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IFAS Extension

Enhanced Stormwater Basins



The Stormwater Ecological Enhancement Project (SEEP) on the University of Florida campus in Gainesville was created by re-contouring and introducing new vegetation to a 3-acre retention pond. Over a period of seven years, the number of vegetative species on the site increased four-fold, and pollutant treatment has improved.



Definition:

Stormwater basins are designed to store stormwater runoff temporarily (detention) or permanently (retention) to reduce flooding potential and to improve water quality. Also known as stormwater wetlands, enhanced stormwater basin designs facilitate increased vegetative diversity and complexity of biogeochemical processes to improve water treatment, biodiversity, aesthetics. Enhanced stormwater basins can be considered along the same continuum of biophysically enhanced stormwater practices where rain gardens are followed by bioretention basins, with enhanced stormwater basins falling at the highest end of the continuum.

Applications

- Common areas in residential communities
- Commercial development

Objectives:

An enhanced basin design creates a multipurpose area serving the need to reduce flooding while adding vital wetland functions such as unique plant and wildlife habitat, recreational opportunities, aesthetics and the potential to treat stormwater to a higher level of quality. By adding lower topographic areas for open-water habitat and berms to temporarily impound entering stormwater, a greater hydrologic diversity within the basin is created. Planting species known to take up heavy metals and remove nutrients as well as introducing a wide range of species that can become established within the basin increases the viability of the basin and its ability to optimize natural processes and resources.

Overview:

Enhanced stormwater basins are engineered to mimic the treatment and runoff attenuation properties of natural wetlands. This is done by integrating two essential elements into a stormwater basin design: increased topographic relief and vegetative diversity. Irregular perimeters, varying basin depths, meandering internal conveyance channels, multiple cells and undulating bottom contours are key features that increase the topographic variability of a retention basin, improving stormwater retention and treatment capacity. Introduction of diverse plantings suited

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to site conditions (i.e., inundation tolerant native species) improve the stormwater treatment performance while simultaneously providing ecological, wildlife, and aesthetic amenities. Enhanced stormwater basins typically use berms to partition the main basin in to multiple zones or cells. Cells can be designed in series resulting in each zone having a different depth, duration and frequency of flooding. These varied hydrologic characteristics result in different treatment processes and long-term development of different vegetative communities.

Benefits

- Retention
- Detention
- Sedimentation
- Metals and nutrient retention
- Increases wildlife habitat and biodiversity
- Community amenity
- Passive recreation
- Educational opportunity
- Aesthetics

Water Protection Benefits:

Water conservation implications – Enhanced stormwater basins do not provide direct potable water benefits, although they do facilitate groundwater recharge and improve downstream water quality.

Stormwater implications -

Quantity

Because these basins use conventional design volume specifications they are as effective as conventional basins at controlling volume.

Quality

As the name implies, the modified design of these stormwater basins enhances and improves upon the pollutant treatment and runoff attenuation properties of traditional retention ponds. Pollutant uptake is increased and peak discharges are reduced. Construction of a forebay and creation of multiple cells within the basin slows water movement and increases particulate settling in designated areas. Planting of species known to assimilate contaminants and creating longer duration flooding conditions in these areas facilitates sediment accumulation, trapping contaminants in the soil. Establishing a variety of plant species and hydrologic conditions diversifies the biogeochemical processes within the basin, increasing the system's ability to reduce contaminants and respond to dynamic environmental conditions.

Design Considerations:

If a site has low permeability, is prone to flooding, or is sensitive to groundwater input, a conventional stormwater basin might be the only viable management option. However, increasing research has developed methods for more naturally-mimicked systems. As with traditional stormwater retention basins, the treatment and volume control performance of ecologically enhanced stormwater ponds is dependent upon the infiltration capacity of site soils. Relatively large land areas are required to construct a suitable treatment basin, but the principles of enhanced stormwater basins can be applied to existing retention ponds of varying sizes and locations. When designing an enhanced stormwater basin, the goal is to optimize multiple functions so that under varying conditions the basin can continue to protect water quality.

Enhanced stormwater basins can become effective teaching opportunities to educate people about the relationship between their activities and water quality, stormwater and ultimately the natural environment. By integrating trails around the edge of the basin or a boardwalk through the basin, these educational opportunities can be enhanced and should be incorporated where possible into the management of these systems. As such, enhanced stormwater basins can become valued community amenities.

Design Keys

- Infiltration capacity of site soils
- Large land area
- Type of plant material
- Construction equipment
- Limit compaction
- Types of soils

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Diagram of enhanced stormwater basin design depicting varied water depth, internal partition, vegetative planting zones and integrated boardwalk and trail to facilitate public access. The "birds eye view" (right) illustrates irregular and elongated basin edge, extended flow path facilitated by internal berm and complex basin topography resulting in multiple cells in series and a wide range in hydrologic conditions within the basin.

Operations and Maintenance:

Increased trapping of sediments and other contaminants within the basin may need to be removed periodically at inlets. By creating multiple cells within the basin, increased detention time and sedimentation in a small portion of the basin is facilitated. This allows for any periodic maintenance requirements to disturb only a small portion of the basin. Care of plantings, especially during initial establishment may also be required depending on aesthetic expectations, including management of invasive plants.

Credits in Green Building Certification Programs:

- LEED for Neighborhood Development Pilot (SLL Credit 10: Restoration of Habitat or Wetlands; GCT Credit 9: Stormwater Management)
- NAHB Model Green Home Building Guidelines (1.3.5 Manage storm water using low-impact development when possible)

Relative Costs:

Although costs and benefits will vary depending upon site conditions, local climate and topography, etc., the Center for Watershed Protection (www.cwp.org) estimates that average construction costs for an enhanced stormwater basin range from $0.60 to $1.25 per cubic foot. Maintenance costs are relatively low compared to those for conventional stormwater retention basins.

References and Resources:

EPA Stormwater BMP Fact Sheet: Stormwater Wetland http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=74

Stormwater Ecological Enhancement Project (University of Florida Natural Area Teaching Laboratory): http://natl.ifas.ufl.edu/seep.htm

Stormwater Wetland Fact Sheet (Stormwater Manager's Resource Center) http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Wetland/Wetland.htm

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Credits

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This fact sheet was produced with funding from The Elizabeth Ordway Dunn Foundation.

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