Making it Last: Operations and Maintenance for Bio-retention Landscapes

Peg Staeheli, ASLA, LEED® AP

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Introduction

- LID Maintenance: Is it different?

- “The maintenance of LID facilities is essential to ensure that design stormwater management and other benefits continue over the full lifecycle of the installation”

- What is meant by “lifecycle”?

- Education Information: What to look for.
  - Drainage
  - Safety
  - Aesthetics

- Training for Maintenance
  - Homeowner
  - Private Crews
  - Public Crews
Landscape Maintenance

- Non-Chemical Approach
- Leaf, Branch and Trash Removal
- Lawn Areas
  - Mowing Tasks
  - Edging
  - Trimming
  - Weed Control
  - Aeration, Overseeding and Top Dressing
  - Fertilization
  - Compost and Compost Tea
  - Lime Application
  - Pest Control
Landscape Maintenance

- Planted Areas - Tree, Shrub and Ground Cover Care
  - Staking and Guying
  - Edging and Trimming Planted Areas
  - Weed Control
  - Pest Control
  - Grooming Perennials and Ornamental Grasses
Landscape Maintenance

- Planted Areas - Tree, Shrub and Ground Cover Care
  - Pruning
  - Mature Tree Care
  - Conifer Pruning
  - Non-NDS Areas - Bark Mulch Replacement
  - NDS Areas - Composted Mulch Replacement
  - Fertilization (Non-NDS Only) and Compost Tea
Landscape Maintenance

- Plant Replacement and Installation
  - Planting Pit Preparation
  - Tree and Shrub Placement
  - Ground Cover Spacing
  - Mulching
  - Staking
Regular maintenance of the natural drainage swales enhances their appearance and long-term function. Features associated with the NDS, such as drain curb cuts, inlets, culverts, pedestrian berms and porous cement concrete walks, driveways and streets require their own scheduled upkeep.

- **Drainage Swales**
  - Protecting Swales During Maintenance
  - Debris
NDS/LID Drainage Maintenance

- Drainage Swales
  - Erosion
  - Sediment Accumulation
  - Ponding and Mosquito Control
  - Drain Curb Cut Openings
NDS/LID Drainage Maintenance

- Drainage Swales
  - Overflow Channels and Pedestrian Berms
  - Culverts (Outlets)
  - Catch Basins and Inlets
NDS/LID Drainage Maintenance

- Hardscape and Other Features
  - Porous Cement Concrete Walks
  - Porous Gravel Pave Pathways
NDS/LID Drainage Maintenance - Ponds

- Obstructions
- Trash
- Sediment
- Algae
- Invasive Plants
- Recirculation
- Mosquitoes
Irrigation

- Irrigation Schedule
  - Lawn Irrigation
  - Tree, Shrub and Ground Cover Irrigation
  - Extreme Drought Conditions
  - Irrigation System Maintenance

- Irrigation Trouble-Shooting
  - User Damage
  - Vehicular Damage
Landscape Trouble Shooting

- Lawns
  - Poor Color
  - Excess Thatch
  - Infiltrative capacity
  - Weed Problem Areas
    - Clover: good or bad?
Landscape Trouble Shooting

- Lawns
  - Compacted Soils
  - Moss
  - Tree Plantings in Lawn
  - Reinforced Grass Edges
Landscape Trouble Shooting

- Trees, Shrubs and Ground Covers
  - Nutrient Deficiencies
  - Diseases
  - Relocating Plants
Landscape Trouble Shooting

- Trees, Shrubs and Ground Covers
  - Plant Species Replacement
  - When a Landscape Plant Becomes a Weed
  - Vehicle/Landscape Edge Conflicts
Denny Park Apartments, Seattle 2007

Site visit 2007
Example of O&M needs
- Works for stormwater but
- Natives…volunteering
- Maintenance staff changes
- Resident communication
- Weeding the planters

Stormwater Planter on building edge

Volunteer natives-
problem trees

Kitchen garden
Needs funding

Stormwater Planter on deck
NDS/LID Drainage Modifications

There may be problem areas within the ROW drainage facilities that require special ongoing maintenance and may warrant field modifications. Drainage facility problem areas can result from grading issues, improper material use, plant growth and establishment, intensive rain events or user impacts.

- **Drainage Swales**
  - Excessive and Repeated Erosion
  - Repeated Sediment Buildup
  - Ponding
  - Excessive Vegetation
  - Change from Lawn to Planting

Grading adjustments are needed where excessive ponding occurs.
NDS/LID Drainage Modifications

- **Other Drainage Related Issues**
  - Washout
    - Is the surface elevation too high at edge of planted area?
    - Does grading of swale channel need adjustment?
  - Porous Pavement and Ground Cover Migration
    - Where fragaria species (strawberry) or other fast-spreading ground covers are planted adjacent to porous pavement, the ground cover may spread too aggressively and root in the pavement. This migration is of particular concern with porous paving, as the ground cover will establish, collect sediment and reduce the pavement’s function. Ground cover plantings must be kept from establishing on porous pavement.
Materials

Materials used in maintenance must meet the original material or product requirements to be consistent with the intent of design. If in doubt, ask either the Owner, Agency, or outside resource.

