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Project Summary Report 0-4572-S
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Project 0-4572: Characteristics of Compost Filter Berms

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PROJECT SUMMARY REPORT

Summary Report: Water Quality Characteristics and Performance of Compost Filter Berms

Several recent Texas Department of Transportation (TxDOT) pilot efforts demonstrated the beneficial uses of compost in roadside applications. Specific uses of composted materials on the roadside include erosion control, compost filter berms, and compost filter socks. Compost application as a soil amendment or mulch has shown positive results for vegetation establishment and is used widely across the state.

TxDOT, the Environmental Protection Agency (EPA), and the Texas Commission on Environmental Quality (TCEQ) were concerned that compost may have a negative water quality contribution through its leachate characteristics when used as a compost filter berm. Specific questions arose regarding possible eutrophication (also called nutrient loading) of receiving waters, a condition in an aquatic ecosystem where high nutrient concentrations stimulate blooms of algae. TxDOT was also concerned about the structural stability of compost filter berms, and this was investigated as an objective, secondary to water quality testing. This project developed supplemental specification information regarding use and placement of compost filter berms and compost/ wood mulch filter socks as viable best management practices (BMPs) for erosion and sediment control based upon the environmental implications of use.

What We Did...

Three different composts were tested: dairy manure compost (DMC), biosolids compost (CBS), and yard waste compost (YWC), mixed at a ratio of 50:50 compost and wood chips for berm applications. Unseeded compost filter berms, seeded compost filter berms, compost/mulch filter socks, and wood mulch berms were tested for water quality and structural stability. Straw bales and silt fence were tested for relative structural stability. Testing was conducted at the Texas Transportation Institute's Hydraulics, Sedimentation, and Erosion Control Laboratory at Texas A&M University's Riverside Campus.

Studies for the unseeded compost filter berms, wood mulch berms, and compost/ mulch filter socks tested samples used on 3 percent slopes with low-velocity flows of approximately 0.25 cubic feet per second (cfs) with a continuous flow of 15 minutes on two soil types: sand and clay. Each of the alternatives was tested for two rounds consisting of three repetitions in each round. If the berm sustained the water quality flow during a round, a 30-minute continuous-flow test was conducted at up to 0.35 cfs to test structural integrity.

All test flows used potable water. Baseline water samples were collected from the water reservoir. Subsequent water samples for the unseeded berms, wood mulch berms, and compost/mulch filter socks were collected from behind (upstream of) the berm/sock and in front of the berm/sock after infiltration. Time-weighted samples were collected at 1 minute, 7 minutes, 15 minutes, 30 minutes, and downstream after 45 minutes (Figure 1).

Testing of the straw bales and silt fence was done in the same manner as the compost filter berms except data collection consisted of water quality for total suspended solids and structural performance.

The seeded compost filter berms were tested in six at-grade channels, three with a centerline grade of 3 percent and three with a centerline grade of 7 percent. The berms were installed, seeded, and allowed to establish vegetation for 45 days prior to testing. Water quality samples collected for the seeded berms were from the water reservoir, behind the berm (upstream of the berm), at 1 minute after infiltration, and after 30 minutes, when overtopping ceased. The sample collected downstream of the berm after overtopping ceased captured direct infiltration through the berm.

The flowchart in Figure 2 outlines the timeline used for laboratory analysis of the samples collected. Water samples were collected in 1 liter cubi-containers and transported to the laboratory in a cooler at approximately 40° F (4° C). All tests used samples at room temperature.

What We Found...

The leachate properties of compost used as filter berms vary with the type of compost used. For unseeded compost filter berms, the YWC introduced the least amount of dissolved solids including sulfates, nitrates,

Figure 1. Sample Collection 1 Minute after Berm Infiltration.

