Constructed Stormwater Subsurface Gravel Wetland

University of New Hampshire - Stormwater Center
http://www.unh.edu/erg/cstev/Presentations/ieca_gravel_wetland_10_07.pdf
Accessed 07/22/2008

DESCRIPTION

Subsurface gravel wetlands are an innovative variation on the traditional stormwater wetland. These systems are lauded for their high pollutant removal efficiencies and are currently used effectively to treat wastewater. These wetlands filter stormwater as it flows horizontally through a sediment forebay and a series of gravel-bottomed wetland cells. The wetland cells consist of a thin layer of wetland soil which supports a thick vegetative cover; below which is a thick layer of gravel where algae and microbes grow in abundance. Treatment occurs through physical, biological and chemical reactions in the wetland soil and gravel layers. Water flows through the series of cells via subsurface pipes and is discharged to a receiving waterway or additional best management practice (BMP) through a submerged pipe in the final cell. These systems are designed to maintain constant saturation of the wetland soils. Existing dry ponds can be retrofitted into a gravel wetland to more effectively treat stormwater runoff and may require less excavation than new construction.

BENEFITS

Overall

- Treats stormwater runoff
- Reduces peak stormwater flows
- Provides local flood control
- Improves quality of local surface waterways
- Enhances the beauty of residential, commercial or industrial sites
- Provides wildlife habitat
- Reduces soil erosion
- Provides effective year-round stormwater treatment in cold climates

Pollutant Removal

High pollutant removal efficiencies are one of the major benefits of constructed stormwater subsurface gravel wetlands. Properly designed gravel wetlands can be very effective at eliminating many pollutants that are of concern in the Charles River watershed:

- Total Suspended Solids: 98% - 100%
- Total Phosphorus: 32% - 88%
- Total Zinc: 95% - 98%[4]

Volume Attenuation/Flow Reduction

Gravel wetlands reduce peak flows by 77% - 85%.[4] Gravel wetlands typically do not infiltrate stormwater runoff because they are designed to be continuously saturated. However, they can be designed to infiltrate treated runoff at the end of the system. Additionally, evaporation will occur, slightly reducing the overall runoff volume.

MAINTENANCE

Needs and Frequency

- Inspect vegetation biannually
- Re-plant vegetation as necessary
- Inspect and remove debris/trash from inlet and outlet structures
- Monitor and control invasive species dispersal
- Remove and properly dispose of sediment from pretreatment forebay annually
- Dredge and properly dispose of sediment from wetland area to prevent the gravel base from becoming clogged, this may require removing and replacing gravel. Frequency will depend on the effectiveness of the sediment forebay but will likely only be required at multiple year intervals.

INSTALLATION COST

Approximately $4 - $5/square foot, including sediment forebay[4]

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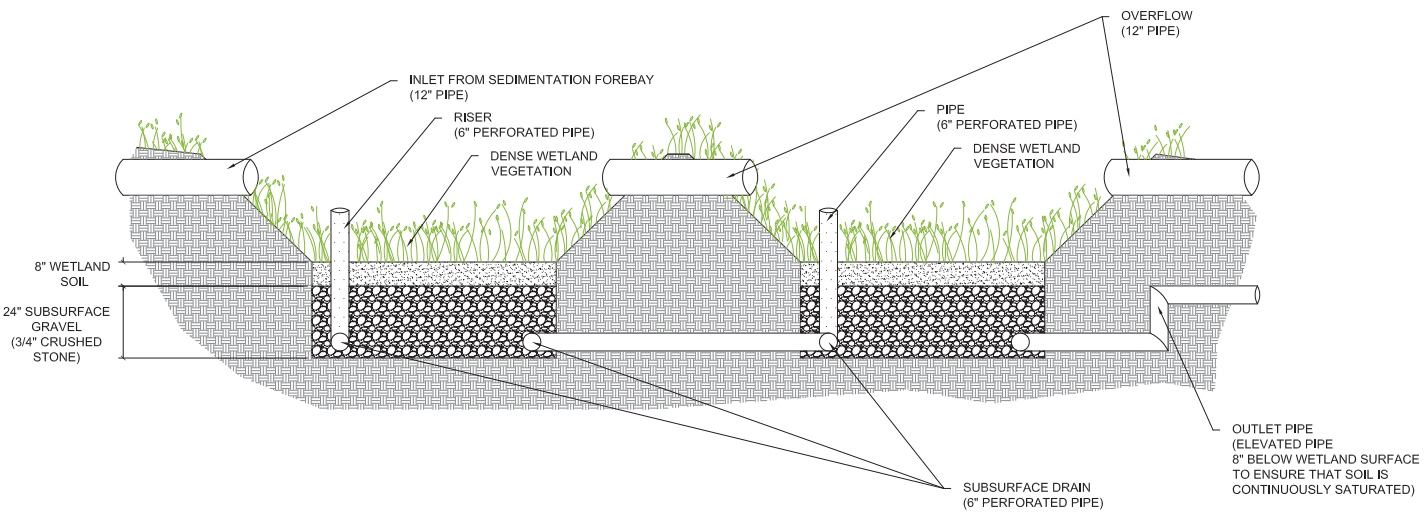
SCHEMATIC



Adapted from:
Subsurface Gravel Wetland
University of New Hampshire Stormwater Center. 2007 Annual Report.

EXAMPLE PROJECTS

Golf Course
Mashpee, MA
A gravel wetland collects and treats runoff from a golf course while adding to the aesthetic appeal of the course.[5]

I-93 Park and Ride Lots
New Hampshire
The New Hampshire Department of Transportation working in conjunction with the University of New Hampshire Stormwater Center designed and launched construction of two subsurface gravel wetlands to capture and treat runoff from commuter park and ride lots.[5]

ADDITIONAL CONCERNS OR UNKNOWNS

- Gravel wetland systems should include a sediment forebay or some other pretreatment mechanism, this is required for stormwater wetlands in Massachusetts.
- An underlining is necessary when the system is sited on permeable soils or in an area that receives runoff from land uses with higher potential pollutant loads.
- Unlike some other stormwater BMPs, gravel wetlands may be appropriate for use in areas with non-infiltrating soils and high water tables.
- Gravel wetlands are not recommended for areas with high sediment runoff.

SOURCES

[1]Georgia Stormwater Management Manual Volume 2 (Technical Handbook). Available at: http://www.georgiastormwater.com/vol2/3-3-5.pdf.

[2]Knox County Tennessee Stormwater Management Manual. Volume 2 (Technical Guidance). 4.4.3. Submerged Gravel Wetland. Available at: http://www.knoxcounty.org/stormwater/pdfs/vol2/4-4-3%20Submerged%20Gravel%20Wetland.pdf.

[3]MassHighway and Massachusetts Department of Environmental Protection (MassHighway). (2004, May). The MassHighway Stormwater Handbook for Highways and Bridges. Available at: http://www.mhd.state.ma.us//default.asp?pgid=content/environ/envpublications02&sid=about.

[4]University of New Hampshire Stormwater Center (UNHSC). (2007). UNHSC 2007 Annual Report. Available at: http://www.unh.edu/erg/cstev/2007_stormwater_annual_report.pdf.

[5]UNHSC-NEMO. Innovative Stormwater Management Inventory. Accessed June 20, 2008. www.erg.unh.edu/lid/index.asp.