

Green Infrastructure Webcast Series:

Retrofits: Green Streets and Operation & Maintenance

Retrofits: Green Streets Resources

Low Impact Development Center's Green Highways & Green Infrastructure website
http://lowimpactdevelopment.org/green_highways.htm

Green Highways Partnership
<http://greenhighways.org>

Transportation Research Board's Cooperative Research Programs
<http://trb.org/CRP/About/DivD.asp>

American Society of Civil Engineers
<http://asce.org>

EPA's Green Infrastructure website
<http://www.epa.gov/greeninfrastructure>

Interlocking Concrete Pavement Institute
<http://www.icpi.org>

RMC Research and Education Foundation
<http://www.rmc-foundation.org/>

Federal Highway Administration
<http://www.fhwa.dot.gov/>

Washington Post article on "Paving an Environmentally Friendly Path" (July 23, 2009)
<http://www.washingtonpost.com/wp-dyn/content/article/2009/07/22/AR2009072203470.html>

Operation and Maintenance Resources

Seattle Public Utilities' National Drainage Systems

<http://www.seattle.gov/util/naturalsystems>

Overview of Seattle's Natural Drainage Systems (PDF – 20 pages)

http://www.seattle.gov/util/stellent/groups/public/@spu/@esb/documents/webcontent/spu01_002840.pdf

Homeowners Landscape manual - Practically Easy Landscape Manual: A Care Manual for Natural Drainage Systems, Fall 2006 Edition (PDF – 19 pages)

http://www.seattle.gov/util/stellent/groups/public/@spu/@esb/documents/webcontent/spu01_002605.pdf

High Point Landscape Maintenance Guidelines (PDF – 74 pages)

http://www.seattle.gov/util/stellent/groups/public/@spu/@esb/documents/webcontent/spu01_002627.pdf

Attached:

- Natural Drainage Systems (NDS) O&M Manual (an updated version will be posed on the Natural Drainage Systems website Fall 2009)
- Landscape Maintenance Categories (LMC) and Characteristics Checklist
- Key Performance Indicators Reporting Form
- Residential Rainwise - Homeowner Maintenance agreement (final will be posted on the Natural Drainage Systems website Fall 2009)

Seattle Public Utilities

Natural Drainage Systems (NDS)
Maintenance Manual

Revision Date: December 2007

Table of Contents

| | |
|----------------------------------|---|
| I. Overview | 4 |
| II. How to Use This Manual | 4 |
| III. NDS Contacts..... | 4 |

List of Tables

| | |
|---|----|
| Table I. Landscape Manual | 5 |
| Table II. System Functionality | 5 |
| Table III. Hardscape Manual | 12 |
| Table IV. Other Elements | 17 |
| Table V. Infiltration | 20 |
| Table VI. Safety, Spill Prevention and Response, and Pest Control | 21 |

I. Overview

This chart is a summary of *routine* maintenance activities for the design of Natural Drainage System (NDS) Projects. Several *non-routine* maintenance activities are also included within this chart.

This chart is intended to be a Maintenance Manual for scheduling and performing maintenance activities. The manual features images and descriptions for vegetation, hardscape, infrastructure, and infiltration rates. It includes NDS sites used currently in Seattle and several images from NDS projects in other municipalities. It is important to realize that *no single project includes every design element*. (That is, all the NDS portrayed in this chart will *NOT* be found within a given NDS project.) Maintenance crew coordinators need to use the relevant maintenance categories for a given project per the NDS Service Agreement.

This manual is divided into four service levels for the vegetation section and three service levels for the hardscape and Infrastructure section. For some design elements, the service levels are very similar.

II. How to Use This Manual

The successful use of this manual hinges on the inspection of project features, which in turn triggers the appropriate maintenance activities. To use this chart first select the desired Service Level for maintenance on an existing NDS project, then maintenance crews will inspect the system for the conditions listed in the left-hand column of the chart. Note that the desired service level may vary from project to project, based on the NDS goals, the project location, the project age (i.e. whether or not the plants have successfully established), and economic considerations. The descriptions and images for each service level may be used to help determine by visual inspection whether recommended maintenance activities, in the right-hand column, will need to be performed.

III. Contacts

| Name | Phone Number | Title |
|----------------|---------------------|--------------------------------|
| Drena Donofrio | 206-571-1566 | NDS O&M Asset Manager |
| Deb Heiden | 206-386-1802 | Urban Ecosystems Asset Manager |
| Tracy Tackett | 206-386-0052 | LID Program Manager |

