

Regenerative Stormwater Conveyance: An Integrated Approach to E&S Control and Sustainable Stormwater Management

The traditional means of managing sediment laden stormwater from earthmoving operations has routinely been through standard erosion and sediment (E&S) control practices (e.g. sedimentation traps/basins, sand filters, etc.). However, recent changes in stormwater discharge criteria by the Maryland Department of Environment (MDE) for facilities within the Chesapeake Bay Watershed have resulted in requirements that exceed the capabilities of traditional E&S controls. This issue recently came to light at the Central Landfill, located in Cecil County, MD, when MDE began to enforce “visible discharge” criteria (i.e. “if it looks cloudy it’s a permit violation”) on stormwater discharges from the site.

Numerous solutions were evaluated to reduce the discharge of sediment from the site (i.e., sediment basin modifications, use of Polyacrylamide flocculants, vegetation enhancements, etc.) by the Cecil County Department of Public Works (CCDPW). However, these approaches were expensive to implement and could not routinely achieve the discharge standard required by MDE. To avoid actively treating stormwater, CCDPW decided to pursue an innovative application of Regenerative Stormwater Conveyance (RSC) techniques to augment traditional E&S practices at the site.



Existing riprap lined stormwater channel before start of project.

RSC systems are natural open channel systems made up of a series of flat, shallow step-pools that convey a large portion of surface water flow to shallow groundwater flow. Stormwater conveyance and passive treatment is accomplished through a network of sand/mulch seepage berms, step pools, cobble weirs and cascades. This network reduces water velocity and volume and facilitates the removal of suspended particles and associated nutrients. This innovative approach has been demonstrated with much success as a post construction stormwater facility; however, the CCDPW project is the first of its kind to use RSC techniques to treat stormwater from construction activities.

The project was managed by the CCDPW Engineering & Construction Division and completed under a design/build contract. The project team included WHM Solutions, the BAI Group, Underwood Associates, and the Aquatic Resource Restoration Company. The project entailed the design and construction of an innovative stormwater management system intended to improve the quality of the stormwater run-off from the County landfill. The result of the effort was the design and construction of a Step-Pool Stormwater Conveyance (SPSC) utilizing RSC techniques that conveys stormwater through the system in a non-erosive manner while facilitating the natural removal of sediment and other pollutants prior to discharge into a tributary of the Northeast River located in the upper Chesapeake Bay watershed. The SPSC replaced an existing 1000’ riprap lined stormwater channel with a 90’ vertical grade change located up-

gradient of an existing sedimentation basin and was completed in April 2013 at a total cost of \$556,000.

The SPSC system was part of an MDE demonstration project which included a three month performance monitoring period to document the effectiveness of the approach. The project was monitored between June and August 2013. During that time there were 12 precipitation events at the site ranging from 0.5" to 4.5 inches of rainfall per event. Turbidity reduction was observed in every monitoring event. Turbidity measured at the top of the SPSC system ranged from 840 NTU to 60 NTU. The average discharge from the system was 25 NTUs with many events below 20 NTUs and all the events at or below the turbidity measured in the receiving stream.



SPSC project under construction

More recently, in April 2014, similar results were measured during a 100 year storm event at the site. Flooding in the area was comparable to Hurricane Sandy. During the storm, turbidity was measured over 800 NTU at the top of the system and the discharge was measured at 46 NTU.

The long term water quality benefits are currently being studied for the project. The preliminary results show many water quality improvements that are expected to increase over time as the site vegetation matures.

In May 2014, the project received an award from the Mid-Atlantic Chapter of the APWA for Technical Innovation. Currently, the project continues to perform successfully and produce similar results to those observed during the demonstration period. Long term, it is expected that significant improvements to stormwater quality will be obtained throughout the active life of Central Landfill and during post-closure.



Post construction - SPSC project approx. 1 year after completion of construction.

The SPSC system at Central Landfill is a promising, cost-effective, integrative approach to manage stormwater, reduce surface water pollution from long-term construction activities and improve stormwater quality. Other successful applications of the project are envisioned to include sites such as landfills, borrow pits, quarries, strip mines, timber harvesting, agricultural sites, or other large site development with extended construction periods.

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