

Low Impact Development in the Maintenance Phase after Construction

Maria Cahill, Green Girl Land Development Solutions

Proper operations and maintenance (O&M) of low impact development (LID) facilities in the final project phase will dictate whether the intended long-term benefits are realized. This fact sheet was developed to help inform the project team—including planners, designers, or contractors—of their roles in the maintenance phase.

Abilities and preferences of the maintenance staff and land owners should be considered when choosing which LID practices to implement.

Low-maintenance LID facilities and landscapes should always be considered first, since the owner's long-term maintenance costs can be much higher than the costs associated with the up-front planning, design, and construction costs. If a jurisdiction requires a particular facility, the design team should work to educate its owner and staff as to the facility's benefits and maintenance requirements.

Maintenance agreement

For privately owned facilities, a maintenance agreement between the jurisdiction and the facility owner will help alleviate confusion about responsibility and required main-



Figure 1.—All on-site activities have the potential to impact regional water quality.

tenance activities. There are many examples of stormwater swales and ponds being filled in after development by property owners who didn't understand their importance or simply didn't want them. To resolve this problem, a number of agencies throughout Oregon have chosen to file an O&M agreement for the property, regardless of land-use type, with the deed. This helps ensure that important information will be transferred from one property owner to the next. *See the example O&M Maintenance agreements from the City of Portland and Clean Water Services.*

Best management practices for maintenance

Maintenance alternatives available to the owner are often defined choices made during the design and construction phases; therefore, it's essential to consider O&M during the early planning phase of the project.

VEGETATED FACILITY MAINTENANCE

Vegetated facilities should have the following additional requirements:

- Maintain with integrated pest management using little to no herbicides, pesticides, or fertilizers. *See Salmon Safe's Certification Standards for Farms, Appendix C,*

*Salmon-Safe High Risk Pesticide List*¹ for pesticides to avoid.

- Maintain with little to no irrigation after establishment, to conserve water.
- Encourage vegetation to grow and become dense. For example, unless flows into the facility are blocked, vegetation doesn't need to be thinned. Preferably, plants will be allowed to grow tall, which will encourage root penetration into native soils and help increase the infiltration rate of the facility over time.²

SEDIMENT REMOVAL

Maintenance of conventional “gray” stormwater infrastructure, such as catch basins, pipes, and culverts, has focused primarily on reducing sediment loads and preventing clogging. Removal of sediment is even more critical for LID facilities such as rain gardens, planters, swales, and porous pavements. If sediments are in a structure like a manhole or catch basin, they are usually vacuumed out. Public facilities probably will require access for a large maintenance vehicle. *Check with your local sewer authority for access requirements that should be considered in the planning and design phases.*

Sediment removal from vegetated facilities might be more difficult, depending on the design. Scooping out sediment from around vegetation without harming the vegetation is time consuming and less likely to be performed. For a vegetated facility

¹ <http://bit.ly/192Ay4z> [last accessed 6-4-14]

² *Conversation with Tom Liptan on a tour*



Figure 2.—This catch basin has so much sediment, a shrub is growing in it.

receiving surface runoff, designers might use a vegetated forebay with rip rap to slow inflow velocities, and a check dam to spread flows over the rest of the facility. When sediment removal is needed, the plant disturbance occurs only in the forebay. Designers might also install a sumped catch basin or concrete settling basin, making sediment removal even easier.

Practices for all sites

Here are some additional maintenance practices to consider at any site.

- Protect air quality. Pollutants in the air settle on impervious surfaces and may pollute downstream waterways with stormwater runoff. Reduce or eliminate mowing. Gas mowers are a considerable source of smog. Consider a de-



Figure 3.—Mowing can greatly impact water quality.

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- sign that reduces lawn or specifies a low-grow seed mix.
- Choose the “right plant for the right place.” Choosing plants that grow best in the specific conditions of your site will reduce maintenance, irrigation, fertilizers, and pest control.
- Limit irrigation.
 - Use native and/or drought-tolerant plants.
 - Use drip-irrigation systems—or, if using native landscapes, hire a landscape contractor to water plants by hand for a two-year establishment period, which in Oregon would amount to irrigating for a total of six to eight months.
 - Inspect the irrigation system regularly.
- Control and manage invasive species. All plants are distributed by birds, wind, or water. Invasive species on your own property provide a source of competition for the native species regionally impacting habitat for native spe-

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cies. Invasives like English ivy and Himalayan blackberry can actually cause streambank erosion.¹

- Reduce erosion. Bare soil has the potential to increase sediments directly to the storm system. Even bare soil not close to a storm drain can contaminate the air.

—Cover bare soil with mulch.

—Maintain steep slopes with good vegetative cover or terrace area with walls.

- Provide source control. Activities to prevent pollutants from flowing or being tracked off the property include:

—Cover trash, recycling, and compost containers. In Portland commercial developments, these are required to be covered by a roof, hydraulically isolated (so that run-on under the roof doesn't occur), and to have an area drain plumbed to the sanitary sewer. Other jurisdictions simply require lids.

—Cover stored materials to reduce the effect of rainfall passing through them and picking up pollutants.

—Clean up pet waste.

See the fact sheets and example operations & maintenance checklists at the OSU Stormwater Solutions website for specific activities associated with various LID components.

