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Challenging Sites: Quick Reference Guide to BMPs

Rainfall over an impervious area or even urban, typically very compacted, landscape areas tends to end up quickly in storm drains, which often drain indirectly or directly to a creek. This stormwater is called runoff and is laden with a whole host of pollutants. Also, the increased runoff volume erodes stream banks, causing landslides and contributing more pollutants.

The best way to protect and restore watershed health is to prevent runoff in the first place, which all of these practices do.

Challenging Sites

A site is considered challenging because it cannot easily or safely infiltrate runoff, so other means of runoff reduction must be identified, which may include prevention, infiltration of rainfall (before it becomes runoff), evaporation of rainfall, or evaporation of runoff. The criteria that make a site challenging include:

- Steep slopes
- High seasonal groundwater tables (i.e. seasonally flooded landscape areas)
- Slowly draining, clayey soils
- Tight setbacks or inadequate space between buildings

Best Practices at a Glance

The practices being proposed for this project are as follows:

Runoff Reduction Approach	Estimated Runoff Reduction	Manages	Through	Relative Cost
Restored Soils	50 – 80%	Rainfall on landscapes	Evaporation & infiltration	Very Low
Tree Planting	98%	Rainfall on landscapes	Evaporation & infiltration	Low
Container Gardens over Hardscapes	40 – 50%	Rainfall on hardscapes	Evaporation	Medium
Depaving	50% - 90%	Rainfall on hardscapes	Evporation & infiltration	Medium
Porous Walkways	90%	Rainfall on hardscapes	Infiltration of rainfall	High

Restored Soils

What is it? The practice of amending disturbed soils by mixing compost and other helpful materials into them. After amending, lawn, shrubs, meadows and/or trees may be planted.

How does this reduce runoff and protect water quality? Restored soil areas aerate the soil and restore the soil biology that provides watersheds with the long-term ability to infiltrate rain.

Where can it be done?

- **Disturbed or compacted soils:** Any soil that has been disturbed or compacted will benefit from compost amending, however existing landscape will be damaged and need to be replaced.
- **Avoid areas around existing landscaping:** If existing landscaping is to be preserved, areas under tree canopies and around other plants should not be tilled as this will damage roots.

What's the maintenance?

- **Reduce or eliminate irrigation, fertilizers, herbicides, & pesticides:** Maintenance practices of compost amended soils are the same as any landscape area, however improved soil health should allow reduction or elimination of irrigation, fertilizer, herbicide, and pesticide use.
- **Yearly mulch application:** Keep soil in landscaped garden areas covered with 2-4" of compost by mulching once a year. Aerate turf areas and top-dress with fine mulch.

What are some cost considerations? This practice varies with the type of landscape you choose to plant on top (lawn, meadow, shrubs, and/or trees). Long-term irrigation demand can be cut by 50% with a payback period of 3-7 years.

Tree Planting

What is it? The practice of planting a tree or group of trees.

How does this reduce runoff and protect water quality?

Tree canopy intercepts and evaporates rainfall, and roots pull water from the ground to breathe it out (evapotranspiration). Trees also hold soil in place with their roots and provide many other widespread benefits to air and land quality and human health, which in turn, impact water quality.

Where can it be done?

- **Where there is adequate soil:** Trees require soil with a minimum depth of 3' and an area of 150 square feet (small trees) to 450 square feet (large trees).
- **Where there are adequate setbacks:** Trees should be planted a minimum of 25' away from street light poles and the curb line of an intersection, and a minimum of 5' away from water mains, water meter boxes, driveway wings, fire hydrants, and utility lines. In the public right-of way, trees are generally recommended to be planted a minimum of 25' away from each other; however, on private property, they can be planted as close together as a few feet, depending on the species.

What's the maintenance?

- **Pruning:** To create a stable structure able to resist wind, trees may benefit from limited but prudent pruning in year 2, 5, 10, 15, 20, and 25. If a regular pruning schedule is followed, these trees can be very healthy, low maintenance amenities.
- **Establishment irrigation:** Irrigate native species during the 2 to 3 year establishment period. The smaller the tree planted (such as bare root) the more quickly it will establish and the sooner irrigation will no longer be needed.
- **Root protection:** Do not mow underneath trees as the foot traffic can compact soil and harm roots.

What are some cost considerations? Small bare root native trees can be obtained for as little as $4, are easy to plant, and can grow to be five feet tall (evergreens) in just a few years. Larger balled and burlapped trees can cost about $100 a piece. In study after study, trees have been found to increase property value and reduce energy costs from cooling.

Contained Planters over Hardscapes

What is it? The practice of placing potted plants over underused or not currently needed hardscapes, such as sidewalks and driveway areas.

How does this reduce runoff and protect water quality? Contained planters over hardscapes act like little ecoroofs on the ground, intercepting rainfall and evaporating 40 to 60% of our average annual rainfall for the area of pavement they cover.

Where can it be done?

- **Any unused impermeable surface:** Contained planters can be placed wherever space is available on an impermeable surface. (By city code, parking spaces must be a minimum of 8.5 feet x 16 feet with an overhang of 2 feet. Driveways must be 9 feet wide, at a minimum. Planter locations should not infringe on these minimum areas.)

What's the maintenance?

