King County
Department of Natural Resources and Parks
Wastewater Treatment Division

June 2010

Green Stormwater Infrastructure for Combined Sewer Overflow Control

The oldest parts of King County's sewer system were designed to carry stormwater from streets and roofs as well as wastewater from homes and businesses to the nearest water body. Today, that water is sent to a wastewater treatment plant. During heavy rains, however, the pipes can fill and overflow into waterways. These are called Combined Sewer Overflows or CSOs. King County's Wastewater Treatment Division plans to control all of its 38 combined sewer overflow (CSO) sites to an average of no more than one overflow per year by 2030, as required by regulatory agencies. Green Stormwater Infrastructure (GSI) is one method that could be used to reduce peak flows of stormwater and groundwater into the combined sewer system (also called "demand management").

What is Green Stormwater Infrastructure (GSI)?

The concept of green infrastructure originated in the conservation field. In this context, large forests, wetlands, greenbelts, and so forth—all part of the natural environment—are viewed as infrastructure because they support essential ecosystem functions. The term is increasingly being used to refer to engineered infrastructure at a smaller scale in relation to green stormwater management practices such as rain gardens and green roofs. These practices make use of soils and vegetation, in combination with other approaches such as rain barrels and permeable pavement, to infiltrate, evaporate, capture, and reuse stormwater.

In addition to helping reduce combined sewer overflows (CSOs) and the amount of untreated stormwater that finds its way to surface water, green stormwater management facilitates natural processes that recharge groundwater, preserve baseflow in streams, moderate impacts to water and air temperature, and protect hydrologic and hydraulic stability. Other names for green stormwater management include low impact development (LID), natural drainage, and water-sensitive design.

What are some GSI techniques?

Ecoroofs (green roofs) consist of shallow layers of growing medium, low-growing vegetation, subsurface drainage, and a waterproof membrane.

Roof disconnection removes water that flows from a roof through a downspout to a combined sewer and redirects it to some other location. It is not considered a GSI technique, but may be combined with "green" features such as rain gardens.

Street trees retain some rain in their canopies and take up a portion of the rain that infiltrates to the soil.

Bioretention involves dispersed small scale landscape features designed to attenuate and treat stormwater. These features are typically vegetation-filled areas, such as rain gardens and swales, with a drainage mechanism, often located in parking lots, median strips, or streets. Bioretention is an element of Seattle's Residential RainWise program on private property and natural drainage systems on neighborhood streets.

Permeable pavement allows rainfall to penetrate the pavement into a porous material that retains stormwater before it enters a combined sewer, limiting or removing the effects of the stormwater on the sewer system. Permeable pavement is not suited for high traffic areas.

What is required for GSI to work for CSO Control?

While GSI can provide benefits in stormwater control, neighborhood enhancements, water quality, and reduction in CSOs, there are several factors that must be considered for successful implementation of GSI for CSO control.

- Enough sources of stormwater- streets, roofs, and other impervious surfaces - that can be disconnected from the sewer system to limit CSOs and meet state standards for no more than one overflow per year on a long term average. If GSI alone cannot control the entire volume added traditional infrastructure may need to be constructed to insure compliance with regulations for CSO control.
- Land area available for GSI. Rain gardens, street trees, swales, and other GSI elements require sufficient space for installation. GSI features may be sited in existing planting strips, in parking lots, on private property, and in other existing space.
- Appropriate soils and topography. GSI benefits from flat areas where water can infiltrate into soils. Steep slopes and poorly draining soils are not recommended for GSI techniques.
- Supporting conveyance infrastructure for large storm events. In order to accommodate storms beyond design capacity, it may be necessary to direct excess flows into a stormwater or sewer system.
- Community support for GSI projects. Installing GSI, like other stormwater and sewer projects, has effects on the community during and after construction. Community understanding of GSI projects and support for their implementation is a critical success factor for this type of infrastructure.

Learn how King County evaluated GSI techniques as part of the Puget Sound Beaches CSO Control Projects.

Visit the project Web page at www.kingcounty.gov\CSOBeachProjects to view and download technical documents describing GSI evaluation for the project basins.

For more information on Seattle Public Utility's stormwater control programs
Residential RainWise
https://rainwise.seattle.gov/systems/water

Natural Drainage Projects
http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/GreenStormwaterInfrastructure/NaturalDrainageProjects/index.htm

Alternate Formats available upon request