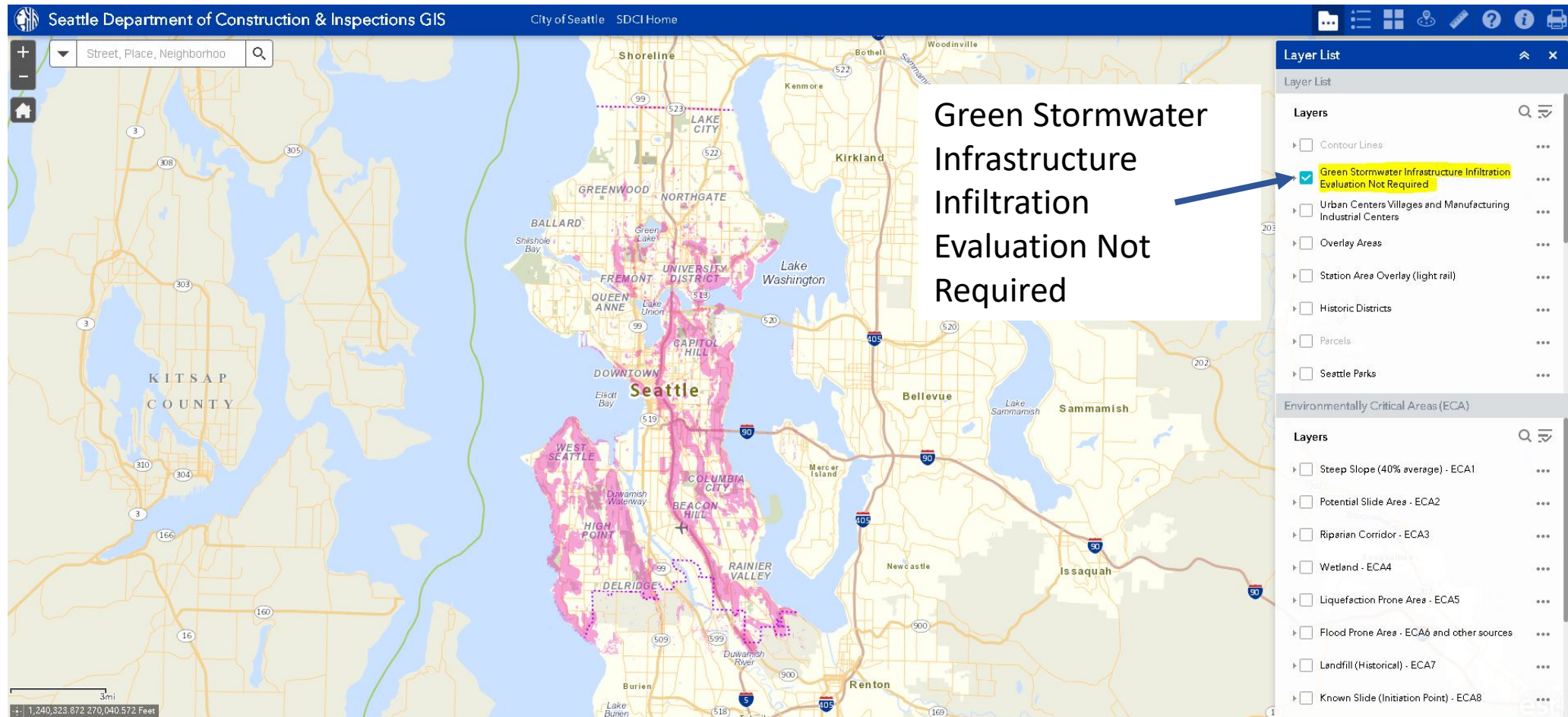
INFILTRATION FEASIBILITY AND TESTING

Volume 3, Section 3.2 (Determine Infiltration Feasibility)

Each of the following steps is outlined in more detail in the subsequent sections.