- **Irrigation:** Contained planters tend to require more irrigation than plants in a landscape area.
- **Mulch:** Reapply mulch regularly as it breaks down to keep the soil covered and prevent erosion.

What are some cost considerations? Container costs vary widely from free, from salvaged barrels to expensive, high-end self irrigating planters. The cost of soil is minimal since potting soil should be avoided; instead, native soil with some soil amendments is recommended.

Depaving Existing Pavement

What is it? The practice of removing any unnecessary areas of impervious pavement (aka hardscape).

How does this reduce runoff and protect water quality? For every square foot of pavement removed in Portland, you can prevent, on average, 22 gallons or runoff/year. The driveway to the right probably prevents about 5000 gallons of runoff/year.

Where can it be done?

- **Any unused permeable surface:** Pavement can be removed wherever it is not needed. The center of a driveway or the 2' overhang of existing parking spaces are two great opportunities for depaving. (By city code, parking spaces must be a minimum of 8.5 feet wide and 16 feet long with an overhang of 2 feet. Driveways must have a minimum width of 9 feet, and roads must have a minimum width of 12 feet. Depaving should preserve these minimum areas.)

What's the maintenance?

- **Weeding:** Remove weeds twice a year, ideally in late May and October.
- **Compost application:** Annually**,** Replenish compost in gardens and under tree canopies to a depth of 2-3" and lawns 1/4".
- **Irrigation:** Irrigate during the 2-3 year establishment period if using natives.

Depaving Existing Pavement (cont)

What are some cost considerations? Cost depends on the method of depaving used. For small areas of concrete, a hand saw has been found to be very effective; otherwise a wet saw can be rented. For larger areas, rentable track hoes for the do-it-yourself can be rented for a day and delivered to your house for around $500. Don't forget dumping fees or a dumpster rental.

Porous Walkways

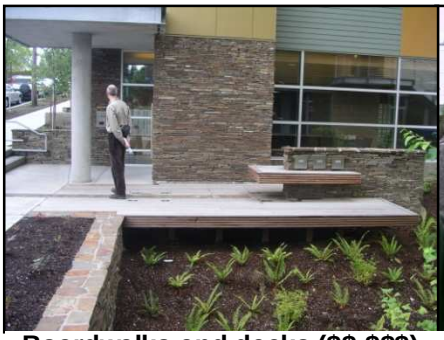
What is it? A surface you can walk on that also manages stormwater. The fact sheet discusses boardwalks & decks, mulch paths, gravel paths, and permeable pavers (both manufactured and homemade).

How does this reduce runoff and protect water quality? For the area where they are installed, they reduce runoff by at least 90% annually, which is a very high rate.

Where can it be done?

- **Wherever a walkway is needed:** Porous walkways can be located anywhere impervious walkways might be used.
- **Steep slopes:** Mulch and gravel paths and permeable pavers should not be placed on a slope steeper than 10%; instead, boardwalks or decks should be used.
- **Below impervious surfaces or unstable slopes:** Mulch and gravel paths and permeable pavers should not be placed where impermeable surfaces will drain onto path, as this will transport sediment that may clog the surface. Also, any landscaping upslope from walkway must be stabilized with vegetation or stepped walls to prevent erosion of dirt onto walkway. Boardwalks and decks are not subject to these limitations.

What's the maintenance? Maintenance varies with the surface type:



Boardwalks and decks ($$-$$$)
Regular cleaning of deck surface, weed removal from gravel underneath deck

Mulch Paths ($)
Weeding in May and October, Mulch replacement every 3 years

Gravel Paths ($)
Weeding in May and October

Poured in place permeable pavers ($$)

Salvaged material/Stepping stones ($$)

Manufactured Permeable Pavers ($$$)

Weeding in May & October or if spaces filled with gravel, periodic vacuuming and infill gravel replacement

What are some cost considerations? The cost varies widely with surface type (see relative costs in captions above); however, for most surfaces, there is an additional cost over conventional pavements because additional gravel beneath the surface is needed to store and infiltrate the rainfall it receives.

Bioretention for Common Areas and the Public Right-of-Way

What is it? Bioretention is the practice of infiltrating runoff through soil to reduce pollution. Some variations include rain gardens, stormwater planters, swales, or vegetated filter strips. These facilities placed in the public right-of-way are called "green streets". Bioretention facilities designed for challenging sites are lined to prevent runoff from infiltrating into the ground; however, water still passes through soil placed above the liner, within the facility.

How does this reduce runoff and protect water quality? As stormwater passes through the soil, pollutants are reduced through physical settling of large solids, filtering of small solids, and chemical and biological activity. Since the facility must be line, runoff is reduced through evaporation from the top of the facility.

Where can it be done?

- **Almost anywhere:** Since the facilities are lined to prevent infiltration into native soils, these facilities are easier to locate than (more effective) infiltration facilities.

What's the maintenance?

- **Weeding:** Remove weeds twice a year, ideally in late May and October.
- **Irrigation:** Using natives or naturalized plants, irrigate during the 2-3 year establishment period.
- **Sediment removal:** Remove sediment once a year, preferably from an easy to access pre-treatment basin.
- Detailed maintenance information: http://extension.oregonstate.edu/stormwater/sites/default/files/fieldguide.pdf