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SCDOT

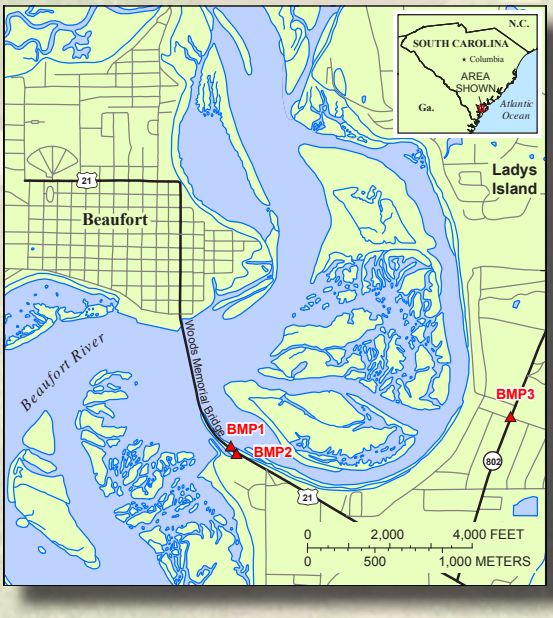
Prepared In Cooperation With The South Carolina Department Of Transportation

Evaluation of Structural Best Management Practices for Highway Runoff in Beaufort and Colleton Counties, South Carolina, 2005–2006

Study Description

As part of the National Pollutant Discharge Elimination System (NPDES) permit program mandated in the Clean Water Act, the South Carolina Department of Transportation (SCDOT) is required to address the quality of stormwater runoff from state-maintained roadways. From 2005 to 2006, the SCDOT and the U.S. Geological Survey (USGS) worked cooperatively in Beaufort and Colleton Counties, South Carolina (SC), to evaluate the performance of four different structural devices that served as best management practices (BMPs). These structural devices were installed to lessen the potential effects of stormwater runoff on water quality in waterways near state roads.

The purpose of this Fact Sheet is to summarize results published in the USGS Scientific Investigations Report 2008-5150. The report documents the ability of these four BMP devices to remove suspended sediment, metals, nutrients, and organics compounds in stormwater runoff. The quantity of rainfall and stormflow and quality of stormwater entering and leaving the BMPs were monitored during 12-13 storms over a 21-month period. The results provide the SCDOT with quantitative information to evaluate whether or not the BMPs effectively enhanced stormwater quality. This information can be used by the SCDOT and other State, local, and Federal agencies in the selection of appropriate BMPs for future installation.



Locations of three of the four structural BMPs evaluated during the study.

Structural Best Management Practices

The structural BMPs in this study were hydrodynamic separation devices that were designed similarly to capture suspended sediment, trash, organic material, and floating oil and grease from stormwater runoff before releasing the stormwater to waterways. In addition, other pollutants that attach to sediment also can be trapped by the devices. These particular BMPs were selected for evaluation because (1) the devices previously have been installed and operated by the SCDOT, (2) they represent the major types of available systems, and (3) the locations were in relatively close proximity to limit the influence of differing environmental conditions. [More information on hydrodynamic separators is available at ***http://www.epa.gov/owm/mtb/hydro.pdf*** and in the associated published USGS Scientific Investigations Report available at ***http://pubs.water.usgs.gov/sir2008-5150***]

Three of the four BMP sites were located on Ladys Island, which is south of Beaufort, SC (see location map). Storm runoff in this part of the study area flows to the Beaufort River, which is an estuarine system. One of the four BMP sites was located at the I-95 South rest area, south of Walterboro, SC (not shown on location map).

Findings from the Study

The difference between the inlet and outlet constituent concentrations during each storm event was used to quantify the amount of constituent removed by a BMP. Overall, the four BMPs were capable of signficantly reducing suspended sediment in the stormwater entering the inlets of the BMPs before discharging the stormwater at the outlets (see chart). The cumulative load of suspended sediment in stormwater entering the BMPs from all the storms sampled during the data-collection period was 1,026 kilograms (1.13 tons). The BMPs removed over half that amount as the cumulative suspended-sediment load of 558 kilograms (0.62 ton). However, the BMPs tended to trap sand-size sediment, thereby releasing a greater proportion of silt- and clay-sized sediment in the water discharging from the outlet.

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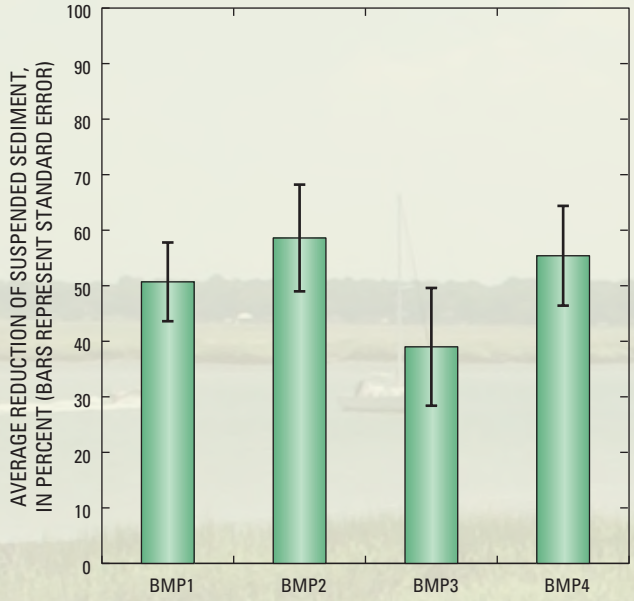
Three of the four BMPs released significantly lower oil and grease concentrations and all four BMPs released significantly lower total trace-metal concentrations in the stormwater discharged from the outlet. In general, the BMPs were not capable of significantly reducing fecal bacteria, nutrient, and total organic carbon concentrations.

The four BMPs also were compared and were determined not to be significantly different in their capacity to remove suspended sediment, total suspended solids, or oil and grease in stormwater runoff. However, BMP4 removed significantly more total cadmium, lead, copper, and zinc than the other BMPs during this study.



Average reduction of suspended sediment concentration, in percent, between inlet and outlet waters of each BMP for the sampled storm events.

In general, multiple interacting environmental factors appeared to influence the amount of reduction of constituent concentrations by the BMPs during individual storms (see error bars on chart). These environmental factors included the rainfall intensity of the storm, the amount and frequency of rainfall between sampling events, seasonal traffic-density patterns, and the period of time since the last maintenance (clean out) of the BMP.

Quality of Highway Runoff

Maintenance and operation of highways and the wear and tear of vehicles commonly result in the release of oil, grease, rust, hydrocarbons, rubber particles, and other solid materials onto the highway surface. Highway runoff during storms also may contain metals, including lead, zinc, cadmium, nickel, and copper, deposited by the ordinary wear of brakes, tires, and other vehicle parts. These materials are washed from highways during storms as dissolved or suspended particles (sediment) and discharged to nearby waterways.

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Full report available online at:

http://pubs.water.usgs.gov/sir2008-5150