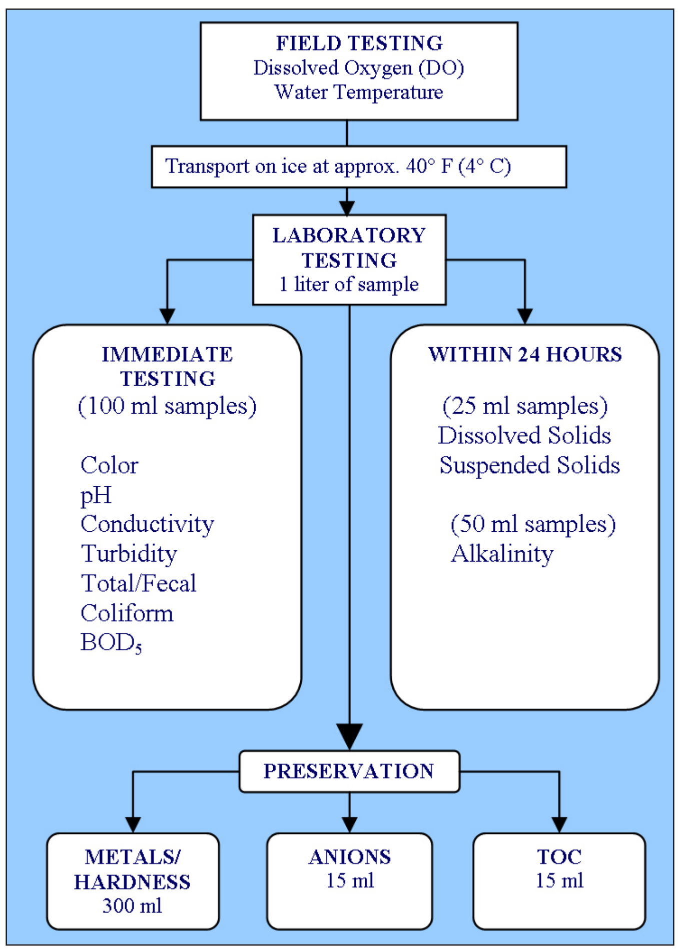

Figure 2. Laboratory Analysis.

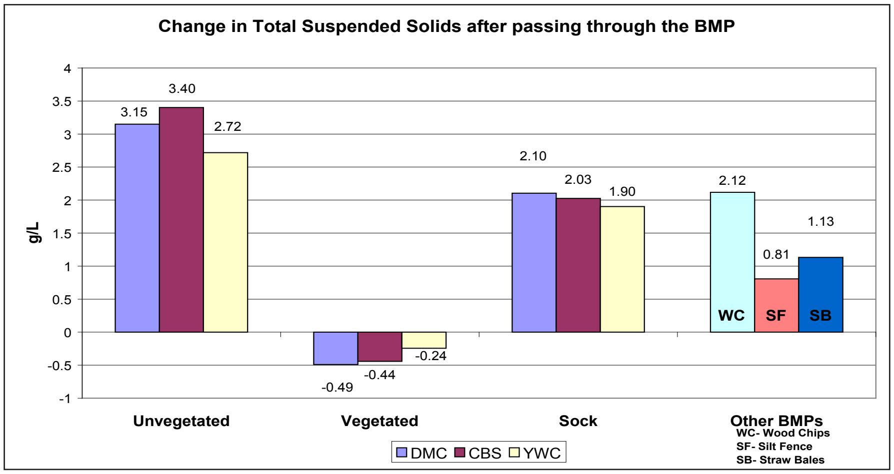

Figure 3. Change in Total Suspended Solids after Passing through the BMP.

and phosphates. CBS and DMC berms were unsatisfactory since both composts introduced substantial quantities of nutrients into the water.

The three types of seeded compost filter berms: dairy manure, biosolids, and yard waste, proved to be highly efficient as sediment trapping devices by bringing about an almost complete removal of suspended solids as shown in Figure 3. While the YWC berm contributed the least contaminants to the water, the DMC berm caused a considerable increase in the nutrient concentration. The CBS berm was intermediate as far as contaminant input goes. The increase in the concentration of nutrients in the water caused by these berms never increased to a level that warrants concern.

The compost filter berms that were seeded and allowed a residence time prior to testing structurally outperformed the unseeded berms (Figure 4). Overtopping was observed in the case of all of the seeded berms for both the 3 percent and 7 percent slopes. There was insignificant damage to the structure of the berms due to sustained overtopping. However, the unseeded berms had a structural failure rate of almost 100 percent under the specified test conditions.

For the unseeded berms, no definite pattern was observed in the failure of the berms. Failure was not restricted to a particular location or mechanism. On clay soil, the primary mode of failure was breaking due to stresses caused in the berm resulting from the longitudinal displacement of the berm. Displacement as great as 19 inches was observed in the case of the unseeded YWC berm as shown in Figure 4.

The Researchers Recommend...

Based on the results of water quality and structural stability testing done under laboratory conditions, the researchers developed supplemental specification information to be included as part of a project's storm water pollution prevention plan (SWPPP), placed in general notes, and/or placed on plan sheets. These are guidelines for compost filter berm and compost filter sock use and placement as a best management practice for erosion and sediment control. These are detailed in Report 0-4572-1.

Figure 4. Un-seeded (Left) versus Seeded (Right).

For More Details...

The research is documented in Report 0-4572-1, *Water Quality Characteristics and Performance of Compost Filter Berms.*

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