³ <http://1.usa.gov/1cPqRW5> [LINK BROKEN]

Writing a plan

Most people think of stormwater management as the structural, highly engineered facilities we install to mitigate impervious surfaces, but stormwater management is provided naturally in landscape areas outside these facilities, too. Numerous activities both in and out of the LID facilities can impact the functioning of the facility, the landscape and, ultimately, the watershed. For instance, using coal tar-based asphalt sealants will generate toxic pollutants that may not be completely sequestered in rain gardens and could degrade water quality in receiving waterways. A spike in those pollutants in the rain garden could also impact the health of the plants and the soil animals that provide the long-term water-quality benefit on-site, meaning that more pollutants than expected

could be conveyed downstream. A well-written plan will identify maintenance procedures that are likely to be implemented, and will include alternative maintenance products and methods for activities that might occur throughout the site.

An operations and maintenance plan will holistically address the following items:

- Plant stewardship (maintenance practices, health monitoring, safety, replacement, and integrated pest management)
- Invasive species management (invasive species list common to the region, integrated pest management strategies appropriate for each species, monitoring)
- Organic materials management (healthy plant material compost-



Figure 4.—These dirty engine parts should be protected from the rain by a roof or some other waterproof covering.

- ing, diseased plant material disposal, wildfire prevention)
- Soil stewardship (soil amendments, approved fertilizers and use, erosion and compaction)
- Irrigation (irrigation volume and schedule, water source, temporary irrigation)
- Stormwater management facilities (plant replacement, sediment removal, erosion prevention, spill prevention, sweeping schedule, shut-off valve, spillway reconstruction, etc.)
- Snow and ice management (approved products, stockpiling of deicers and snow)
- Materials management (replacement standards and practices, hardscape maintenance and cleaning, site safety, hazardous material disposal)
- Recyclable, trash, and composting (methods for controlling pollution from these sources)
- Landscape maintenance equipment (maintenance practices and area defined, maintenance schedule to reduce emissions, invasive species transport)
- Sensitive site management (protection of vegetation, soil, and habitat)
- Adaptive management (re-evaluation process for adapting to future conditions)⁴

⁴ This list was copied from the ASLA's Sustainable Sites Initiative Guidelines & Performance Benchmarks 2009. Credit 8.1



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Figure 5.—Overwatering and poor directional control are wasting water and increasing flows to streams.

Drawing a plan

The O&M Plan should include a map of the site indicating where important features are located and how they should be accessed. The following items should be included in a site map:

- Access routes and areas to be protected from vehicular and foot traffic
- Impervious surfaces
- LID facilities
- Collection and conveyance systems
- Spill control kit

Interdisciplinary communication

During the planning phase at the very beginning of the project, maintenance staff should be consulted

to identify practices that they are most likely to use and to learn their attitudes about practices that could be implemented. If maintenance staff is left out of the discussion, it's likely that they may not understand the role of the LID practices they are required to maintain. In addition, LID facilities and their components may need to be tailored to the available maintenance equipment. When these steps are left out, facilities are often improperly maintained or they are modified to make maintenance easier—either of which may affect the facility's function in unexpected ways.

After construction is complete, a post-construction training should take place that educates the owner, maintenance staff, and other stakeholders about site stewardship practices.

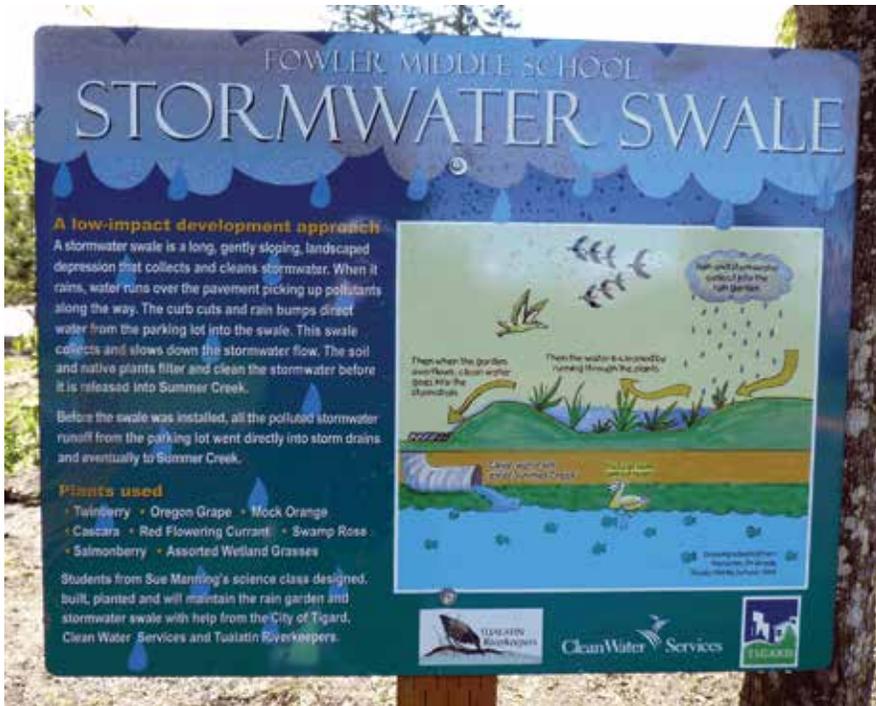


Figure 6.—Signage at Glencoe Elementary School in Portland protects the school’s rain garden from compaction.

References and resources

Example pre-notification letters to private property owners and a list of equipment needed to perform stormwater inspections:

<http://bit.ly/1jfGtI0> [last accessed 6-4-14]

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