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Field Monitoring of Erosion and Sediment Control Practices and Development of Additional Iowa DOT Design Manual Guidance

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Abstract

The National Pollutant Discharge Elimination System General Permit No. 2 requires the Iowa Department of Transportation (DOT) to develop a stormwater pollution prevention plan for all construction activities that are covered by the permit. The Stormwater Pollution Prevention Plan includes the design, installation, and maintenance of erosion and sediment control (E&SC) practices to minimize downstream impact from stormwater discharges. The Iowa DOT has specifications, standard drawings, and guidance for the design of E&SC practices, but these practices had not been formally evaluated for field performance.This research aimed to understand the performance of current E&SC practices and enhance the design guidance available to the Iowa DOT. Silt fence ditch checks, wattle ditch protection, silt fence perimeter control, and temporary sediment control basins were monitored for performance on US 30 in Tama County, Iowa. Two modified silt fence ditch check installations had an average of 2.5 and 4 times as much sediment accumulation as a standard silt fence, the modified wattle ditch protection had 13.15 times the sediment retention of a standard wattle installation, and silt fence perimeter control modifications led to less T-post deflection and failures observed than with the standard installation.

A temporary sediment control basin was monitored as a single basin and as basins in series. In the single basin, turbidity increased by an average 92 nephelometric turbidity units (NTUs) after residence in the basin, whereas the basins in series provided a turbidity reduction of 215 NTUs in the first basin and 870 NTUs in the second basin. However, the system of basins provides negligible turbidity reduction.

In addition to field monitoring, laboratory flume testing was conducted to compare the hydraulic performance of wattles. Average depth and length ratios were calculated for each tested wattle in addition to the percent difference between the wattle and an impervious weir and were classified from Class 1-4 with Class 1 being the least effective and Class 4 being the most effective at reducing supercritical flows. From flume testing, straw wattles meet Class 2; coconut coir, wood chips, and synthetic fiber wattles fall into Class 3; and miscanthus fiber would qualify as Class 4. This field study provided researchers insight on the performance of standard and several trial modified E&SC practices. Controlled testing should continue to verify results observed in the field.