Table I. Landscape Manual

| Service Category | Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service D (Poor Effort) |
|---|--|--|---|--|
| Aesthetics (vegetation and trash) | <ul style="list-style-type: none"> • Planted vegetation is healthy, dense, and attractive • Little or no weeds are present • Clean, distinct edges • Mulch is evenly distributed & deep enough • No bare spots • No evidence of erosion (stabilized surfaces) • At least 80% survival of establishing plants • Limited shoulder compaction • Plant palette is working for facility • Homeowner is fully maintaining (where applicable) | <ul style="list-style-type: none"> • Planted vegetation is mostly healthy with a generally good appearance • Small quantities of weeds are present • Loose edges: grass encroaching on swale or vice versa, plant hanging onto street/sidewalk • Some mulch is present • Occasional bare spots • Erosion likely unless maintenance improved • Some shoulder compaction • Plant palette is mostly working for facility • Homeowner is providing some maintenance (where applicable) • Able to achieve Level A without complete retrofit | <ul style="list-style-type: none"> • Poor Planted vegetation health and appearance • Weeds common • No edges; surrounding vegetation spills into swale or vice versa • Mulch is absent • Bare spots are frequent • Substantial eroded areas • Shoulder compaction • Plant palette is not working for facility • Homeowner is not maintaining swale (where applicable) • Unable to achieve higher service levels without complete retrofit | <ul style="list-style-type: none"> • Poor Planted vegetation health and appearance • Weeds dominant • No edges; surrounding vegetation spills into swale or vice versa • Mulch is absent • Bare spots are common • Substantial eroded areas • Shoulder compaction • Plant palette has failed • Homeowner is not maintaining swale (where applicable) • Unable to achieve higher service levels without complete retrofit |
| Special Considerations for Noxious Weeds | Zero tolerance of Class A, B, C and non-designated noxious weeds | Zero tolerance of Class A and B. Class C weeds are controlled or absent. Non-designated weeds are controlled or absent. | Zero tolerance of Class A weeds. Class B and C are controlled. Non-designated are present (Control Prog. Is minimal) | Zero tolerance of Class A weeds. Class B, C, and Non-Designated are largely uncontrolled except for public safety reasons (illegal dumping, obstructs vision) |
| <p><u>King County Noxious Weed List</u></p> | | | | |

| | | | | |
|---|---|--|--|--|
| <p>Planted vegetation coverage, health and appearance</p> | <p>Lush vegetation; excellent appearance</p>  | <p>Mostly healthy vegetation with good appearance</p>  | <p>Mostly healthy vegetation with neglected appearance</p>  | <p>Poorly planted vegetation health and neglected appearance</p>  |
| | <p>Healthy, well-maintained vegetation; excellent appearance</p>  | <p>Appearance is good</p>  | <p>Moderate appearance</p>  | <p>Poorly maintained appearance</p>  |

| | | | | |
|---|--|--|---|---|
| <p>Organic matter (mulch layer), edges, shoulder compaction</p> | <p>Deep mulch layer, clean edges, limited compaction</p>  | <p>Some mulch, loose edges, some compaction</p>  | <p>Little mulch, no defined edge, shoulder compaction</p>  | <p>No mulch, no defined edge, shoulder compaction</p>  |
| <p>Presence of weeds</p> | <p>No weedy species present</p>  | <p>Occasional weedy species</p>  | <p>Lots of Weedy species</p>  | <p>Weedy species predominant</p>  |

Erosion and bare spots

No erosion or bare spots



Some erosion and bare spots



Substantial erosion and bare spots



Completely eroded and bare spots



Table II. System Functionality

| Service Category | Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Poor Effort) |
|--|--|--|--|---|
| SYSTEM FUNCTIONALITY | | | | |
| Bioretention (vegetation & soils/substrate) | <ul style="list-style-type: none"> • At least 80% of swale bottom is covered with healthy, wetland vegetation • Soil is well aerated, no evidence of vehicle compaction • No erosion, channelization or scouring • Water drains within 24 hours • Minimal bare spots • Acceptable level of sediment or debris accumulation | <ul style="list-style-type: none"> • Between 60-80% of swale bottom is covered with healthy, wetland vegetation • Some evidence of vehicle compaction (lack of mulch) • Some erosion, channelization or scouring • Most water drains within 24 hours, minimal long-term ponding • A few bare spots • Acceptable level of sediment or debris accumulation | <ul style="list-style-type: none"> • Between 40-60% of swale bottom is covered with healthy, wetland vegetation • Compacted soils • Erosion, channelization or scouring • The presence of long-term ponding (> 72 hours) • Many bare spots • Significant build up of sediment or debris | <ul style="list-style-type: none"> • Less than 40% of swale bottom is covered with healthy, wetland vegetation • Compacted soils • Erosion, channelization or scouring • The presence of long-term ponding (> 72 hours) • Many bare spots • Significant build up of sediment or debris |
| Biofiltration (vegetation & soils/substrate) | <ul style="list-style-type: none"> • At least 80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least 18 - 24 inches high • No erosion, channelization or scouring • No ponding • Minimal bare spots • Acceptable level of sediment of debris accumulation | <ul style="list-style-type: none"> • Between 60-80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least 18 - 24 inches high • Some erosion, channelization or scouring • No ponding • A few bare spots • Acceptable level of sediment or debris accumulation | <ul style="list-style-type: none"> • Between 60-40% of swale bottom covered with healthy, uniformed fine-stemmed vegetation, of at least 18 -24 inches high • Erosion, channelization or scouring • The presence of ponding • Many bare spots • Significant build up of sediment or debris | <ul style="list-style-type: none"> • Less than 40% of swale bottom covered with healthy, uniformed fine-stemmed vegetation, of at least 18 -24 inches high • Erosion, channelization or scouring • The presence of ponding • Many bare spots • Significant build up of sediment or debris |
| Bioretention + biofiltration (vegetation & soils/substrate) | <ul style="list-style-type: none"> • At least 80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Soil is well aerated, no evidence of vehicle compaction | <ul style="list-style-type: none"> • Between 50-80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Some evidence of vehicle compaction (lack of mulch) | <ul style="list-style-type: none"> • Less than 20-50% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Compacted soils • Erosion, channelization or scouring | <ul style="list-style-type: none"> • Less than 20% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Compacted soils • Erosion, channelization or |