- *Step 1* - Evaluate Infiltration Investigation Map
- *Step 2* - Evaluate horizontal setbacks and site constraints
- *Step 3* - Conduct subsurface investigation and evaluate vertical separation requirements
- *Step 4* - Conduct infiltration testing
- *Step 5* - Determine design infiltration rate
- *Step 6* - Conduct groundwater monitoring, receptor characterization, and mounding analysis, if applicable
- *Step 7* - Evaluate use of infiltration to meet minimum requirements

INFILTRATION FEASIBILITY AND TESTING



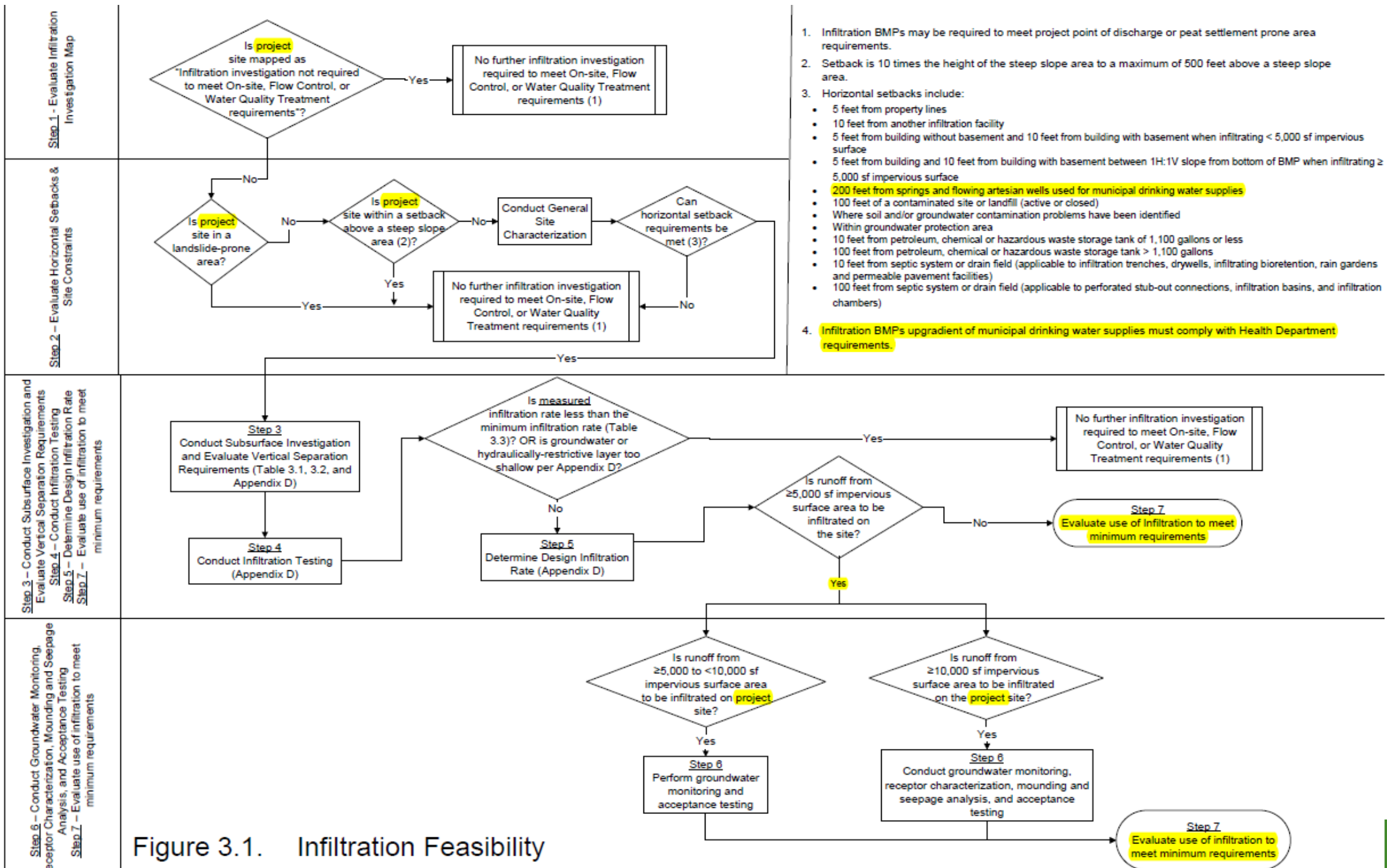


Figure 3.1. Infiltration Feasibility

- Small PIT no longer applicable for > 1 acre impervious
- Revised footnotes (next slide)

Table 3.1. Minimum Investigation and Testing Requirements for Shallow Infiltration BMPs.

