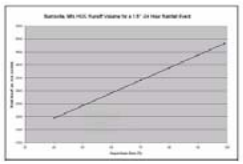
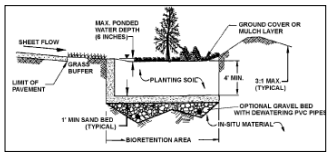
Low Impact Design Storm Water Management Practices for the UW-Green Bay Campus

Rain Garden / Bioretention Cell

- Rain Garden: "A landscaped garden in a shallow depression that receives the stormwater from nearby impervious surfaces, focusing recharge"
- Bioretention Cell: A rain garden modified by installing an underdrain system for use in areas of low-permeability soils
- During precipitation, slow infiltration until soils saturated, overland flow after saturation
- Urbanization short-circuits infiltration
- Rain gardens and bioretention cells help reduce runoff and runoff-related pollution by slowing flow of surface runoff and infiltrating stormwater prior to discharge to a water body



Runoff volume per acre vs. percent impervious area. Burnsville, MN Water Resources Management Plan



Schematic cross-section of a bioretention cell. VA Department of Planning and Natural Resources

- Low-permeability soils at UW-Green Bay do not work well with rain gardens.
- Bioretention cells will work to filter pollutants pollutants and slow runoff rate.
- Parking lots and buildings can be modified to divert runoff through bioretention cells.
- Overflow system can be used with bioretention cells to handle large storm events and spring snowmelt.

Parking lot rain garden in Burnsville, MN. This design can be modified to work as a bioretention cell. Note the storm sewer overflow. Burnsville, MN Water Resources Management Plan

Bioretention cells can remove an average of:
-90% heavy metals
-80% phosphorus
-97% chemical oxygen demand
-86% total suspended solids
-67% oil and grease
The design of the bioretention cell can be changed to remove certain pollutants more effectively, if needed.

Treatment Trains/Stormwater Parks

BMPs in a series

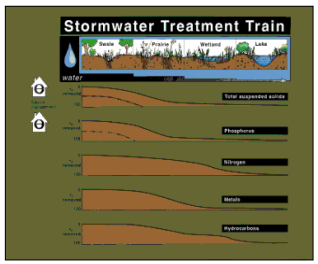
- incorporates several stormwater treatment mechanisms in a sequence
  - enhances runoff treatment
  - each piece designed to treat a different pollutant
  - maximizes pollutant removal and stormwater infiltration

Advantages

- decreases cost of storm sewer infrastructure
- maintenance of wildlife habitat corridors and open space
- protection of downstream H_2O bodies

Disadvantages

- large land area may be required
- may require permits (i.e. for infiltration BMPs)



Schematic of a stormwater treatment train showing amount of runoff infiltrated at each BMP and the amount of different pollutants removed as each BMP. From Applied Ecological Services http://www.appliedeco.com/Projects/Stormwater%20Treatment%20Train.pdf

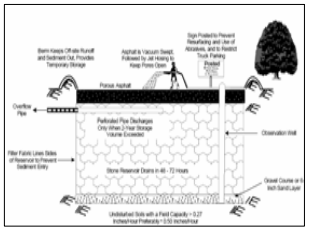
Cost comparison of sustainable landscape and traditional landscape. Table differentiates between annual costs as well as total up-front costs. From Conservation Design Forum http://www.cdfinc.com/CDF_Resources/Sustainable_Landscape_Cost_Comparison.pdf

Activity/Year	Sustainable Landscape (Annual Cost)	Traditional Landscape (Annual Cost)	% of Difference Sustainable/Traditional
Up Front Installations Traditional landscape require a wider spectrum of landscape treatments, so their up from investment is necessarily greater than that for a new native landscape.			
Design	$25,000	$25,000	0%
Construction	$100,000	$216,000	52%
Post-Planting Management	$16,000	$28,000	43%
Total Up-Front Costs	$141,000	$269,000	48%

Pollutant Removal of Pervious Pavement (%)	
Pollutant	**Pollutant Removal**
Total Suspended Solids	95%
Total Phosphorous	65%
Total Nitrogen	82%
Nitrous Oxides	N/A
Metals	98-99%
Bacteria	N/A

http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Infiltration%20Practice/Porous%20Pavement.htm

Permeable Pavements



http://www.epa.gov/owm/mtb/porouspa.pdf

Permeable Pavements are a safety advantage over traditional pavements because water quickly soaks into the pavement rather pooling. This eliminates the risk of vehicles hydroplaning and prevents the surface from becoming slick and slippery.

Permeable Pavements not only help reduce runoff, preventing erosion control problems, they also minimize the storm sewer requirements of a facility. This saves money not only in storm sewer piping installation costs, but also in maintenance.

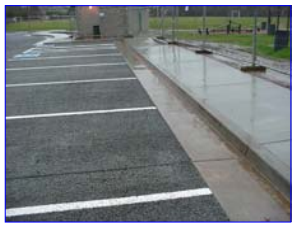


Photo shows contrast between permeable pavement and traditional pavement. Photo provided by WI Concrete Pavement Association

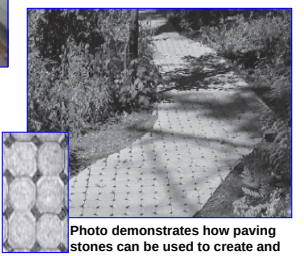


Photo demonstrates how paving stones can be used to create and aesthetically pleasing and environmentally friendly design. http://www.mapc.org/regional_planning/LID/PDFs/permeablepaving.pdf

Permeable Pavements are designed to allow stormwater to drain into the sub-grade for filtration and ground water recharge.

Permeable Pavements:

- Permits stormwater runoff to percolate through it rather than flood storm sewers.
- Provide for vegetation to be watered reducing the need for irrigation.
- Allow for natural recharge of the aquifers similar to natural filtering effects.
- Improves upon the quality of water entering waterways and aquifers.