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Stormwater Management and Post-Construction Best Management Practices

Storm Water Management—Manage for High Frequency-Low Intensity Rainfall Events

S Infiltration Systems

The goal of infiltration based BMPs is to reduce the volume of runoff and contain potential pollutants on-site. Pollutants such as nutrients and hydrocarbons are treated by the microorganisms that exist in soils. Urban runoff can create thermal increases in water temperature that can impact stream ecology. Infiltration is the only way to reduce thermal pollution. Heated runoff is cooled to the temperature of the soil, which typically remains at a constant 55º F below the frost line. Infiltration systems mimic the historic groundwater seep that recharged surface waters.

S Soil Quality

Healthy soil should be able to absorb and hold water in pore space throughout the soil profile. When the soil profile is altered through land disturbing activities and compaction, the pore space is reduced thus restricting water infiltration into the soil. The organic matter content of the soil is the key to absorbing and holding water on-site which reduces the amount of runoff. The organic matter content of soils in Iowa is estimated to be 60-80% less than historic levels when prairies were first plowed. Restoring and protecting soil quality will be a key component of on-site water management systems that absorb and infiltrate more water and reduce runoff.

Low-Impact Development (Smart Growth)

Traditionally, stormwater management has involved the rapid conveyance of water to an engineered pond or surface water body. Low impact development (LID) is a different approach to stormwater management that modifies development to try to maintain some natural hydrologic function. This development method treats stormwater by on-site infiltration of rainwater. The management practices associated with LID may include some of the following :

- Infiltration of rainwater through vegetated trenches and basins with some filtration devices;
- Landscaping methods that include rain gardens, biorention cells or bioswales, and native vegetation;
- Stormwater conveyance through vegetated channels such as bioswales and directing runoff from impervious areas to vegetated areas;
- On-site capture and storage of rainwater using rain barrels or subsurface storage;
- Minimization of impervous area by using green roofs, narrower streets, porous pavement, concave medians, and landscaped traffic-calming areas.

Protect and Restore Soil Quality:

CDF Inc.

- Minimize land disturbing activities and avoid compaction
- Increase organic matter content through the use of compost applications
- Strategic use of native vegetation

Low Impact Development Practices:

S **Vegetated Roof Covers**

Vegetated roof covers reduce the amount of impervious surface by capturing and evapotranspiring rainwater. The roof is multilayered and typically consists of a drainage layer covered by a manufactured soil matrix protected by growing vegetation. Green roofs may extend the life of roofs, reduce energy costs, significantly reduce stormwater runoff, and ultimately reduce the size of typical stormwater controls within the community. Roofs can be designed to accommodate specific low or high intensity storms by varying the media depths.

S **Rain Barrels**

Rain barrels are designed to hold rainwater collected from residential rooftops. Water is retained in the barrel and can be used for yard watering of vegetation. The barrels are designed with overflow options to allow water to infiltrate beneath the barrel or be redirected to such features as a rain garden. Barrels would be especially effective in areas of cities with combined sewers.

S **Rain Gardens**

A shallow depressional area planted to native vegetation that absorbs and infiltrates runoff from impervious surfaces and may discharge to groundwater, a storm drain , or surface outlet. Depending on site conditions a subgrade tile system may be recommended to enhance infiltration, especially where high water tables exist. Rain gardens reduce the volume of stormwater runoff pollutant loads delivered to surface water.

Rain gardens can be used in individual residential, commercial, or institutional settings to mitigate impervious surface runoff.

Storm Lake Rain Garden

Under construction

Newly completed

S Bioretention Cells

Bioretention cells are designed to function similar to rain gardens except that they collect larger volumes of runoff generated at sites with a high percent of impervious surfaces. They are often used in industrial settings, corporate campuses, shopping centers, or other sites with large parking facilities. The cells are designed with more temporary storage to accommodate larger volumes of runoff and consequently will have more depth compared to a typical rain garden.

S Bioswales

A vegetated swale is an alternative to standard below ground stormwater sewers. They intercept or receive impervious surface runoff and blend infiltration and slow conveyance of stormwater. The soil matrix of the swale can be amended to enhance infiltration and percolation. These systems can be engineered to absorb the high frequency low intensity storms but can convey the large storm events while providing vegetative filtering. Bioswales can discharge to groundwater, storm sewer intakes, or directly to surface water.

Land area prior to bioswale Installation (CDF Inc.)

Well-vegetated bioswale after installation (CDF Inc.)

Bioswale under construction in Davenport, Iowa (River Action)

S Permeable Paving Alternatives

These surfaces provide reduce site runoff by increasing infiltration into the soil. There are a number of permeable paving surfaces available from paver block systems to geoweb reinforced grass surfaces. These systems can be designed to infiltrate virtually any design storm including the 100-year storm or they can be used strategically with impervious surfaces to capture the high frequency lower intensity storms.

In addition to hydrocarbons, heavy metals, salts and other motor vehicle related contaminants, permeable paving alternatives reduce TMDL contaminants and thermal pollution.


Porous pavement installations, Iowa City, Iowa.

European installations of porous pavers.

S **Concave Medians:**
These are essentially constructed similarly to rain gardens and bio-cells except that they are placed in a median strip between two lanes of traffic or in parking lots. Depending on the setting, they may be confined to narrow cross-sections, which may restrict their capacity to low intensity storms. Raised medians can be retrofitted by excavation and curb cuts to allow water to enter.

Conventional Stormwater Management

S **Detention Ponds:**
Detention ponds temporarily store runoff and control the rate of release to reduce downstream flooding. In the past, detention ponds have not provided significant water quality benefits due to the short duration of storage and the lack of control of low intensity storms. The ponds will trap some sediment, but are not designed to capture the first flush of contaminants. Two-stage outlets can enhance the removal of these contaminants.

S **Retention Ponds:**
Retention ponds are designed primarily to manage stormwater discharge to prevent flooding. They can enhance sediment trap efficiency and can reduce some nutrient loading while controlling rate of release to control downstream flooding. They also provide an aesthetic amenity that doubles as wildlife habitat and a recreation source, and which also enhances property value. Two-stage outlets can enhance the removal of contaminants by increasing retention time of low intensity storms.

S **Constructed Wetlands:**
Constructed wetlands provide water storage benefits similar to retention ponds. The filtering, biological, and chemical removal mechanisms provided by wetlands can also improve the quality of stormwater discharges. Wetlands are aesthetically pleasant and provide wildlife habitat and recreational outlets. The soils underlying the wetland should be relatively impermeable in order to maintain a permanent water level.

Remnant native wetlands should never be used to store or treat stormwater. Thermal and contaminant loads will degrade vegetative communities thus reducing biological diversity.