University of Minnesota Landscape Arboretum Runoff Model

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GENERAL DESCRIPTION:

Minnesota Landscape Arboretum Runoff Model. 2003

Construction of the Minnesota Landscape Arboretum (MLA) Runoff Model began in August 2002 and was completed in June 2003. This educational model was funded by the Minnehaha Creek Watershed District, the Metropolitan Council, Bogert Products, Inc., and the Minnesota Landscape Arboretum. The model is located in the parking lot in front of the Marion Andrus Learning Center. It was designed to demonstrate how stormwater runoff volume can be reduced by modifying surface infiltration characteristics.

DESIGN AND CONSTRUCTION:

The model is divided into 5 equally sized watersheds ranging from nearly 100% permeable to almost 100% impermeable. The runoff from each watershed collects in its respective pool where it can be measured and recorded. Each of the 5 areas is surrounded by a linear band of concrete with a raised ridge to keep the runoff waters in each of the respective areas. The areas are sloped to the collection pools and the pools account for 7.4% of the area in each watershed.

Watershed 1 Highest Infiltration

14% mulched planting beds ; 60% permeable paving, 18.4% concrete

Prior to installation of the permeable paving, infiltration tests were conducted to obtain measurements of how much water the soil can absorb in a given amount of time. Two base layers of limestone were then installed. The first was 9" thick and consisted of 1 ½" chunks. The top layer was 3" thick and consisted of ¾" chunks. Finally a 1" thick layer of 3/8" limestone chips was laid in such a way to provide a uniform surface for the permeable paving installation. Once the paving was in place, the voids were filled with 3/8" limestone chips. Two planting areas one filled with daylilies, the other with trees and shrubs, are located at each end of this watershed, allowing for increased infiltration.

Installation of permeable paving for watershed 1.

Watershed 2 Trench Infiltration

14.2% mulched planting beds, 60% bituminous paving with infiltration trenches, 18.4% concrete

As with watershed 1, infiltration tests were conducted prior to installation of infiltration trenches. Two trenches, the depth of which was based on infiltration of the soil, were constructed below the trench grate location and filled with coarse gravel. The bituminous impervious pavement was then installed to be flush with the top of the trench gates. This allows runoff reaching the gates to flow downward into the trenches. Two planting areas, one with sumac ground cover, the other with trees and shrubs, were also installed at each end of this model to allow for infiltration into the ground instead of runoff collection in the pool of this watershed.

Watershed 3 Designing Around Existing Trees
32.3% plants, 41.9% bituminous, 18.4% concrete

This watershed was constructed around an existing Honeylocust tree. The soil was left intact to preserve the root zone of the tree and covered with an organic mulch. Little bluestem, a native prairie grass, was planted at the outer edge of the mulched bed. A large portion of this watershed is impervious paved surface, typical of a home driveway. Additionally, grass was installed in front of the pool to promote further interception of runoff.

Watershed 4 Minimal Infiltration
14.2% plants, 60% bituminous, 18.4% concrete

This watershed has two grass strips at each end for intercepting water. Even these two small areas can make a difference in water runoff. The lack of curb barriers in front of the pool allow the runoff to flow directly into the grass where absorption can take place.

Watershed 5 impervious Model: Highest Runoff
74.2% bituminous, 18.4% concrete

Watershed 5 represents the maximum amount of impermeable paving. It lacks the presence of any vegetation and shows the poorest environmental design. This collection pool can easily overflow with rainfall events, since very little water will infiltrate into this watershed and the majority will flow from the site.

To illustrate the differences in runoff, when a 1.65" inch rainfall event occurred in July 2003, these were the amounts of rainfall found in the collection pools:

Watershed 1	2.2 inches
Watershed 2	3.1 inches
Watershed 3	7.3 inches
Watershed 4	10.2 inches
Watershed 5	above 12 inches and overflowing

RUNOFF MODEL MAINTENANCE

It is recommended that permeable paving be pressure vacuumed so that infiltration can continue unobstructed. The MLA's permeable paving has not been pressure vacuumed, although regular street sweeping does occur in the parking lot. This helps to clear away extra debris that may clog the permeable pavers and prevent runoff from infiltrating to the soil below. The grass areas are mowed regularly and may be sprayed with herbicides for weed control. Water that accumulates in the pools from rain events is drained into a nearby irrigation pond. A small amount of chloride is added to the water to prevent algae growth. The pools are cleaned as needed, including removing sediment from the bottom and/or any debris that has accumulated.

Watershed pool 5, the impervious model, is located in the foreground of this picture. The overflowing pool has the largest amount of water compared to the other pools. In the background another pool can be observed to be near capacity, but not overflowing. Pool 5 always shows the greatest increase in water level, while pool 1 shows the least. Typically, pool 1 only rises by the amount of rain that falls, since there is almost no runoff for watershed 1. As you move on to the other pools, more water accumulation can be observed due to reduced permeability of the watersheds.

For more information, please visit:

http://www.icpi.org/design/permeable_pavers.cfm
http://www.lid-stormwater.net/permpavers_benefits.htm
http://www.lowimpactdevelopment.org/

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