Cost Effective Monitoring Strategies in MS4 Programs

A Tale of Two Cities:

The Evolution of Monitoring Strategies in Municipal Separate Storm Sewer System (MS4) Programs

City of Hoover NPDES Permit History

On October 12, 2001, the Alabama Department of Environmental Management (ADEM) issued National Pollutant Discharge Elimination Systems (NPDES) Permit Number ALS000001 for "Birmingham Area Municipal Separate Storm Sewer System and Jefferson County", that became effective on 1 November 2001 and expired on 31 October 2006. The City of Hoover, the 6th largest city in Alabama, was required to comply with permit requirements.

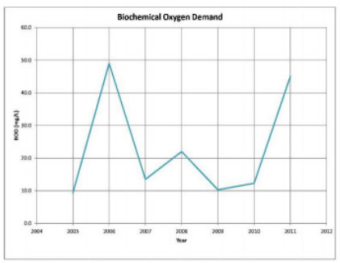
Permit monitoring requirements consisted of identifying monitoring locations that would be representative of various land use types and collecting stormwater samples during a storm event at each monitoring location once or twice a year.

For a storm event to qualify for sampling, it had to be proceeded by 72 hours of dry weather from the previous measurable storm event (rainfall greater than 0.10 inches), and produce a minimum of 0.10 inches of rainfall. The stormwater sampling criteria was a flow weighted composite sample initiated within the first two hours of discharge.

Typically, a flow weighted composite sample would take approximately 3 to 6 hours to collect. Collection methods could either be manual using field personnel, or using automated sampling equipment.

At a minimum, the permit required sampling at each location on an annual basis resulting in a single data point, an unrepresentative snapshot for each representative land use, of what was happening in the stream.

The City of Hoover found that the single data point provided little value for evaluating the effectiveness of its MS4 program. In 2007, the City withdrew from the Storm Water Management Authority (SWMA) and assumed responsibility for developing and implement-ing its own Municipal Separate Storm Sewer System (MS4) program ADEM administratively extended the requirements and conditions of NPDES Permit Number ALS000001 until an individual NPDES permit could be issued to the City of Hoover.



Annual sampling strategy, 7 years

Cost-Benefit Analysis

As part of its new program, the City of Hoover needed to satisfy regulatory requirements within its funding constraints. The City performed an evaluation of SWMA activities performed to support the MS4 program, and prioritized each activity based on its need for permit compliance and the associated costs. Results of the evaluation revealed that the activities within the monitoring program were required for permit compliance, however the human resources and lab logistics required to capture a storm event at 4 to 5 locations were an expensive endeavor. The City decided to implement the existing monitoring program while it conducted a more detailed cost-benefit analysis.

The monitoring requirements of the original permit, developed more than a decade earlier, were based on available technology at the time. The City identified significant advancements in monitoring technologies and initiated an effort to evaluate new instruments and techniques that might prove more cost effective, and could produce data that was more representative of stream conditions.

To determine sampling parameters requirements, the City reviewed the State's water quality criteria, 303(d) list, Total Maximum Daily Load (TMDL) list, and pollutants of concern (sanitary sewer overflows, sediment, nutrients, etc.). Common water quality parameters included dissolved oxygen, temperature, turbidity, conductivity, pH and level. These base parameters provide a general insight to stream health and/or could also be used as surrogate parameters to evaluate pollutants of concern. The City identified trade-offs in the monitoring methods: continuous monitoring didn't provide the full array of parameters when compared to grab sampling, however grab sampling resulted in limited and skewed data. The City determined that to get more value out of the data, more data was needed.

After the criteria for continuous monitoring equipment was established, the City began evaluating various types on the market. The In-Situ TROLL 9500 Multiparameter Sonde with a telemetry system was selected. The 9500 was capable of measuring the parameters of interest at a user-selectable time interval. A 15-minute reading interval was selected.with a push to the web every hour. This measurement rate would produce approximately 8,760 hourly data points for each parameter over a year, which would provide a much clearer picture of stream conditions. It was also capable of sending alerts when a preset trigger condition was met. For example, if conductivity exceeded a threshold set by the City, the system would send the City an alert. The City could then deploy staff to investigate the situation to determine if a non-stormwater discharge was occurring.

