Fact Sheet #3

Stormwater Technology: StormTreat System

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*The **StormTreat Fact Sheet** is one in a series of fact sheets for stormwater technologies and related performance evaluations,which are undertaken by the Massachusetts STrategic Envirotechnology Partnership (STEP).*

A summary of the STEP verification entitled, ***T**echnology Assessment, StormTreat System, StormTreat Systems, Inc.*, *September 1997* is provided in this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.stepsite.org/progress/reports) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). Research and performance evaluations of stormwater technologies are ongoing, under more rigorous and controlled testing requirements. Consequently, design efficiencies and performance ratings are subject to future updates.

Description/Definition

The StormTreat system is a unique stormwater treatment technology that combines sedimentation, oil and grease separation, and physical and biological filtration. The system includes sedimentation chambers and a biological filter capable of supporting wetland plants. The StormTreat system has the potential to provide enhanced treatment of stormwater compared to conventional stormwater best management practices (BMPs), such as sand filters and infiltration basins. The system can be designed either as a recharge unit within an infiltration system (recharge mode), or with a controlled discharge to surface water or a stormwater conveyance system (closed mode).

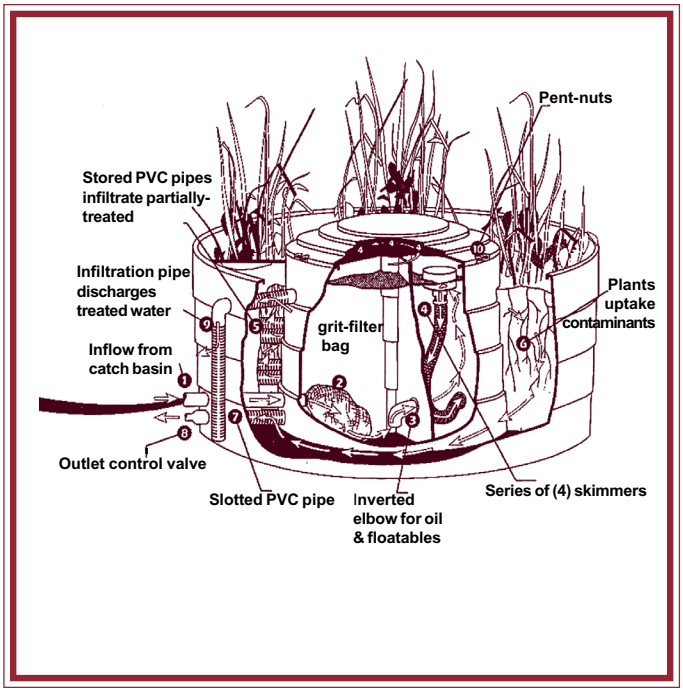

Figure 1. StormTreat Unit (after STS, Boston, MA 1997)

Equipment and Sizing

The system is 9.5 feet in diameter and 4 feet in depth. The chamber is manufactured from molded recycled polyethylene. Other components are made of PVC, gravel (in the biofilter), native wetland plants (in the biofilter), metal closures, and various fittings constructed of plastic or other durable materials. The unit, designed for recharge, is installed in a 12' x 12' excavation, with a minimum of 12" of stone below and surrounding the unit's sides. The closed mode unit is installed in the same size excavation with 6" of stone below the unit. Treated stormwater discharges from the closed mode unit through a 1" to 2" PVC pipe to a surface discharge or a conveyance system. Under typical installations, only one mode, recharge or closed, would be used per site. Depending on the area to be treated, any number of units could be utilized in parallel.

Performance/Effectiveness

The system is designed to provide physical separation/filtration of grit and suspended solids and biological and physical/chemical reduction of pollutant parameters such as: BOD, nitrogen, phosphorus, petroleum hydrocarbons, metals and bacteria. Additional filtration occurs when the system is designed with recharge after the biofilter.

Hydraulic properties of the system suggest that residency time (5 days) within the separation chambers and the biofilter will have a direct relationship on treatment potential. Removal rates of pathogens may be much lower at shorter retention times. Residency time and operating conditions, such as: moisture, temperature, oxygen, nutrients, and light will most likely affect performance. Seasonal variation of TSS removal is not likely to occur as a result of the biofilter system performance, since removal is primarily based on sedimentation/ filtration. TSS removal is more likely to vary as a function of sediment loading.

Typical flow rates through the system will range from approximately 2 to 50 gallons per minute, based on a 0.5 inch precipitation event over a 5.8 hour duration (Wanielista and Yousef, 1993).