Impervious Area Infiltrated on the Site ^{a,b,j}	Step 3		Step 4		Step 6				
	Subsurface Investigation		Infiltration Testing		Groundwater Monitoring		Characterization of Infiltration Receptor	Groundwater Mounding and Seepage Analysis	Acceptance Testing
	Minimum Number	Type	Minimum Number	Type	Minimum Number of Wells	Duration and Frequency			
<2,000 ft ²	1 per facility AND at least 1 per 150 linear feet of a facility ^{c,d}	Simple subsurface investigation	1 per facility AND at least 1 per 150 linear feet of a facility ^{c,d}	Simple Infiltration Test ⁱ	0	NA	No	No	No
≥2,000 to <5,000 ft ²		Standard subsurface investigation		Simple Infiltration Test ⁱ or Small PIT; if ≥2,000 ft ² of the site infiltration will occur within a single facility, ^e the Small PIT ^f method is required	0	NA	No	No	No
≥5,000 to <10,000 ft ²		Comprehensive subsurface investigation ^h	1 per facility AND at least 1 per 150 linear feet of a facility ^{c,d}	Small PIT ^f	1	Monthly for at least 1 wet season; monthly for at least 1 year if within 200 feet of a designated receiving water ^b			Yes
≥10,000 ft ² to <1 acre				Small PIT ^f	3	Monthly for at least 1 year ^b	Yes, for infiltration basins	Yes ^g	Yes
≥1 acre				Small or Large PIT ^{f,k}					

Note: Deviations from the minimum requirements in this table, when recommended and documented by the licensed professional, may be approved by the Director. If the licensed professional determines continuity of subsurface materials based on site investigations or if acceptance testing will be done during construction then fewer tests may be approved. Designer shall be prepared to make allowances to the design during construction if site conditions differ than assumed for the design or if the acceptance test during construction determines that the infiltration rate is lower than assumed for the design.

^a Site is defined for SFR and Parcel projects as the project area; for Trail, Sidewalk or Roadway projects, it is defined by one intersection to the other and blocks may vary in length.

^b If the project site is within 200 feet of tidal waters, groundwater data capturing low/high tide fluctuation for one calendar year shall be collected to determine if groundwater at the project is influenced by tidal fluctuations. Groundwater monitoring is not required if available groundwater elevation data within 50 feet of the proposed facility shows the highest

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- ~~h For projects where runoff from 5,000 square feet or more of impervious surface area will be infiltrated on the site, infiltration within 500 feet up-gradient or 100 feet down-gradient of a contaminated site or landfill (active or closed) requires analysis and approval by a licensed hydrogeologist. For projects with infiltration facilities within 500 feet up-gradient or 100 feet down-gradient of a contaminated site or landfill (active or closed), analysis and approval by a licensed hydrogeologist is required if runoff from 5,000 square feet or more of impervious surface area will be infiltrated on the site.~~
- i The Simple Infiltration Test is not allowed for projects with no off-site point of discharge (*Section 4.3.2-4*). These projects shall use a Small PIT.
- ~~j Permeable pavement not included in the impervious area total.~~
- ~~k A small scale PIT may be substituted if the site has a high infiltration rate (>4 in/hr), making a large scale PIT difficult, and the site geotechnical investigations suggest uniform subsurface characteristics.~~

- (h) Revised sentence format but requirement still applies for contaminated sites or landfills
- (j) Exclude permeable pavement from impervious area total
- (k) Allow Small PIT at sites with high infiltration rates (>4 in/hr)

INFILTRATION FEASIBILITY AND TESTING

Simple

Simple Subsurface Investigation Elements			
Minimum Investigation Depth and Vertical Separation Requirements			
All BMPs			
Season	Minimum Investigation Depth (ft) ^a	Minimum Vertical Separation, ft ^a	
		Groundwater	Hydraulically-Restrictive Layer
Wet Season (November – March)	2	1	1
Dry Season (April – October)	3	2	1

- Map of investigation and testing locations
- Soil characteristics
- Depth to groundwater
- Results of subsurface investigations

