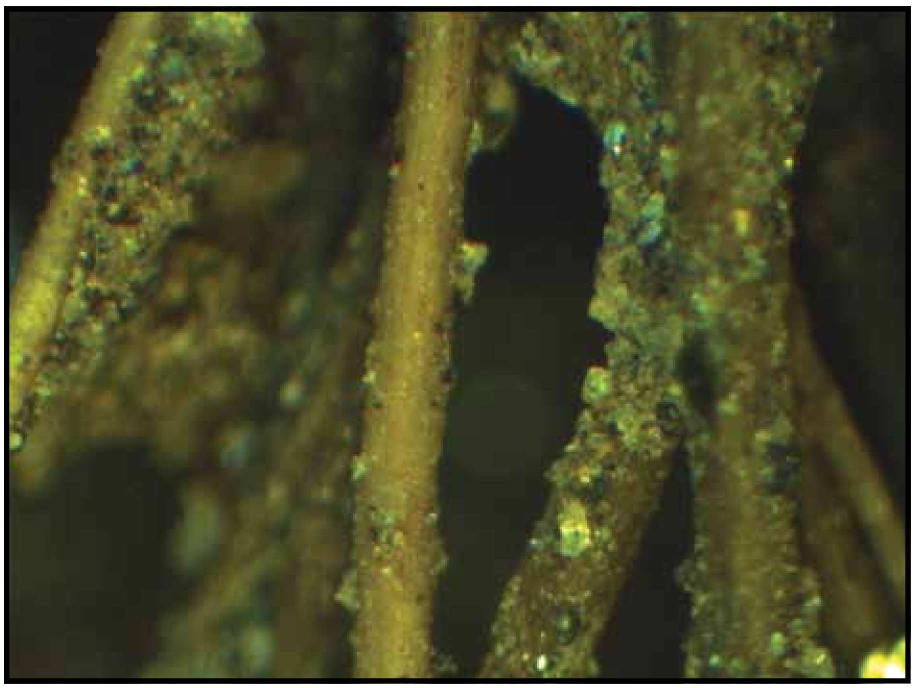
North Carolina Study Yields Field Testing Insights

The town of Highlands, N.C., applied for and won a grant from the Clean Water Management Trust Fund that allowed it to implement new drainage improvements near the downtown district and add a water quality treatment system that would help protect Mill Creek. Part of that system was a manufactured water quality vault. The project included testing the water above and below the vault for solids and nutrients, but the project's design team, McGill Associates P.A., saw the potential to look further than simply testing total suspended solids (TSS) and a few other constituents.

The general public and many stakeholders in the water industry may not be aware of the fact that reducing TSS is simply a surrogate for removing dangerous pollutants in storm water. The theory follows that by removing sediment, especially small particles, one can reasonably assume that one is removing other constituents that are more difficult to measure. In most jurisdictions, small separator vaults are assumed to be unable to remove small particles and dissolved pollutants, and thus are categorized as pretreatment devices. While these theories and assumptions may be valid, the researchers involved in this testing were determined to look further to see exactly what the vault contained in its bed load, and what it had trapped in its fiber filter.

Conventional water sample testing revealed that the vault had removed 96% of the TSS using SM-2540-D as the analysis method. Further water sample tests for nutrients showed 74% removal efficiencies for both total nitrogen and total phosphorus. These results seem to indicate that the vault in this study was trapping particles much smaller than theorized, so the sediment trapped by the device was analyzed for particle size distribution. That analysis showed that the bed load contained 57% sand-, 35.5% silt-, and 7.5% clay-sized particles. Simple physics indicates that a vault of this size could never "settle out" clay-sized particles, so it is probable that some other mechanism is at work to capture those particles. These results require further analysis of the bed load contents of similar devices to reveal how this occurs. There is evidence that small particles rarely exist freely suspended in storm water, but that they are attached to larger particles and other materials. When the materials taken from this vault were examined under the microscope, this behavior by small particles was evident, as they were seen clinging to practically every surface, including vegetative materials. The accompanying photomicrograph shows this clearly, as the fiber filter taken from the vault is covered in particles ranging in size from 1 to 20 μ.



Further testing involved analyzing the trapped sediment for nutrients and metals to see if the removal rates shown by the water sample analysis were supported by what was found in that sediment, and the results clearly demonstrated high levels of nutrients and metals. The final step was to analyze the coconut fiber filter itself to see what it contained. This analysis demonstrated that high levels of both nutrients and heavy metals had been trapped and retained by this filter.

Testing for inert sand- and clay-sized particles will never tell the full story of how effective a best management practice actually is in the field, but that is the best method that has been advanced to date. This study of a small vault in Highlands may provide some insight into how we can better assess our efforts at protecting our watersheds. SWS

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