- **Plant Material**
  - **Plant Selection**
    - Plant materials for bio-retention are typically carefully selected to suit the varied conditions for a site. To ensure successful establishment and function of vegetation, select plants suited to the locations’ microclimates.
    - Select plants based on these guidelines:
      - Typical of their species or variety
      - Healthy with vigorous growth
      - Fully developed form with dense branching
      - Vigorous, fibrous root systems
  - Balled and Burlapped (B&B) and Bare-Root Plants
  - Container Plants
  - Lawn Seed Mix
Materials

- Pest, Weed and Disease Control Products
  - Weed Control
  - Pest and Disease Control
- Mulch
  - Compost Mulch
  - Medium Bark Mulch
  - Arborist Wood Chips (hog fuel)
- Fertilizers and Amendments
  - Lawn Areas
  - Trees
  - Mixed Planted Areas
  - Compost Tea
  - Lime
- Sand and Soil Mixes
  - Fill sand
  - Gravelly Sand
  - Bioretention Mixes
- Rock, Cobbles, Drain Rock and Gravel
  - Cobbles for Drainage Facilities
  - Drain Rock for Landscaped Edges
  - Drain rock or gravel for Gravel Pave Geogrid Cells
Equipment

- **Power Equipment**

- **Manual Equipment**

- **Other Equipment/ Specialty Items**
  - Flame Weeders, Hot water weeders, Small on-site composting bins
# High Point Natural Drainage Maintenance Schedule At-A-Glance

## Applies to All Landscaped Areas [Natural Drainage System (NDS) and Non-NDS]

<table>
<thead>
<tr>
<th>Month</th>
<th>NDS Areas</th>
<th>Non-NDS Areas ONLY</th>
<th>Pond</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apply Compost Mulch and Compost Tea</td>
<td>Vacuum Compost Concrete Walks</td>
<td>Add Medium Bark</td>
</tr>
<tr>
<td></td>
<td>Vacuum Rubber Concrete Walks</td>
<td>Vacuum Sediment, Re-fill Gravel Pave</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sweep Gravel and/or Gravel Pave</td>
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</tbody>
</table>

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</thead>
<tbody>
<tr>
<td></td>
<td>Prune Trees and Shrubs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Irrigation System</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pruning and Grooming Schedule: High Point Maintenance Manual, Section 24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Schedule

### January
- **1 time/week**
- **1 time/month**
- **1 time**
- **1 time**
- **1 time**
- **1 time**
- **1 time**
- **Late dormant season**

### February
- **1 time/week**
- **1 time/month**
- **1 time**
- **1 time**
- **1 time**
- **1 time**
- **Late dormant season**
- **Late dormant season**

### March
- **1 time/week**
- **1 time/month**
- **2 times**
- **1 time**
- **1 time**
- **1 time**
- **1 time**
- **1 time**

### April
- **1 time/week**
- **1 time/month**
- **3 times**
- **2 times**
- **1 time**
- **1/3 spring and/or fall**
- **Post bloom season**

### May
- **1 time/week**
- **1 time/month**
- **3 times**
- **1 time**
- **2 times**
- **1 time**
- **1 time**
- **Post bloom season**

### June
- **1 time/week**
- **1 time/month**
- **weekly**
- **3 times**
- **1 time**
- **1 time**
- **Bed, Swales and Pond**
- **Bed, Swales and Pond**

### July
- **1 time/week**
- **1 time/month**
- **weekly**
- **1 time**
- **3 times**
- **1 time**
- **Bed, Swales and Pond**
- **Bed, Swales and Pond**

### August
- **1 time/week**
- **1 time/month**
- **weekly**
- **3 times**
- **1 time**
- **1 time**
- **Bed, Swales and Pond**
- **Bed, Swales and Pond**

### September
- **1 time/week**
- **1 time/week**
- **weekly**
- **1 time late Sept. or Oct...**
- **3 times**
- **1 time**
- **1 time**
- **1 time**

### October
- **1 time/week**
- **1 time/week**
- **3 times**
- **... early Oct...**
- **2 times**
- **1 time**
- **1/3 spring and/or fall**
- **Bleeding Sap Pruning Season**

### November
- **1 time/week**
- **1 time/week**
- **2 times**
- **1 time**

### December
- **1 time/week**
- **1 time/month**
- **1 time**
- **1 time**

## Notes
- See Pond Operations and Maintenance Manual in Pond section of binder.
Additional Resources

- American Concrete Institute - Publication 522R-06 on Pervious Concrete May 2006
  http://www.aci-int.org/PUBS/newpubs/522.htm
- Green Meridian
- King County Department of Natural Resources - This agency provides information on a variety of natural lawn and garden care topics. Detailed information on pest and weed-identification and control are available.  http://dnr.metrokc.gov/topics/yard-and-garden/
- King County Extension - An organization that provides year-round advice on landscape issues, such as pests, diseases and plant selection. They are available weekdays by phone at 206/296-3440 and at various locations throughout the city, including West Seattle’s Farmers Market.  http://king.wsu.edu/Gardening/
- National Ready Mixed Concrete Association - Pervious Concrete Publications - www.nrmca.org
- Seattle Tilth - A local organization that provides information on organic gardening with a focus on urban agriculture. Their website provides links to information on organic gardening, soils, plant selection and many other topics. Their Maritime Northwest Garden Guide may be purchased from their website.  http://www.seattletilth.org/
- Seattle Public Utilities - This agency provides information on natural systems drainage, lawn care, plant selections, water use and other topics. - http://www.seattle.gov/util/services/
- Supplier Websites
  - Hendrikus Organics - www.hendrikusorganics.com/fertilizerblends.htm
  - Nature Safe - www.naturesafe.com/content/products/organic.html
  - Plant Health Care - www.planthealthcare.com/catalog/index.html
  - Walt’s Organics - www.waltsorganic.com
  - www.eartheasy.com/article_corn_gluten.htm
  www.pierce.wsu.edu/water_quality/LID/index.htm
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