CASE STUDY

THE MIDDLE RIO GRANDE WATERSHED BASED MS4 PERMIT

ALBUQUERQUE MS4 – THE EARLY YEARS

In the early years of its permit history, the Albuquerque Metropolitan Arroyo Flood Control Agency (AMAFCA) operated with a typical MS4 Phase I, individual permit that included Minimum Control Measures along with Best Management Practices to enhance water quality including:

- Public education and outreach
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention/good housekeeping

Monitoring was conducted under permit compliance and in support of MS4 operations. Patrick Chavez, AMFACA's Stormwater Quality Program Engineer, is responsible for developing and maintaining the Agency's Stormwater Monitoring Program (SWMP).

The conventional NPDES permitting approach provided little consideration of upstream sources except as background concentrations of a pollutant. Often, attainment of water quality standards and other water quality goals was independent of addressing upstream pollutant contributions. The limited data provided by grab sampling made it difficult to determine whether BMP's were effective in supporting water quality standards defined by the EPA.

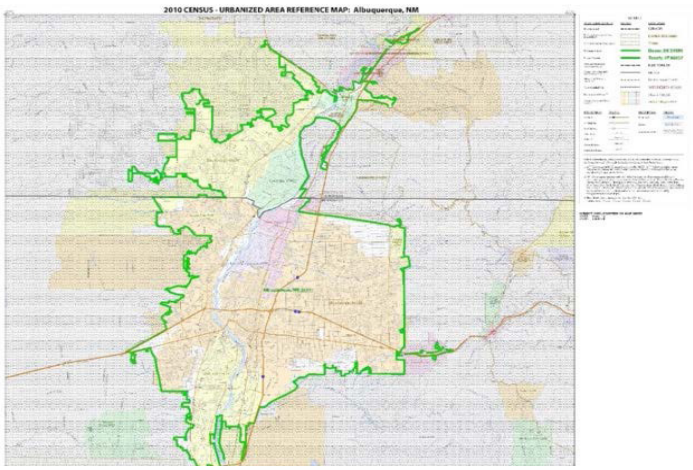

Figure 1. Albuquerque urbanized area.

EPA ANNOUNCES THE WATERSHED BASED PERMIT

In 2009, at the request of EPA, the National Research Council (NRC) published a report entitled "Urban Stormwater Management in the United States". In the report, The NRC determined that the framework for addressing sewage and industrial wastes within the Clean Water Act was not well suited to the more difficult problem of stormwater discharges, and recommended that EPA make fundamental changes in the current management of stormwater including switching to a watershed based permitting approach.

As a first step, the NRC suggested the EPA create a pilot program that would allow them to explore the many complexities of watershed-based permitting (WBP). Some of the pilots' goals included implementing mechanisms to better tailor stormwater management plans and stormwater permits to meet the needs and conditions of the selected watersheds. In addition, the pilots would document efficiencies to be gained by the permitted entities in implementing certain elements of the stormwater program, e.g., education, outreach, and monitoring.

The EPA announced three pilot areas selected to explore watershed permitting concepts for stormwater management. The Middle Rio Grande (MRG) valley (see map in Figure 4) was chosen as one of three pilot Watershed Based Permit (WBP) projects nationwide because of existing water quality impairment in the Rio Grande and the opportunity to work on the challenges of permitting unique to arid and semi-arid parts of the country.

Figure 2. AMAFCA aerial view.

BENEFITS OF A WATERSHED BASED PERMIT (WBP)

In contrast to earlier permits, the watershed based permit allows both the Phase I and Phase II permittees to adopt a common minimum set of goals in the watershed to avoid further loss or degradation of designated beneficial uses within the MRG watershed's component waterbodies.