An indirect benefit of a continuous monitoring system was that staff would no longer be required to collect grab samples during qualifying storm events. These events often fell outside of their 8-5 schedules and/or on weekends. Schedules would be more manageable and predictable, and staff could be freed up to perform additional duties such as maintenance.

The City's cost-benefit analysis over a 5-year period, including maintenance, revealed that the costs of establishing a continuous monitoring station was approximately 30% less than the flow composite sampling method and produced significantly more data.

As a result, the City moved forward to obtain ADEM approval to modify its monitoring program.

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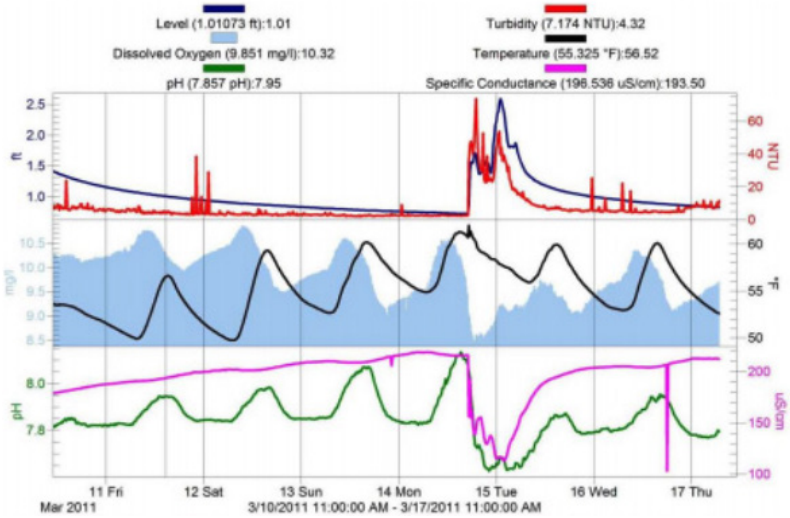

Continuous monitoring strategy, 1 week

A Paradigm Shifts

In 2010, the City of Hoover received regulatory approval and installed two continuous monitoring stations on Patton Creek. A third site was added in 2013. Over a six-year year period, the continuous monitoring stations provided valuable insight into what was happening within the Creek, and helped the City to eliminate non-stormwater discharges. The City of Hoover was the first municipality in the State of Alabama to utilize this technology in its MS4 program.

Shortly after implementing its new monitoring program, the City identified an illicit, industrial discharge, along with potential sanitary sewer overflows.

Building on Success

After seeing the benefits that The City of Hoover was realizing with their continuous monitoring program, The City of Montgomery decided to make a similar bid. In order to obtain approval, the City needed to convince both ADEM and EPA that continuous monitoring met the compliance requirements for the individual NPDES permit.

Obtaining approval of ADEM and EPA required the City of Montgomery to meet with EPA representatives to convince them of the value of the technology. The City argued that continuous monitoring improved compliance by reducing the risk of missing qualifying storm events. More importantly, when combined with near real-time alarms using telemetry, they argued that continuous monitoring enabled them to identify potential pollutant sources and truly solve problems versus just collecting data. ADEM and EPA commended the City on its innovative approach, and encouraged them to move forward with the new monitoring technology within their individual permit program.

The City of Montgomery was the first municipality in Alabama to renew its MS4 NPDES permit. As a result, the City was successful in getting continuous water quality monitoring and telemetry technology incorporated into its MS4 NPDES Permit.

Continuous Improvement Equals Ongoing Cost Reductions

The City of Hoover continues to evaluate and incorporate state-of-the-art technology into its monitoring program. In April of 2016, the City replaced its aging TROLL 9500 instruments with In-Situ Aqua TROLL 600 Mulitparameter Sondes. New advancements in sensor and antifouling technology incorporated into the Aqua TROLL 600 design have further reduced program costs by extending deployment times and lowering costs associated with field visits for maintenance.

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