Technology Status

The StormTreat system is based on reasonable and accepted principles in water treatment technology, including biological reduction technologies for carbon, TSS, and petroleum hydrocarbons. The applicability of this technology is similar to that of several other BMPs, including: sand filters, organic filters, and infiltration systems, all described in the *Stormwater Management Handbooks* (DEP and CZM, 1997). However, to establish total suspended solids (TSS) and contaminant removal rates in excess of those reported, further research on the StormTreat system should include: i) evaluation of seasonal variation in performance, ii) variation due to climatic and soil conditions, iii) vegetation establishment and viability, iv) system performance as a function of wetland plants and type, v) impact of freeze/ thaw cycles and road salt on performance, vi) bacteria and pathogen removal efficiency in dry weather periods, and vii) performance as a function of flow rate.

Applications/Advantages

- The system is designed to treat the first flush of stormwater events, consistent with Standards 4 and 6 of the *Stormwater Management Handbooks*. Performance data suggest that the StormTreat system can provide removal rates for TSS at 80% removal (Standard 4 and 6) when sized accordingly (closed mode).
- In the recharge mode, the system may be designed to meet Standard 3. When designed according to standard practices, the system should provide equivalent or better treatment than conventional infiltration BMPs.
- The StormTreat system may meet treatment requirements for land uses with higher potential pollutant loads (Standard 5), provided it is not installed as a recharge unit.
- The system is suitable for new and retrofit situations.
- The system is suited for constricted areas.
- It can be used in areas from 0.5 to 10 acres or on individual inlets. For larger installations, units may be located throughout the drainage area, rather than in a central location to provide treatment of runoff closer to its source.
- The StormTreat system is likely to remove grease and oils with its unique skimmer mechanism.

STEP Verification vs. Regulatory Approval

STEP provides assistance to developers of innovative technologies. STEP verification of stormwater treatment systems is not required to receive necessary approvals from conservation commissions or the Department of Environmental Protection (DEP). However, if a system has received verfication, a conservation commission shall presume that the technology will function as proposed, provided the conditions are similar to those in which performance was verified. STEP reports are not technology approvals, and do not constitute an endorsement or recommendation for use. Questions on stormwater regulatory issues should be referred to the DEP regional offices.

Considerations/Limitations

- All installations of the StormTreat system require basic pretreatment which may be in the form of a separate stormwater inlet or catch basin.
- Removal rates for biologically controlled processes (nitrogen and bacteria) may vary seasonally due to changes in wetland plant growth.
- The StormTreat system is untested as a recharge system. The soil permeability of the surrounding soils will be the limiting design factor.
- Cost competitive advantages of the StormTreat system over conventional best management practices (BMPs) have not been developed. Further information is required to clarify typical operation and maintenance costs.

Reliability/Maintenance

Inspection of the system after major storm events is recommended during the initial period of operation. Inspection of internal structures, including, baffles, skimmers, and control valves should be part of an annual inspection plan.

Suction or vacuum pumping of solids and replacement of the grit bag filter is recommended once every 3 to 5 years. Shorter periods of time between pumping may be required with higher sediment loadings. The sedimentation bulkheads can be removed and washed or repaired through the central access. The biofilter medium should also be inspected as needed to assess solids buildup. Seasonal changes may require plant maintenance which could occur along with normal cleaning of catch basins and connecting pipes. Maintenance of the wetland system should include plant viability observations during growing and non-growing season. Replacement of sand media may be required once every 10 - 20 years. Without further field data, it is unknown how long the media will last. However, based on sand filter technology for domestic wastewater treatment, expected life may exceed 10 years.

References

Winkler, E.S. 1997. "Technology Assessment, StormTreat System, StormTreat Systems, Inc." University of Massachusetts. Amherst, MA. *STEP Web site:* www.stepsite.org/progress/reports.

Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

Krahforst, Christian et al. 1998-1999. "An Evaluation of Innovative Stormwater Treatment Technology Installations Designed to Mitigate Storm Drain Pollution Impacting Shellfish Beds at Wychmere Harbor, Harwich and the Jones River, Gloucester MA." MA Section 319 NPS Project 95-02. *Office of Coastal Zone Management Web site:* www.mass.gov/czm/masection319npsproject9502.pdf

*StormTreat Web site:*www.stormtreat.com

TARP Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

Wanielista, M.P. and Y.A. Yousef, 1993. "Stormwater Management." John Wiley and Sons, Inc. New York.