

SCCWRP Annual Report 2009

Evaluating stormwater sampling approaches using a dynamic watershed model

Drew Ackerman, Eric D. Stein and Kerry J. Ritter

ABSTRACT

Accurate quantification of stormwater pollutant levels is essential for estimating discharges to receiving waters as required by many monitoring programs. Numerous sampling approaches exist that attempt to balance accuracy against level of effort (i.e., cost) required to collect the samples. This study employs a novel approach by evaluating the accuracy of different stormwater monitoring methodologies via the output from a continuous simulation watershed model. Seventy eight distinct methodologies were evaluated by “virtual sampling” of fourteen years of model output for Ballona Creek near Los Angeles, California. The 78 methods can be grouped into four general sampling strategies (with numerous permutations): volume-paced compositing, time-paced compositing, pollutograph sampling, and microsampling. The performance of each sampling strategy was evaluated by comparing the median relative error (bias) between the virtually sampled and the true modeled event mean concentration (EMC) of each storm. As a combined measure of bias and precision, the percentage of storms where sampling methods yielded estimates within acceptable levels of accuracy (i.e., 10% of true EMC) were computed across various categories of storm sizes. Finally, costs associated with site setup, personnel costs while sampling and laboratory costs were estimated for each of the methods. Pollutograph sampling consistently outperformed the other three methods both in terms of bias and accuracy. However, pollutograph sampling was the most costly method evaluated. Time-paced sampling consistently underestimated while volume-paced sampling over estimated the storm EMCs. Microsampling performance approached that of pollutograph sampling at a substantial cost savings. The most efficient method for routine stormwater monitoring in terms of a balance between performance and cost was volume-paced composite sampling, with variable sample pacing to ensure that the entirety of the storm was captured. Pollutograph sampling is recommended if the data are to be used for detailed analysis of runoff dynamics.

Full Text

http://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2009AnnualReport/AR09_195_210.pdf