Because the water quality of the MRG is attributable to upstream sources in addition to local discharges, the individual and cooperative monitoring requirements help to identify upstream pollutant contributions to the regulated MS4s. The education and outreach requirements also help to promote early and continuous involvement of parties responsible for upstream sources.
The permit includes flexibility to establish cooperation among permittees and watershed stakeholders, particularly in the areas of education, outreach and monitoring. Permittees work collaboratively with the lead permittee, AMAFCA, to coordinate work, thereby maximizing cooperation, integrating and prioritizing implementation, and realizing cost reductions.

The flexibility of the permit allows for the development and implementation of a joint SWMP among the MRG permittees in cooperation with public agencies or private entities. The primary benefit of the cooperative watershed framework in the MRG is that it promotes more effective and efficient improvements in water quality than an uncoordinated, single-source oriented stormwater management program.

Permit requirements

The permit (Part I.C.1) requires that discharges not cause or contribute to a violation of an applicable numeric or narrative surface water quality standard and AMAFCA to control the discharges of pollutant(s) of concern to impaired waters and waters with approved TMDLs.

Sampling of discharges resulting from storm events at locations coming into the MS4 jurisdictional (upstream) area, and leaving the MS4 jurisdictional area (downstream) are required. Permittees are required to sample for TSS, TDS, COD, BOD5, DO, oil and grease, E. coli, pH, total kjeldahl nitrogen, nitrate plus nitrite, dissolved phosphorus, total ammonia plus organic nitrogen, total phosphorus, PCBs, and gross alpha.

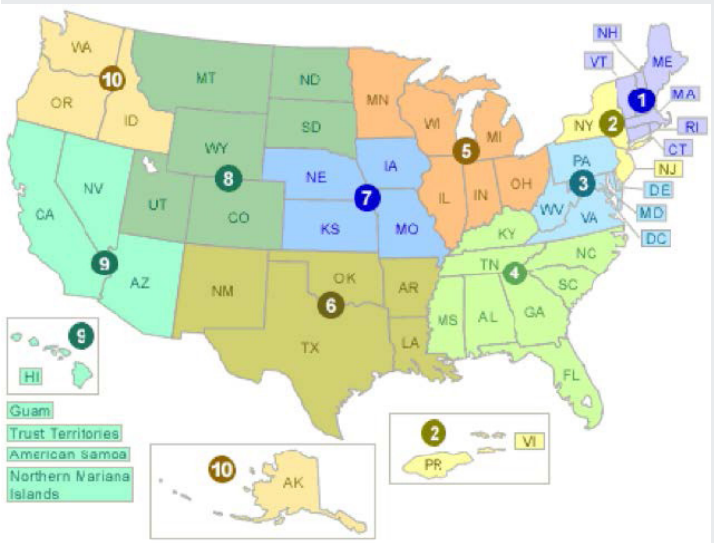

Figure 3. Pilot project locations - Ramsey Washington Watershed District, Milwaukee Metro Watershed, MRG Watershed.

Excessive levels of pollutants discharged during dry weather to the MS4 (i.e. illegal dumping of liquids into a storm drain inlet or system) must be identified, investigated, and addressed within the contributing jurisdiction.

As a Class A Permittee, AMAFCA is also responsible for monitoring stormwater discharges from Type 1 and 2 industrial facilities which discharge located within their jurisdiction.

One or more of the minimum measures can be implemented within a given MS4 by an entity other than the discharger, provided the other entity agrees to implement the control measure on behalf of the MS4, and that the proposed measures are as stringent as those required in the corresponding MS4 permit.

Stormwater sampling may be conducted at outfalls, internal sampling stations, and/or in-stream monitoring locations, and Permittees may choose either Option A (Individual Monitoring Program) or Option B (Cooperative Monitoring Program), as pictured below.

There is significant incentive in the permit to participate in a cooperative sampling program that includes financial contribution by all participating entities. Cost is dependent on the number of entities participating.