| Service Category | Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Poor Effort) |
|---------------------------------|---|---|--|---|
| | <ul style="list-style-type: none"> • No erosion, channelization or scouring • Water drains within 24 hours • Minimal bare spots • Acceptable level of sediment or debris accumulation | <ul style="list-style-type: none"> • Some erosion, channelization or scouring • Most water drains within 24 hours, minimal long-term ponding • A few bare spots • Acceptable level of sediment or debris accumulation | <ul style="list-style-type: none"> • The presence of long-term ponding (> 72 hours) • Many bare spots • Significant build up of sediment or debris | <ul style="list-style-type: none"> • scouring • The presence of long-term ponding (> 72 hours) • Many bare spots or noxious weeds/grass • Significant build up of sediment or debris |
| Swale bottom vegetation |  |  |  |  |
| Sediment or debris accumulation |  |  |  |  |
| Conveyance | <ul style="list-style-type: none"> • Healthy vegetation | <ul style="list-style-type: none"> • Mostly healthy vegetation | <ul style="list-style-type: none"> • Some vegetation | <ul style="list-style-type: none"> • Poor or no vegetation |

| Service Category | Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Poor Effort) |
|---|---|--|--|--|
| (vegetation & soils/substrate) | <ul style="list-style-type: none"> • No erosion, channelization or scouring • Minimal bare spots • No build up of sediment or debris • No non-designed obstructions to flow | <ul style="list-style-type: none"> • Some erosion, channelization or scouring • A few bare spots • Some build up of sediment or debris • Minimal non-designed obstructions to flow (over-grown vegetation, trash rack blockages) | <ul style="list-style-type: none"> • Erosion, channelization or scouring • Many bare spots • Significant build up of sediment or debris • Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage) | <ul style="list-style-type: none"> • Erosion, channelization or scouring • Many bare spots • Significant build up of sediment or debris • Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage) |
| |  |  |  |  |

Table III. Hardscape Manual

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|--|--|---|--|--|
| HARDSCAPE & INFRA-STRUCTURE | <p style="text-align: center;">Summary</p> <ul style="list-style-type: none"> • sediment is minimal • infrastructure is always accessible • no competition between roots and pipes • no trash is present • small accumulation of organic debris on grates or screens • limited buildup of sediment behind check dams or log weirs • no erosion or undercutting surrounding weir walls • rocky and walls are stable and secure • stormwater sedimentation structures less than ½ full (NPDES) | <p style="text-align: center;">Summary</p> <ul style="list-style-type: none"> • some sediment is present • infrastructure is usually accessible • some competition between roots and pipes • small amounts of trash are present • moderate accumulation of organic debris on grates or screens • occasional large sediment deposits behind check dams or log weirs • minimal erosion and/or undercutting surrounding weir walls • occasional loose rocks; walls are secure • stormwater sedimentation structures less than ½ full (NPDES) | <p style="text-align: center;">Summary</p> <ul style="list-style-type: none"> • Lots of sediment buildup is observed • infrastructure is mostly inaccessible • significant competition between roots and pipes • Trash is present • Heavy accumulations of organic debris on grates or screens • frequent large sediment deposits behind check dams or log weirs • Erosion and/or undercutting surrounding weir walls • Loose rocks; walls are not secure • stormwater sedimentation structures less than ½ full (NPDES) | |
| <input type="checkbox"/> Sedimentation structures— TYPE 2 | <p>Sediment is blocking 10% of structure</p>  | <p>Sediment is blocking 30% of structure</p>  | <p>Sediment is blocking 50% of structure</p>  | <input type="checkbox"/> if sediment present, remove trash and unwanted organic debris <input type="checkbox"/> muck out / vacuor structure and dispose of waste properly |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|--|---|--|--|---|
| <input type="checkbox"/> Grates and debris screens on catch basins (CBs) | Accumulation of organic debris covers 10% of structure  | Accumulation of organic debris covers 30% of structure  | Accumulation of organic debris covers 50% of structure  | <input type="checkbox"/> if present, muck out / vector catch basins and dispose of waste properly. Clear debris and vegetation growth around intakes. |
| <input type="checkbox"/> Outlet structures—TYPE 2 | Accumulation of organic debris covers 10% of structure  | Accumulation of organic debris covers 30% of structure  | Accumulation of organic debris covers 50% of structure  | <input type="checkbox"/> Remove debris and dispose of waste properly |
| Flow control structures and overflow structures or pipes | Accumulation of organic debris covers 10% of structure | Accumulation of organic debris covers 30% of structure | Accumulation of organic debris covers 50% of structure | <input type="checkbox"/> remove debris and vegetation growth and dispose of waste properly |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|---|---|---|---|---|
| |  |  |  | |
| <input type="checkbox"/> Log weirs and check dams | <p>Sediment deposit of check dams or log weirs is about 10%</p>  | <p>Sediment deposits of check dams or log weirs is about 30%</p>  | <p>Sediment deposits of check dams or log weirs is about 50% or more</p>  | <input type="checkbox"/> add splash-pool (rocks) to reduce scouring of swale-bottom for undercutting or eroding <input type="checkbox"/> remove sediment, debris, and trash if ponding upstream of check-dam |
| <input type="checkbox"/> Weir walls w/ flow control notch | <p>Sediment deposit downstream of check dams or log weirs is about 10%</p> | <p>Sediment deposit downstream of check dams or log weirs is about 30%</p> | <p>Sediment deposit downstream of check dams or log weirs is about 50% or more</p> | <input type="checkbox"/> add rocks to splash-pool to prevent scouring <input type="checkbox"/> reinforce weir wall (<i>non-routine</i>) if leakage occurs at structure edges |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|---|--|---|---|--|
| |  |  |  | |
| <input type="checkbox"/> Rockery / boulders PHOTOS TO BE UPDATED (shown here with little vegetative cover, but rocks may become covered in plant growth in well- established projects) | 10% of rocks or walls are unsecured  | 30% of rocks or walls are unsecured  | 50% of rocks or walls are unsecured  | <input type="checkbox"/> ensure large rocks and boulders are stable |
| Manufactured block sidewalls | 10% of rocks or walls are unsecured | 30% of rocks or walls are unsecured | 50% of rocks or walls are unsecured | <input type="checkbox"/> ensure blocks and bricks are stable |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|---------------------------------|--|---|---|--|
| |  |  |  | |
| Soil-wrap walls ("green walls") | <p>Erosion or undercutting of 10% is walls visible around rockery, walls and weirs</p>  | <p>Erosion or undercutting of 30% is visible around rockery, walls and weirs</p>  | <p>Erosion or undercutting of 50% is walls visible around rockery, walls and weirs</p>  | <ul style="list-style-type: none"> □ repair as needed stabilize loose soil-bricks, notify vegetation crew if weeds present, water needed, or re-planting required |

