

## Characterization of Stormwater Particle Size Distribution and Sediment Concentration through Evaluation of Manhole Sumps with SHSAM

### Executive Summary

Urban stormwater runoff contains sediment which pollutes water resources. Manhole sump structures have been constructed in many cities to capture the sediment material, but removal of the captured sediment has to be done for this system to be effective. Software is available to estimate sediment build up and help predict maintenance needs, but the software requires inputs of stormwater sediment concentration and stormwater sediment particle size distributions (PSDs). This study uses historical data from the University of Minnesota Twin Cities Campus Water Utility and the City of St. Cloud Minnesota maintenance records to calibrate the SHSAM model for stormwater runoff parameters. Assessment of the maintenance activity has also been done to evaluate maintenance effectiveness.

Sediments in urban stormwater can be characterized using a NURP50 PSD, which will provide a conservative estimate if you are using PSD for removal efficiency since finer particles settle slower and are less often removed by treatment. We recommend using a coarser PSD's with a D50 of 0.05mm to 0.1mm if you are using a PSD for estimating maintenance schedules and sediment removal amounts. When using the SHSAM model, the sediment concentration value appears to be more sensitive than the PSD input parameter.

We propose a sediment concentration of 400 mg/L be used for the SHSAM model or other calculations as an average value, with a typical range of 250 mg/L to 450 mg/L. Variation occurs with watershed characteristics and location and there is also variation in concentration with storm events.

Inspecting sump structures once per year with maintenance following inspections appears to result in capture of half of the accumulated sediments, with approximately half of the sediments being lost from flushing in intense storm events. Removal of the full sediment load captured appears possible if cleanout activity occurs twice per year. There is 1.68 c.f. of sediment captured per drainage acre per year with annual inspections followed by maintenance, while 3.08 c.f. of sediment is generated per acre per year. The sump material volume per acre of drainage is 5.32 c.f. when including organic material. The overall cost for stormwater sediment capture by sumps is approximately \$600/CF.

Use of calibrated input parameters in calculations and models, such as those determined here result in more accurate estimates of maintenance needs. Analysis of maintenance records also provides insight into how effective the maintenance is and how it can be improved.