Establishment of an Effective Total Maximum Daily Load Through Reliable Water Quality

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INTRODUCTION
The federal government amended the Clean Water Act in 1987 by establishing a permitting framework under the National Pollutant Elimination Discharge Elimination System (NPDES) to protect the physical, chemical, and biological integrity of the nation’s receiving waters. When receiving waters are determined to be impaired due to an increase in certain types of pollutants, local enforcement agencies will normally issue a total maximum daily load (TMDL) order for those pollutants to prevent further decline in water quality. The margin in pollutant concentrations (the difference between the existing and critical concentrations) is multiplied by the stream flow to calculate the total allowable discharge load. The TMDL process considers other factors as well, such as safety and other pollutant sources in the watershed for TMDL analysis. Description of the TMDL process and available tools for conducting TMDL analyses are provided by the U.S. Environmental Protection Agency (EPA)(Shoemaker et al, 1997).

Establishing an effective TMDL program requires standard and consistent monitoring at the local, state and national level. Without proper standardization there will be noticeable differences in different aspects of stormwater monitoring and data collection. These noticeable differences among various monitoring programs may include, but are not limited to, sample collecting methods, analytical techniques, detection limit, data reporting, and data analysis. These differences have demonstrated to be problematic when considering TMDLs across an entire watershed.

This paper attempts to show how an inconsistent monitoring program will affect the reliability of water quality data and hence affect TMDL calculations. Another variable found to influence mass loading calculations in TMDLs is inconsistent methods of statistical data analysis when significant numbers of water quality data are below detection limits (non-detects). The influence of sample representativeness, analytical methods, and data analysis methodology on total maximum daily load computations is discussed in this paper. In addition, several suggestions and corrective measures are introduced that may be used toward establishing standardized monitoring programs for TMDL calculations.

MAJOR PARAMETERS IMPACTING TMDL COMPUTATION
There are many parameters that can affect the computation of TMDL. The influence of all of these parameters on TMDL calculations are beyond the scope of this paper. However, the impact of three major factors, including sample collection/representativeness, analytical method and reporting limit, and data analysis are discussed below.

Sample Collection/Representativeness
Most large-scale storm water monitoring programs use computer-controlled automatic samplers to collect samples of storm water runoff. Such samplers are typically programmed to pump small amounts of storm water under specified conditions. In most cases, the samples that are collected are based on the estimated volumes of the storm water that can passed through the sampler’s flow measurement system that control the sampler’s operation. These samples are collected in proportion to the measured flow...