Table III. Other Elements

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|---|---|---|--|--|
| <p>OTHER ELEMENTS</p> | <ul style="list-style-type: none"> • up to 10% blockage caused by organic matter, sediment, debris or trash • irrigation system functions properly with no blockages or breaks in drip system • ponding only to intended depth (varies by location) • pond capacity is maintained • no liner leakages reported | <ul style="list-style-type: none"> • between 10-30% blockage caused by organic matter, sediment, debris or trash • irrigation system functions properly with no blockages or breaks in drip system • ponding only to intended depth (varies by location) • some sediment may reduce pond capacity • no liner leakages reported | <ul style="list-style-type: none"> • more than 30% blockage caused by organic matter, sediment, debris or trash • irrigation system has occasional blockages or breaks in drip lines • ponding only to intended depth (varies by location) • sediment buildup causes reduced pond capacity • no leakages reported | |
| <p><input type="checkbox"/> Curb cuts</p> | <p>Curb is up to 10% blocked</p>  | <p>Curb is between 10-40% blocked</p>  | <p>Curb is above 40% blocked</p>  | <p><input type="checkbox"/> remove trash and organic debris and dispose properly</p> |
| <p><input type="checkbox"/> Culverts</p> | <p>Culvert is up to 10% blocked</p> | <p>Culvert is between 10-40% blocked</p> | <p>Culvert is more than 40% blocked</p> | <p><input type="checkbox"/> remove trash and organic debris and dispose properly</p> |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|---|--|---|---|---|
| |  |  |  | |
| <input type="checkbox"/> Irrigation systems (for establishing vegetation) | <p>holes in drip irrigation correspond with plant locations; nozzles have no breaks, leaks, or blocks</p>  | <p>plants and drip holes mostly aligned minimal seeping of water when system is off; no breaks or blockages</p>  | <p>system has breaks or leaks; vegetation is not being adequately watered; complaints of ponding</p>  | <input type="checkbox"/> repair as needed (for establishing vegetation 0-3 years old) |
| <input type="checkbox"/> Porous/pervious pavers | <p>water infiltrates well, pavers are up to 10% clogged or minimal ponding is observed</p> | <p>water infiltrates well, pavers are between 10-40% clogged and minimal ponding is observed</p> | <p>water does not infiltrate well, pavers are more than 40% clogged</p> | <input type="checkbox"/> vactor debris |

| Service Category | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) | Recommended Maintenance Activities |
|------------------|---|--|---|------------------------------------|
| |  |  |  | |

Table IV. Infiltration

| | |
|-----------------------------|--|
| Infiltration Failure | Any evidence of a cell holding water for more than 24 hours needs to be reported to USM LID/NDS O&M Asset Manager for monitoring or retrofitting. Contact: Drena Donofrio at 206-571-1566 |
|-----------------------------|--|

