Data Reporting Guidelines for Certification of Manufactured Stormwater BMPs: Part II

CE Database: Stormwater management, best management practice, performance characteristics, water quality, certification

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Abstract

Data Reporting guidelines presented here were developed as part of the ASCE/EWRI Task Committee on Guidelines for Certification of Manufactured Stormwater BMPs. This work is the collaboration of the Stormwater Infrastructure Committee of EWRI's Water, Wastewater, and Stormwater Council (WWSC) and the Wet Weather Flow Technology Committee of the Urban Water Resources Research Council (UWRRC). These guidelines were developed by review of the major manufactured treatment device certification protocol requirements drawing primarily from the Technology Assessment Protocol-Ecology (TAPE) and the Technology Assessment Reciprocity Partnership (TARP). These reporting guidelines have been broadened to support the International Stormwater Best Management Practices (BMP) Database. With the increasing need for the field testing of proprietary devices comes the importance of consistent data reporting guidelines to be used when reporting to regulatory agencies or designers. The need for standardized reporting is underscored by the tremendous impact the range of testing factors can have upon testing results. These factors include the testing environment, experimental design, testing methodologies, statistical analysis, and data presentation. The need for consistency is underscored by the complex influence these factors have upon performance results. A clear and consistent data reporting approach can ensure that these biases are minimized, well understood, and that representative field testing can be effectively evaluated by the regulatory agency. A consistent reporting format is also needed to aid vendors to efficiently navigate the complicated application process for device certification. Finally, an independent third-party is needed to either conduct or review the testing to ensure testing impartiality. The committee membership includes stakeholders from the regulatory, academic, manufacturing, and design communities.

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Introduction

The need for a strict coherent approach to the testing of manufactured treatment devices (MTD) for stormwater management is ever increasing. MTD abound in the marketplace; however, there is limited information about system performance by third-party verification, and third-party verification protocol is not consistent This makes it difficult for consumers and stormwater managers to make informed decisions. A few states are making progress on this front, but there is no recognized consensus in the approach. To address this issue, both prescriptive testing protocols for laboratory and field conditions are required. The data acquired through those processes requires detailed reporting. The certification process itself can arguably be as difficult as the device testing process. Because of a lack of reporting guidance for the dominant testing protocol, vendors are left to discover the reporting requirements. This can lead to an inefficient, incomplete, and multi-stepped review process that can take years to negotiate effectively.

The ASCE/EWRI Task Committee on Guidelines for Certification of Manufactured Stormwater BMPs was convened in 2007 and is comprised of a range of stakeholders from academics, industry, and regulatory communities. By the end of 2009, the subcommittee on Data Reporting is responsible for preparation of the reporting guidelines for the presentation of testing results, so the data can be readily interpreted by the regulatory community.

The result of effective data reporting is a System Performance Evaluation Report that presents sufficient information to determine if an MTD meets the requisite performance standards within a reasonable level of statistical confidence. The System Performance Evaluation Report includes both summary data and sufficient experimental data to provide a detailed review of system performance. A critical review of leading testing protocols was performed and used as the basis for these guidelines. The first and only approved certification report for a MTD was also included. These reporting guidelines may need to be further adapted based on the synthesis of the subcommittee's products on both Field Testing and Data Analyses.

Background

Prescriptive testing protocols are needed because the range of influences upon testing and performance data is wide and not always well understood. Influences include watershed characteristics, storm event characteristics, maintenance requirements, system sizing, and testing methodologies. A testing protocol that does not dictate methods introduces biases that are challenging to account for.. In addition for performance characteristics to be compared across a range of different MTDs similar analytical methods and monitoring strategies must be used. The function of existing protocols is often to provide both a uniform testing environment and an accelerated review process that aids in the acceptance of stormwater technologies. Arguably, the current protocols have mixed success as measured by the existence of very few approved technologies despite programs existence for over 7 years.

If the testing protocol adequately addresses these issues, the testing results must be presented in order that a committee of scientists is not necessary to synthesize and interpret the results. This last point is significant, because the staff of the many regulatory agencies that reviewing the test results can not be expected to decipher the range of factors influencing system performance. As such, reporting results require sufficient information ranging from detailed appendices of experimental data to summary data indicating whether the systems met requisite performance standards within a reasonable level of statistical confidence.

A consistent reporting format does not currently exist; this leads to an , which has lead to a non-transparent and inefficient application and review process. Consistent and thorough data reporting requirements will aid regulatory review and vendor application alike.