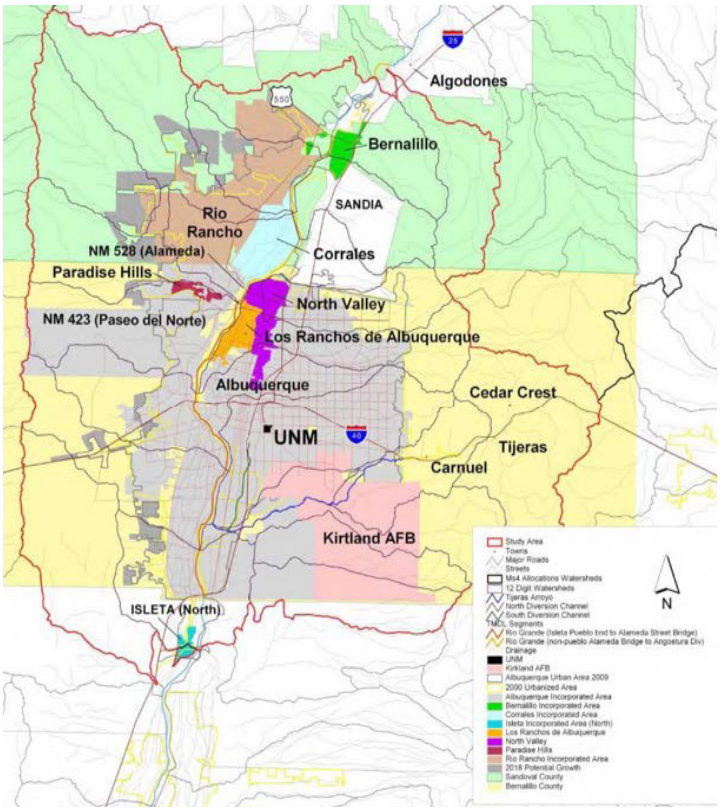

Figure 4. EPA Study Area

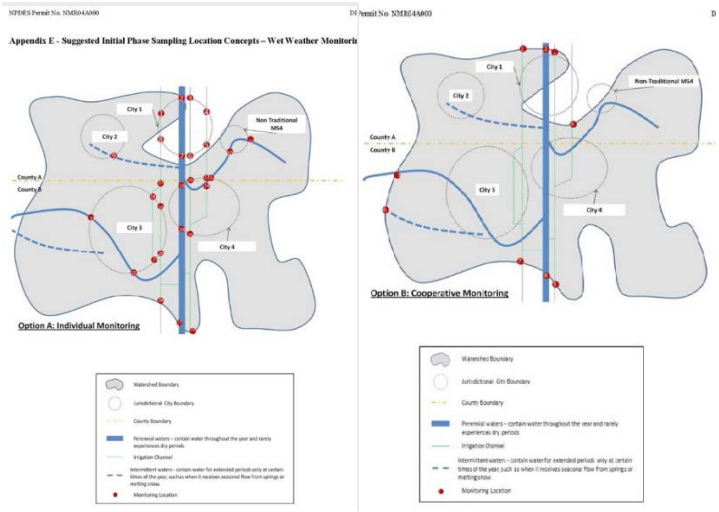

Figure 5. (left) Option A: Individual Monitoring Program;
Figure 6. (right) Option B: Cooperative Monitoring Program;

LESSONS LEARNED WITH CONTINUOUS MONITORING

In support of its SWMP, AMAFCA received five In-Situ TROLL 9500 Multiparameter instruments from the U.S. Geological Survey. The units had internal batteries and onboard data logging which made them ideal for continuous monitoring. They were deployed at five key sites along the Middle Rio Grande within the permit boundaries, collecting pH, ORP, DO, temperature, turbidity and depth, continuously. While the TROLLs provided more data, they had challenges of their own.

As part of environmental conditions for the permit, The Fish & Wildlife Service requires AMAFCA to monitor DO and temperature, recording readings every fifteen minutes. The data is used to calculate and report conditions during a storm event. The early design of the TROLL 9500 lacked a sleep mode to "wake" it up at a user-defined interval to log a data point, and then return to "sleep". The units were continuously "on". Thus, batteries lasted only 2-4 weeks. If the batteries died over the weekend, they lost DO data at the given location causing them to be out of compliance with the biologic component of the permit.