Table VI. Safety, Spill Prevention and Response, and Pest Control

| Service Category | Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) |
|---|---|---|--|--|
| SAFETY, MOBILITY, ACCESS | <ul style="list-style-type: none"> • Vegetation causes no visibility (line of sight) or driver safety issues • Infrastructure is always accessible • Vegetation around infrastructure is maintained at height to prevent damage during routine maintenance | <ul style="list-style-type: none"> • Vegetation causes minimal visibility (line of sight) or driver safety issues • Infrastructure is mostly accessible • Most vegetation around infrastructure is maintained at height to prevent damage during routine maintenance | <ul style="list-style-type: none"> • Vegetation causes visibility (line of sight) or driver safety issues • Infrastructure is not accessible • Vegetation around infrastructure is will be damaged during routine maintenance | <ul style="list-style-type: none"> • Vegetation causes visibility (line of sight) or driver safety issues • Infrastructure is not accessible • Vegetation around infrastructure is will be damaged during routine maintenance |
| |  |  |  |  |
| SPILL PREVENTION | <ul style="list-style-type: none"> • Exercise spill prevention measures whenever handling or storing potential contaminants. | | | |
| SPILL RESPONSE | <ul style="list-style-type: none"> • Clean up spills as soon as possible to prevent contamination of stormwater. | | | |

PEST CONTROL

Insects:

- Standing water remains in the basin for time periods suitable to insect development.
- Identify the cause of the standing water and take appropriate actions to address the problem.

Rodents:

- Rodent holes are present near the facility.
- Fill and compact soil around the holes.

Natural Drainage Systems
Landscape Maintenance Categories (LMC) and Characteristics Checklist
Items for reporting in bold

Project Sites

- Carkeek Cascade at NW 110th**
- Broadview Green Grid - Carkeek Cascades at NW107th**
- Pinehurst Green Grid**
- 19th Avenue NE
- 20th Avenue NE
- 23rd Avenue NE
- NE 117th Street
- NE 113th Street
- 25th Ave NE
- Broadview Green Grid - SEA Streets**
- Phinney Ave N SEA Street
- Palatine Ave N SEA Street
- 1st Ave NW SEA Street
- 2nd Ave NW SEA Street
- SEA Streets #1**
- Viewlands Cascade**

| | | Maintenance Category A (Excellent) | Maintenance Category B (Good) | Maintenance Category C (Moderate) | Maintenance Category D (Low) |
|--|--|---|---|--|---|
| NDS Element | | | | | |
| Aesthetics (vegetation & trash) | All | | | | |
| | | <input type="checkbox"/> At least 90% of planted vegetation is healthy, dense, and attractive | <input type="checkbox"/> At least 75% of planted vegetation is healthy with a generally good appearance | <input type="checkbox"/> Between 40-75% of planted vegetation is healthy with a generally good appearance | <input type="checkbox"/> Less than 40% of planted vegetation is healthy and has a generally good appearance |
| | | <input type="checkbox"/> Less than 10% of the vegetation are weeds, unless on edge and provided erosion control | <input type="checkbox"/> Less than 25% of the vegetation are weeds, unless on edge and providing erosion control | <input type="checkbox"/> Between 60-25% of the vegetation are weeds, unless on edge and providing erosion control | <input type="checkbox"/> Greater than 60% of the vegetation are weeds |
| | | <input type="checkbox"/> Zero tolerance for noxious weeds | <input type="checkbox"/> Goal of zero tolerance for noxious weeds | <input type="checkbox"/> Control noxious weeds | <input type="checkbox"/> Control noxious weeds |
| | | <input type="checkbox"/> Clean, distinct edges | <input type="checkbox"/> Loose edges: grass starting to encroach on swale or vice versa, plants starting to hang over street/sidewalk | <input type="checkbox"/> Loose edges: grass encroaching on swale or vice versa, plant hanging over street/sidewalk | <input type="checkbox"/> No edges; surrounding vegetation spills into swale or vice versa |
| | | <input type="checkbox"/> Mulch covers 100% of swale and is at least 4" deep | <input type="checkbox"/> Mulch covers at least 90% of swale and is at least 4" deep | <input type="checkbox"/> Mulch covers at least 60% of swale and is at least 4" deep | <input type="checkbox"/> Mulch covers less than 60% of swale |
| | | <input type="checkbox"/> No bare spots | <input type="checkbox"/> Less than 10% bare spots | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> More than 40% bare spots |
| | | <input type="checkbox"/> No evidence of erosion (stabilized surfaces) | <input type="checkbox"/> A few areas of potential erosion | <input type="checkbox"/> Some areas of erosion | <input type="checkbox"/> Substantial eroded areas |
| | <input type="checkbox"/> Homeowner is fully maintaining (where applicable) | <input type="checkbox"/> Homeowner is providing some maintenance (where applicable) | <input type="checkbox"/> Homeowner is providing low level of maintenance (where applicable) | <input type="checkbox"/> Homeowner is not maintaining swale (where applicable) | |
| | | | Able to achieve Level B without complete retrofit | <input type="checkbox"/> Unable to achieve higher service levels without complete retrofit | |
| Consideration for Noxious Weeds | | Zero tolerance for Class A and Class B noxious weeds. Goal of zero tolerance for Class C noxious weeds. | Zero tolerance for Class A noxious weeds. Goal of zero tolerance for Class C noxious weeds. | Zero tolerance for Class A noxious weeds. Class B and Class C noxious weeds are controlled. | Zero tolerance for Class A noxious weeds. Class B and Class C noxious weeds are controlled. |
| | | King County Noxious Weed List | | | |