The technology protocols and reports reviewed as part of this effort included:

- TARP Tier II Guidance Document: Protocol for Stormwater Best Management Practice Demonstrations. (NJCAT, 2003).
- New Jersey Tier II Stormwater Test Requirements - Amendments to Tarp Tier II Protocol. (NJCAT, 2006).
- TARP (Technology Acceptance Reciprocity Partnership) Tier I Guidance Document. TARP. (2001).
- NJCAT Technology Verification: Stormwater Management Stormfilter (CONTECH Stormwater Solutions, Inc. 2007).
- ETV Verification Protocol Stormwater Source Area Treatment Technologies. US EPA Environmental Technology Verification Program, Washington DC. (USEPA, 2002).
- Technology Assessment Protocol- Ecology's (TAPE) by the State of Washington, Department of Ecology. (WADOE, 2002).
- Improved Protocol for Classification and Analysis of Stormwater-Borne Solids. Water Environment Research Foundation, Alexandria, Virginia. (WERF, 2007)
- Urban Stormwater BMP Performance Monitoring. (USEPA and ASCE 2002)
- International Stormwater BMP Database. (ASCE et al, 1996))

International Stormwater BMP Database

The reporting framework was broadened to include data reporting criteria that will also meet the requirements for inclusion in the International Stormwater BMP database (BMPDB). The purpose of the BMPDB is to provide scientifically sound information for improved the design selection, and performance of stormwater management strategies. Continued population of the database and assessment of its data will lead to a better understanding of factors influencing BMP performance and help to promote improvements in BMP design, selection, and implementation. Statistical performance reporting requirements consistent with those used in the BMPDB are proposed as part of the MTD reporting framework. The database is only as valuable as the information that is included in it. The breadth and depth of the testing that will be done for MTD certification are ideal for inclusion in the BMPDB.

Work Plan

The subcommittee work plan for year one was to develop a consensus on a Reporting Framework. This was accomplished by the review of existing protocols, literature, and technology evaluation reports. Next, the framework was to be developed in the form of an annotated outline and sample mock-up. By year two, final input from the subcommittee will be completed. The next stage is for the draft Reporting Framework to be circulated amongst the full committee. The Final Data Reporting Guidelines will be completed in 2009. At which point, the full committee guidelines will be presented at the EWRI Annual Meeting.

DRAFT Reporting Framework

The reporting framework includes information ranging from the testing location, MTD specific information, test methods and procedures, and testing and sampling conditions. The test methods section will be determined largely from the subcommittee on Field Testing Methodology. The performance results and discussion are presented from two perspectives: 1) complete testing summary statistics and 2) on an individual event basis. Overall system performance is needed to determine the basic MTD performance. The summary statistics reflect largely the BMPDB (ASCE, 1996). The individual storm reports (ISR) on system performance enables understanding of the system variability with respect to storm event characteristics. This section has been adapted largely from existing reporting protocols for TAPE (2008).

The framework is listed below.

1. Summary: Executive Summary with rated performance rating, Study Summary, Data Collection Summary
2. Definitions
3. Site Conditions: longitude, latitude, land cover type, land use activities, site conditions, site elevations and slopes, location of sampling equipment, location of on-site stormwater collection system, and a description of any upstream BMPs
4. Technology Description:
   a) The specific device used (model number, size)
   b) Functionality of treatment mechanisms including pretreatment and bypass requirements
   c) Physical description: engineering plans, site installation requirements
   d) Cost of system and installation
   e) Sizing methodology: flows, volumes, etc.
   f) Maintenance procedures
5. Test Methods and Procedures
   a) Particle size for influent, effluent, and residuals, mass based, concentration based
   b) Water quality parameters monitored
   c) Data Quality Objectives (DQO), QA methods, and measurement accuracy for the observations
   d) Measuring instruments, sampling frequency, and sampling program information
   e) Sampling Locations and Peak Concentration Timing
6. Testing and Sampling Event Characteristics:
   a) Storm date, depth, antecedent dry period, intensity, duration, season, type of runoff (precipitation, snowmelt, groundwater, etc.)
   b) Number of influent and effluent aliquots; storm volume, % storm treated influent, effluent, peak flow rate, calculation of peak reduction and lag coefficients, number of storms exceeding design criteria.
   c) Comparisons with Data Quality Objectives
7. MTD Performance Results and Discussion:
   a) Event mean concentrations for influent and effluent with summary statistics (N, mean, median, coefficient of variation, standard deviation, one –tailed sign t-test)
   b) Detection limits and confidence intervals
   c) Performance metrics: removal efficiency, efficiency ratio

d) Statistical Evaluation: time series plot, box and whisker with confidence intervals, effluent probability method, linear regression . Statistical analyses should be consistent with the International BMP Database (bmpdatabase.org).
e) Solids characterization: influent, effluent, residuals particle size analysis
f) Accumulated mass reductions
g) Individual Storm Reports with event characteristics (6a and 6b), combination event hydrograph and hyetograph with sample times; system performance characteristics (7a-c), monitoring details
h) Quality Assurance, rejection criteria and rejection summary.
i) Maintenance findings: discussion on recommended maintenance schedules

8. Conclusions, Performance Claims, and Limitations
9. Appendices: Raw data and credentials
10. Third Party Review. The testing and reporting, if not performed by an independent professional third party, must be reviewed. The independent review should include a review summary and observation of at least one monitoring event.
11. Appendices

Conclusions

Guidelines produced by the Data Reporting subcommittee will be completed in 2009. The
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