Ongoing battery issues resulted in lost data, and an inability to reliably comply with reporting requirements. Lack of real-time visibility to sensor status, especially the depth of water over the sonde (critical to pH sensor performance), resulted in added uncertainty. Thus, the stormwater team was forced to make frequent site visits to conduct maintenance on the units. The system's maintenance and resource requirements proved to be a burden on the Agency

"Every morning I sit down with a cup of coffee, open HydroVu, and have a little moment with the sondes to see what's happening over a 30 square-mile reach."

- Patrick Chavez, AMAFCA Stormwater Quality Program Engineer

Phasing in new technology in support of a Watershed Based Permit

For permit compliance, the Middle Rio Grande cooperative now has two monitoring points, north and south of the urbanized portion of the river. Other more arid areas within the watershed are not monitored due to their flashy nature; none of them are connected to the river 24/7/365.

At the same time the new watershed based permit was launched, Patrick's team decided to leverage the benefits of collective funding and the reduced number of monitoring sites required for compliance, to increase the quantity, quality and availability of data. A decision was made to upgrade the old sondes in phases to newly available technology from In-Situ.

In-Situ had recently released its Tube Telemetry System and Aqua TROLL 600 Multiparameter Water Quality Sonde. Many major improvements were made to the sonde, including extended battery life, redesigned sensors, and an antifouling system. The Tube Telemetry System also includes a lithium-ion battery that provides a supplemental power source for both the TROLL 9500 and the Aqua TROLL 600. This was an important consideration and ultimately improved the availability of DO data because of the consistent and reliable power source.

The Agency added a Tube to one TROLL 9500 site, and replaced a TROLL 9500 at another site with an Aqua TROLL 600 and Tube. The newer sondes and the Tubes are non-vented (ack the vent tube necessary to compensate water level readings for changes in atmospheric pressure). The non-vented option eliminates the risk of flooding during periods of high runoff, which was problematic in earlier Tubes. In the past, because they didn't know what the river was doing, they were eyeballing levels using USGS streamgage data. Using In-Situ's cloud-based data management software, HydroVu, Patrick knows exactly what the depth is over every sensor at any given time.

This enabled them to stream data from the two monitoring points in near real-time to the office. At the two sampling points the Aqua TROLL 600 continuously collects temperature, pH, dissolved oxygen, conductivity, turbidity and level/depth. Data is uploaded to In-Situ's cloud-based data management system, HydroVu Data Services, via the Tube Telemetry Systems.

The monitoring systems provide around the clock monitoring at compliance sites. While the permit still requires them to collect seven grab samples, having access to the data real-time gives Chavez the ability to tell if something isn't looking quite right.

"If it's sunny and dry and we see a peak in turbidity or pH, we know we should go look. There might be an illicit discharge," Chavez said. They can then come together with various agencies in the watershed to address the issue. "We get better data, better reports, and have a better handle on what's happening in the river," Chavez added.

PROGRAM GROWTH AND LEADERSHIP

As Patrick's team gains experience with the new technologies, they continuously improve the system to insure the best possible performance from their sites. In their deployment, they chose to remove the end cap of the Aqua TROLL 600 restrictor, a common practice in rivers with high sediment loads to help minimize sediment fouling.

Patrick has been tracking task order time and materials with his consultants at each site over the years. As he updates each site to the new Tube Telemetry and Aqua TROLL 600 Multiparameter Sonde paradigm, he's seeing a reduction in the time required to manage each site, and a resulting return on investment. That return on investment allows Chavez to fund further growth of the program.

Because of its innovative monitoring approach, AMAFCA is looked to as leader. When other agencies in the region need data, they call AMAFCA because they know how much data is being collected. The experiences gained give this MS4 a vast wealth of experience to share with smaller communities.

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