| System Type | | | | | | |
|--|--|--|---|---|--|--|
| Bioretention (vegetation & soils/substrate) | SEA Streets (2 nd Ave NW from NW 117 th St to NW 120 th St) | | | | | |
| | SEA Streets (2 nd Ave NW from NW 117 th St to NW 120 th St) | | | | | |
| | BGG SEA Streets (Phinney Ave N, Palatine Ave N, 1 st Ave NW, 2 nd Ave NW from NW 110 th St to NW 107 th St) | | | | | |
| | Pinehurst (19 th Ave NE from NE 115 th St to NE 117 th St, 20 th Ave NE and 23 rd Ave NE from NE 113 th St to NE 117 th St, NE 113 th St from 20 th Ave NE and 23 rd Ave NE) | | | | | |
| | | <input type="checkbox"/> At least 90% of swale bottom is covered with healthy, wetland vegetation | <input type="checkbox"/> At least 75% of swale bottom is covered with healthy, wetland vegetation | <input type="checkbox"/> Between 40-75% of swale bottom is covered with healthy, wetland vegetation | <input type="checkbox"/> Less than 40% of swale bottom is covered with healthy, wetland vegetation | |
| | | <input type="checkbox"/> Bottom soil is well aerated, less than 10% compaction | <input type="checkbox"/> Bottom soil is well aerated, less than 20% compaction | <input type="checkbox"/> Less than 40% compaction | <input type="checkbox"/> More than 40% compaction | |
| | | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> Some erosion, channelization or scouring | <input type="checkbox"/> Erosion, channelization or scouring | |
| | <input type="checkbox"/> Less than 10% bare spots | <input type="checkbox"/> Less than 25% bare spots | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Greater than 40% bare spots | | |
| | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Significant build up of sediment or debris – greater than 3 inches, unless otherwise noted | | |
| | | | <input type="checkbox"/> Moderate level of sediment or debris accumulation – 3 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | | | |
| Biofiltration (vegetation & soils/substrate) | | | | | | |
| <i>*this value is equal to 3 x design flow depth and will vary with each project</i> | | <input type="checkbox"/> At least 90% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least XX* inches high | <input type="checkbox"/> At least 80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least XX* inches high | <input type="checkbox"/> Between 60-80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least XX* inches high | <input type="checkbox"/> Less than 60% of swale bottom covered with healthy, uniformed fine-stemmed vegetation, of at least XX* inches high | |
| | | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> Some erosion, channelization or scouring | <input type="checkbox"/> Erosion, channelization or scouring | |
| | | <input type="checkbox"/> Less than 10% bare spots | <input type="checkbox"/> Less than 20% bare spots | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Greater than 40% bare spots | |

| | | | | | |
|---|-------------|---|---|---|---|
| | | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 3 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – greater than 3 inches, unless otherwise noted |
| | | | | | |
| Bioretention with Biofiltration (vegetation & soils/substrate) *this value is equal to 3 x design flow depth and will vary with each project | Which ones? | <input type="checkbox"/> At least 90% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least XX* inches high | <input type="checkbox"/> At least 80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least XX* inches high | <input type="checkbox"/> Between 40-80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least XX* inches high | <input type="checkbox"/> Less than 40% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least XX* inches high |
| | | <input type="checkbox"/> Bottom soil is well aerated, less than 10% compaction | <input type="checkbox"/> Bottom soil is well aerated, less than 20% compaction | <input type="checkbox"/> Less than 40% compaction | <input type="checkbox"/> More than 40% compaction |
| | | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> Some erosion, channelization or scouring | <input type="checkbox"/> Erosion, channelization or scouring |
| | | <input type="checkbox"/> Less than 10% bare spots | <input type="checkbox"/> Less than 25% bare spots | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Greater than 40% bare spots |
| | | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Significant build up of sediment or debris – greater than 3 inches, unless otherwise noted |
| | | | | <input type="checkbox"/> Moderate level of sediment or debris accumulation – 3 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | |

| | | | | | |
|---|-----|---|---|---|---|
| Conveyance (vegetation & soils/substrate) | | <input type="checkbox"/> At least 90% of swale bottom is covered with healthy vegetation | <input type="checkbox"/> At least 75% of swale bottom is covered with healthy, wetland vegetation | <input type="checkbox"/> Between 40-75% of swale bottom is covered with healthy, wetland vegetation | <input type="checkbox"/> Less than 40% of swale bottom is covered with healthy, wetland vegetation |
| | | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> No erosion, channelization or scouring | <input type="checkbox"/> Some erosion, channelization or scouring | <input type="checkbox"/> Erosion, channelization or scouring |
| | | <input type="checkbox"/> Less than 10% bare spots | <input type="checkbox"/> Less than 25% bare spots | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Greater than 40% bare spots |
| | | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Acceptable level of sediment or debris accumulation – 2 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Less than 40% bare spots | <input type="checkbox"/> Significant build up of sediment or debris – greater than 3 inches, unless otherwise noted |
| | | <input type="checkbox"/> No non-designed obstructions to flow | <input type="checkbox"/> Minimal non-designed obstructions to flow (over-grown vegetation, trash rack blockages) | <input type="checkbox"/> Moderate level of sediment or debris accumulation – 3 inches, unless otherwise noted or accumulation prevents achievement of previous bullet | <input type="checkbox"/> Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage) |
| | | | | <input type="checkbox"/> Several non-designed obstructions to flow (over-grown vegetation, trash rack blockages) | |
| Other Structures | All | | | | |
| Weir walls, check dams, and log weirs | | | <input type="checkbox"/> Weir walls, check dams and log weirs are stable and secure | <input type="checkbox"/> Minimal erosion and/or undercutting around weir walls, check dams and log weirs | <input type="checkbox"/> Moderate erosion and/or undercutting around weir walls, check dams, and log weirs |
| Rockery, boulders, manufactured block sidewalls, soil-wrapped green walls | | | <input type="checkbox"/> Acceptable level of sediment or debris accumulation behind weir walls, check dams or log weirs – 2 inches, unless otherwise noted | <input type="checkbox"/> Moderate level of sediment or debris accumulation behind weir walls, check dams or log weirs – 3 inches, unless otherwise noted | <input type="checkbox"/> Significant level of sediment or debris accumulation behind weir walls, check dams or log weirs – greater than 3 inches, unless otherwise noted |