Standard

Standard Subsurface Investigation Elements			
Minimum Investigation Depth and Vertical Separation Requirements			
Season	Minimum Investigation Depth (ft) ^a	Minimum Vertical Separation (ft) ^a	
		Groundwater	Hydraulically-Restrictive Layer
Infiltration Basins			
Wet Season (November – March)	6	5	5
Dry Season (April – October)	7	6	5
All Other Infiltration BMPs			
Wet Season (November – March)	2	1	1
Dry Season (April – October)	4	3	1

- Soil characteristics
- Detailed soil logs
- Small PIT report must be signed & stamped by a licensed professional

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Comprehensive

- Same report content as Standard
- Report must be prepared, signed, and stamped by geotechnical engineer or hydrogeologist

Comprehensive Subsurface Investigation Elements			
Minimum Investigation Depth and Vertical Separation Requirements			
Season	Minimum Investigation Depth (ft) ^{a,b}	Minimum Vertical Separation (ft)	
		Groundwater	Hydraulically-Restrictive Layer
Infiltration Basins			
Wet Season (November – March)	6	5	5
Dry Season (April – October)	10	8	5
Permeable Pavement Facilities			
Wet Season (November – March)	2	1	1
Dry Season (April – October)	4	3	1
Infiltrating Bioretention with Underdrain			
Wet Season (November – March)	2	1	1
Dry Season (April – October)	10	8	1
Infiltrating Bioretention without Underdrain and All Other Infiltration BMPs			
Wet Season (November – March)	4	3	3
Dry Season (April – October)	10	8	3

INFILTRATION FEASIBILITY AND TESTING

Simple Infiltration Test

- Dry Season vs Wet Season
- Minimum 2-feet deep x 2-feet across hole
- Pre-soak
- Testing
- Measured Rate
- Design Rate
- Use Checklist



www.seattle.gov/Documents/Departments/SDCI/Forms/SimpleInfilTestChecklist.pdf



INFILTRATION FEASIBILITY AND TESTING

Pilot Infiltration Test (PIT)

- Mimics constructed facility
- Licensed Professional Required
- Small vs. Large PIT
- Use Checklist

www.seattle.gov/Documents/Departments/SDCI/Forms/StormwaterPITChecklist.pdf



INFILTRATION FEASIBILITY AND TESTING

Table 3.3. Minimum Measured Infiltration Rates.

Infiltration BMP	Minimum Measured Infiltration Rate for On-site List Approach (in/hr)	Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Water Quality Treatment, and On-site Performance Standards (in/hr)
Infiltration Trenches	5	5
Drywells	5	5
Infiltrating Bioretention without underdrain	0.6	0.6
Infiltrating Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-site List Approach)
Permeable Pavement Facility	0.3	0.3 ^b
Permeable Pavement Surface	0.3 ^a	No minimum
Sidewalk/Trail Compost-Amended Strip	0.3^a	No minimum
Perforated Stub-out Connections	0.3	Not applicable (only for On-site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers/ Vaults	Not applicable	0.6

^a Infiltration testing not required, only necessary to prove infeasibility.

^b No minimum infiltration rate if underdrain is installed.

INFILTRATION FEASIBILITY AND TESTING

On-site List Calculator Summary Sheet

Infiltration Information

Is infiltration investigation required?	Yes	Type of test:	Simple infiltration test	
Is infiltration on the site feasible?	Yes			
Site Measured Infiltration Rate	4	x Infiltration Rate Correction Factor	0.5	= 2 Site Design Inf Rate

BMP Sizing

Surface	Area (sf)	Select BMP
1	1,000	Infiltrating Bioretention #1
2	0	
3	0	

BMP

Infiltrating Bioretention #1

BMP Facility Inputs

Contributing Area (sf)
Ponding Depth (inch)
Sideslopes
Underdrain

1,000
6
Sloped sides
No Underdrain

BMP Size and Credit

35 sf
13,574 gal managed/year

QUESTIONS?

SideSewerInfo@seattle.gov

206-684-5362

SDCI will be hosting regular live Q&A sessions throughout July and August. Please see the SDCI Stormwater Code page for more information and dates.

