

Particle Size Distribution (PSD) In Stormwater Runoff

Objective

The following discussion is intended to provide some insight for setting rules regarding PSD requirements for a post construction BMP. This is not intended to support any particular product.

Background

This is a subject that has progressed over many years. To establish a point of reference, I recommend reading a short-three page article (attached) that is part of Rinker Materials' Info Series titled Particle Size Distribution (PSD) In Stormwater Runoff. This article from 2004 was written in support of rules to "...mandate the design of control structures that capture fines (< 100 micron)." The article compares the results of the major studies that continue to drive the direction of this discussion. This includes a figure that gives a graph of the PSD ascribed to each of these major studies.

Discussion

The debate as to the definitive character of storm-water runoff continues with little possibility of exact success. The material carried in storm-water runoff is subject to time-variable conditions in every location where it occurs. Even if we had long-term sampling for a basin, it would not be able to predict an event as random as a truck load of material being left uncovered in a single rain event. To the extent that the cited studies do not represent any long-term testing there can be little true doubt that storm-water runoff has very fine constituent parts as well as larger material. Studies that have looked at wetlands have indicated their composition included significant fines that had built up over time frames of thousands of years. Indeed, the question that was raised with the first of these studies was not the size of material transported but whether the presence of material transport represents a true pollution threat. The EPA has taken the position that it is a pollutant in that sediment from earth-moving projects has had disastrous effects on stream ecosystems. This is definitely true; however, those same ecosystems would die without water's transport ability. EPA has found itself in the position of having to act without clear, defined technical solutions. To that extent, its initial rules regarding nonpoint source pollution called for state and local governments to write rules to remove 80% of the pollution from storm water. A document (Wright Water Engineers et al., 2007) provided on the current EPA web site offers 15 reasons why percentage reduction should not be used to classify a post-construction BMP. At the same time, the current guidance on the federal level is "that is still what is required". Total suspended solids

have been the object of most requirements that try to establish a measurement of this undefined 80%. This is because TSS can be tested with less cost than most other factors and reductions in TSS can result in improvements to other parameters, as well. This brings us to the poorly defined question of what constitutes 80% of the pollution in storm-water runoff. EPA has operated on the assumption that a BMP will provide this required pollution reduction if it meets the guidelines EPA establishes for the practice. They have yet to establish guidelines for an assumed reduction for hydrodynamic devices. In the past, any attempt to set a capture PSD that was limited to sand size particles or less was considered to be in agreement with the EPA intent. While that broad latitude in PSD may not be extended to states and local governments in the future, that change should be companioned with a revision of the vague 80% removal. For an example, of one of the most extensive evaluation and regulation examples of this type today would be New Jersey where a multi-million-dollar private evaluation industry has been established (NJCAT) that establishes test protocol and testing to certify water-quality products. Even with this extensive industry being local, New Jersey has written its own requirements with the use a larger PSD than that embraced by NJCAT. New Jersey requires a PSD with a median of 100 microns (see attached). This is not vastly dissimilar to many sand-size requirements when you consider this is a median. One can have some amount of material larger than 100 microns as long as there is enough material less than 100 microns to make the median 100 microns. A popular test material used to approximate this type of requirement is OK-110 sand. This is a sand product that has been used for metal castings for years that has a rather uniform PSD of about 110 microns. Some regulations include this PSD as part of their regulation.

Wright Water Engineers and Geosyntec Consultants, 2007. Frequently Asked Questions Fact Sheet for the International Stormwater BMP Database: Why does the International Stormwater BMP Database Project omit percent removal as a measure of BMP performance?