| | | | | | |
|--|-----|--|---|---|--|
| | | | <input type="checkbox"/> Rockery, boulders, and walls are stable and secure | <input type="checkbox"/> 10 % of the rocks or boulders are loose; 10 % of walls have areas of erosion or lack vegetation | <input type="checkbox"/> 30 % of the rocks or boulders are loose; 30 % of walls have areas of erosion or lack vegetation |
| | | | <input type="checkbox"/> No erosion or undercutting visible around rockery, boulders or walls | <input type="checkbox"/> Minimal erosion or undercutting visible around rockery, boulders or walls | <input type="checkbox"/> Moderate erosion or undercutting visible around rockery, boulders or walls |
| | | | | | |
| Safety, mobility, access | All | <input type="checkbox"/> Vegetation causes no visibility (line | <input type="checkbox"/> Vegetation causes minimal visibility (line of sight) or driver safety issues | <input type="checkbox"/> Vegetation causes moderate visibility (line of sight) or driver safety issues | <input type="checkbox"/> Vegetation causes significant visibility (line of sight) or driver safety issues |
| | | <input type="checkbox"/> of sight) or driver safety issues | <input type="checkbox"/> Infrastructure access is 20% blocked | <input type="checkbox"/> Infrastructure is 50% blocked | <input type="checkbox"/> Infrastructure is not accessible |
| | | <input type="checkbox"/> Infrastructure is accessible | <input type="checkbox"/> 80% of vegetation around infrastructure is maintained at height to prevent damage during routine maintenance | <input type="checkbox"/> 60% of vegetation around infrastructure is maintained at height to prevent damage during routine maintenance | <input type="checkbox"/> Vegetation around infrastructure is too tall and will be damaged during routine maintenance |
| | | <input type="checkbox"/> Vegetation around infrastructure is maintained at height to prevent damage during routine maintenance | | | |
| | | | | | |
| Long-term Ponding - if failing report to USM with in one week | | <input type="checkbox"/> Water drains within 24 hours (100% of swale) | <input type="checkbox"/> Water drains within 24 hours (100% of swale) | <input type="checkbox"/> Water drains within 24 hours for at least 90% of swale bottom | <input type="checkbox"/> Water drains within 24 hours for at least 90% of swale bottom |

Overall score for KPI Reporting Form* _____

*Overall score will be lowest category of check box

NDS KPI Reporting Form USM Urban Watersheds

Date:

| Project Location | Drainage area (sq ft) | Hardscape Maintained to: | | Land-scaped area (sq ft) | Vegetation Maintained to: | | Infiltration Failure | |
|---|-----------------------|--------------------------|--------|--------------------------|---------------------------|--------|----------------------|--------------------------------------|
| | | Target | Actual | | Target | Actual | Yes/No | Cells retrofitted (Urban Ecosystems) |
| Carkeek Cascade at NW 110th | 4,730 | B | | 17,130 | B | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| Broadview Green Grid - Carkeek Cascades at NW107th | 8,240 | B | | 29,330 | B | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| Pinehurst Green Grid | 19,160 | B | | 69,650 | B | | | |
| 19th Avenue NE | 3,170 | B | | 9,850 | B | | | |
| 20th Avenue NE | 5,390 | B | | 27,370 | B | | | |
| 23rd Avenue NE | 5,710 | B | | 18,160 | B | | | |
| NE 117th Street | 2,240 | B | | 6,400 | B | | | |
| NE 113th Street | 2,320 | B | | 7,870 | B | | | |
| 25th Ave NE | 330 | B | | ?? | B | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| High Point | | B | | | B | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| Broadview Green Grid - SEA Streets | 9,470 | B | | 63,640 | D | | | |
| Phinney Ave N SEA Street | 2,000 | B | | 15,700 | D | | | |
| Palatine Ave N SEA Street | 2,840 | B | | 19,080 | D | | | |
| 1 st Ave NW SEA Street | 2,060 | B | | 12,130 | D | | | |
| 2 nd Ave NW SEA Street | 2,570 | B | | 16,730 | D | | | |

| | | | | | | | | |
|----------------------------|---------------|----------|--|----------------|----------|--|--|--|
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| SEA Streets #1 | 1,390 | C | | 15,860 | D | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| Viewlands Cascade | 2,680 | B | | 7,120 | D | | | |
| Comments | | | | | | | | |
| Project Achievement | | | | | | | | |
| Other | | | | | | | | |
| Comments | | | | | | | | |
| Total Achievement | 45,670 | | | 202,730 | | | | |

