



Shortened Abstract

Title: *SCALING DOWN TO SCALE UP: SMART STORMWATER CONTROLS FOR EXTREME RAINFALL RESILIENCE*

R.G. Bathurst, PE, BC.WRE, LEED AP*

RGB Civil Engineering LLC, 847 S Shore Drive, Glen Burnie, Maryland 21060

*bbathurst@rgbcivileng.com

What Will Be Presented:

Originally constructed in 1981, the stormwater management pond at Baltimore Gas and Electric's Energy Operations Building represents an early generation of stormwater infrastructure in Baltimore County, Maryland. Located in the headwaters of the Middle Gwynns Falls Watershed, the facility was originally designed solely for flood mitigation, consistent with pre-modern standards that did not incorporate water quality treatment.

This presentation will showcase how the legacy pond was retrofitted with an innovative Smart Stormwater Management system that integrates real-time monitoring, cloud-based analytics, and adaptive control strategies. The upgraded "Smart Pond" dynamically responds to storm events to optimize hydraulic performance, pollutant removal, and overall system resilience.

The presentation will include:

- Performance results demonstrating improved peak flow attenuation during extreme rainfall events;
- Economic analysis showing approximately \$450,000 in generated water quality treatment value through retrofit implementation;
- An overview of how micro-scale control technologies can provide macro-scale resilience benefits for aging stormwater infrastructure;
- Research collaboration efforts with University of Maryland, Baltimore County under the Chesapeake Bay Trust Restoration Research Program; and
- Discussion of how Smart Stormwater Management systems align with emerging guidance in the draft Pennsylvania Post-Construction Stormwater Management (PCSM) Manual, including the use of Active Adaptive Flow Control technologies for stormwater control measures (SCMs).

What the Audience Will Learn:

Attendees will gain insight into how legacy stormwater management facilities can be transformed into high-performing, climate-resilient assets through smart, adaptive control technologies. The session will demonstrate how Smart Stormwater Management systems can:

- Improve water quality treatment and flood mitigation performance without major structural expansion;
- Enhance resilience to increasingly intense rainfall patterns through real-time operational control;
- Provide measurable economic and regulatory value for existing stormwater infrastructure;
- Support compliance with evolving stormwater management guidance and permitting frameworks; and
- Be integrated with a wide range of stormwater control measures, including detention basins, wet ponds, bioretention systems, underground storage facilities, and infiltration-based SCMs.

The presentation will also provide practical insight into how adaptive stormwater controls may support future implementation of emerging PCSM guidance and modernized stormwater management practices.

BIOGRAPHY:

Mr. Bathurst is a President at RGB Civil Engineering located in Glen Burnie, MD. Bob graduated from Drexel University with a BS degree in Civil Engineering and MS degree in Industrial Administration from Carnegie Mellon University. He has advanced education in civil engineering with specialization in water resources and has testified as an expert witness in matters regarding stormwater management throughout the course of his 37-year career. Bob holds BC.WRE Board Certification from the American Academy of Water Resources Engineers (the highest level of advanced post-license certification offered in the water resources engineering profession for professional engineers) and holds Professional Engineer licenses in Maryland, Pennsylvania, & West Virginia. Bob has served as a consultant to the Maryland Department of the Environment - Water & Science Administration since 2002 and City of Baltimore - Office of Plans Review and Inspections since 2004.

A Digital O&M Toolkit: Conditional Forms and a Database of Routine Stormwater Management Inspections

B. Cary^{1*}, J. Wright¹, & A. Torreyson¹

¹*Tetra Tech, Inc.*

**Corresponding author email: blake.cary@tetratech.com*

What I will be presenting:

Inadequate maintenance can lead to a progressive decline in stormwater management performance, yet traditional inspection methods are often insufficient to mobilize the appropriate maintenance crews. This presentation describes Tetra Tech's work for The County of Los Angeles to evaluate and optimize its operations and maintenance (O&M) program for the Monteith and View Park stormwater systems. The systems convey stormwater through a diversion structure, trash screen, slide gate, pretreatment device, monitoring systems, and drywells before infiltration. The updated O&M structure includes background on required maintenance and provides easy navigation to component-specific inspection and maintenance forms. These details strengthen the O&M document as a practical resource by clarifying how each system is intended to perform and by directly supporting digital form development. To improve consistency in field inspections and support inspectors, digital forms were created using Esri's Field Maps Designer with conditional logic, automated calculations, and required fields tailored to individual components. Inspection data are stored in ArcGIS Online at the device level and linked to storm events, creating a structured record that supports long-term asset management, performance tracking, and more informed maintenance decisions. The presentation will highlight the rationale, implementation approach, and key outcomes of this digital O&M toolkit.

What the audience will learn:

Attendees will learn how a stormwater O&M program can be translated from a paper or judgment-based process into a repeatable digital workflow that improves inspection consistency and decision making. The presentation will show how component specific forms can be built within Esri Field Maps Designer, including the use of conditional logic to tailor questions to different structures such as pretreatment devices, slide gates, and monitoring equipment. Participants will also see how required fields and automated calculations help reduce missed observations, standardize data collection, and improve the quality of field documentation. In addition, the session will demonstrate the value of storing inspection results in ArcGIS Online as a centralized, searchable record linked to individual storm events and management devices. The audience will leave with practical lessons on organizing an O&M toolkit for complex linear stormwater systems, improving the handoff between inspection and maintenance crews, and building a database that supports maintenance prioritization, system performance review, and long-term asset management. These ideas can be adapted for other stormwater facilities seeking more efficient operations.

Private SMPs, Public Value: Insights from Monitoring Privately Owned GSI

R. Schaeffer^{1*}, M. Avenier¹, T. Stables¹, K. Csatari¹

¹Philadelphia Water Department, 1101 Market St. 4th Floor, Philadelphia, PA 19107

*Corresponding author email: richard.schaeffer@phila.gov

What I will be presenting:

Since 2020, the Philadelphia Water Department (PWD) has conducted performance testing and water level monitoring at privately owned regulated stormwater management practices (SMPs). Construction of these SMPs is required when land development results in an earth disturbance of 15,000 square feet or greater in most parts of Philadelphia. These SMPs encompass roughly 30% of green stormwater infrastructure (GSI) in Philadelphia by greened acreage but are and have historically been underrepresented in PWD's testing and monitoring efforts due to logistical hurdles such as SMP size and site access limitations. As of May 2026, performance testing and water level monitoring has been conducted at 8 private regulated SMPs to assess storage utilization, draindown rates, and identify causes of any observed performance issues. The results of this testing and monitoring are being used to update PWD's Stormwater Management Guidance Manual.

What the audience will learn:

The audience will learn about general performance characteristics of privately owned GSI, such as ability to manage runoff and issues observed during testing and monitoring, as well as how lessons learned from these efforts are incorporated into updates made to PWD's Stormwater Management Guidance Manual through a multi-step process:

1. Data and field observations are obtained from testing and monitoring
2. Analysis of observations and data to determine performance metrics
3. Develop repair and maintenance recommendations, and produce comprehensive assessment of system performance using performance metrics, system design, and site history
4. Assessments of all private regulated SMPs are considered in aggregate to determine lessons learned and update guidance manual

Additionally, this presentation will cover topics such as monitoring strategy and timeline, site selection criteria, goals and objectives, and limitations of testing and monitoring. The content of this presentation will be most applicable to public utilities and environmental protection agencies, as well as anyone involved in the implementation of GSI, including designers and property developers responsible for the construction and maintenance of onsite stormwater management.