Reported by: _____

NOTE: Form to be filed out by Field Operations Representative, sent to Drena Donofrio in USM and Diane Clausen

| | |
|-----|------|
| Key | A= 4 |
| | B= 3 |
| | C= 2 |
| | D= 1 |

How to Use
Project achievement is determined for each project location. Total Achievement is the KPI for all NDS
To determine project achievement multiply project area by actual numerical maintenance
To determine total achievement sum project achievement and divide by total number of project



**SEATTLE PUBLIC UTILITIES
RAINCATCHER PILOT PROJECT
AGREEMENT**

This agreement (Agreement) is made on the ____ day of _____, 20__, by and between Seattle Public Utilities (SPU) and _____(Homeowner).

This Agreement establishes the understanding between SPU and the Homeowner regarding the terms and conditions governing the Homeowner's participation in SPU's RainCatcher Pilot Project. Homeowner owns and occupies the real property located at _____, Seattle, Washington (Property).

TERMS AND CONDITIONS

In consideration of their mutual promises and commitments, SPU and Homeowner hereby mutually agree as follows:

1. Homeowner grants SPU permission to enter onto the Property, at reasonable times to be arranged in advance by mutual agreement, to:
 - a. evaluate whether the Property is an appropriate site for the installation and effective operation of the rainwater reclamation and detention system.
 - b. install the System, if SPU determines the Property is an appropriate site for the installation of the System; and
 - c. monitor, repair, and evaluate the System.

2. In the event SPU determines that the site is appropriate for installation of the System, SPU will:
 - a. encourage the Homeowner to be present and to participate in the installation of the System on the Property;
 - b. demonstrate for the Homeowner the proper operation and maintenance procedures for the System;
 - c. provide Homeowner with written instructions for the proper operation and maintenance of the System; and
 - d. remain available to respond to any questions from the Homeowner about the System during the term of this Agreement.

3. SPU will conduct all activities on the Property, including installing, repairing, monitoring, and evaluating the System, in a safe manner and so as not to interfere unreasonably with the Homeowner's use of the Property.
4. SPU will exercise reasonable care to avoid damage to or loss of Homeowner's Property or improvements located on it during the course of performance of this Agreement. SPU will assume responsibility for damage, loss, or injury caused by the sole negligence of SPU's employees and agents during the course of performance of this Agreement. SPU will provide a written report to the Homeowner within 48 hours of any such damage, loss, or injury, and Homeowner will cooperate with SPU to mitigate any such damage, loss, or injury, if reasonable mitigation measures can be taken.
5. Homeowner will operate and maintain the System in accordance with the operation and maintenance procedures provided by SPU. Homeowner will exercise reasonable care to avoid interference with, damage to or loss of the equipment, instruments, and other property SPU installs on the Property under this Agreement and will provide prior written notice to and consult with SPU regarding any planned alterations to the Property that may affect System performance.
6. The term of this Agreement will begin on the date *written on the inspection sign off form(Exhibit C) to be filled out upon satisfactory completion by SPU or its agents* and end 5 years after the installation of the System.
7. At the end of the term of this Agreement, ownership of the System will transfer to Homeowner, unless Homeowner prefers to have the System removed from the Property. If at the end of the term of this Agreement Homeowner requests that SPU remove the System from the Property, SPU will remove the System from the Property and restore the Property to pre-project conditions, to the extent that is reasonably feasible, at no cost to the Homeowner.
8. At anytime prior to the end of the term of this Agreement, Homeowner may request that SPU remove the System from the Property, and SPU will do so and restore the Property to pre-project conditions, to the extent that is reasonably feasible, at no cost to the Homeowner; provided, however, that if Homeowner requests that SPU remove the System within the first two years of this Agreement, Homeowner must reimburse SPU for the costs associated with removing the System and restoring the Property.
9. No use, however extended, of the Property shall create or vest in SPU any ownership or property rights in the Property.
10. There shall be no compensation to the Homeowner other than the promises and commitments made by SPU as part of this Agreement.
11. Nothing contained in this Agreement shall be construed to require the Homeowner to alter or improve the Property or any access to the Property. Homeowner will provide prior written notice to and consult with SPU regarding any planned alterations to the

Property that may affect System performance. (Examples would include, additions to the property that would affect roof drainage area, or alterations to gutters or downspouts.)

12. As soon as possible, but no later than three days after listing the Property for sale, Homeowner will provide written notice to SPU of Homeowner's intentions to sell the Property, so as to allow SPU adequate time to either remove the System from the Property or negotiate with the potential new owner regarding the continued use of the System.

13. All written notices or reports required under this Agreement shall be given by posting in first class mail as follows:

To SPU: Seattle Public Utilities
Real Estate Services
700 5th Avenue, Suite 4900
P.O. Box 34018
Seattle, WA 98124-4018

To Homeowner: _____

SPU and Homeowner have executed this Agreement in duplicate, effective on the date first written above.

By: _____
Seattle Public Utilities

Date: _____

By: _____
Homeowner

Date: _____