8-1-2013

Challenges, constraints and opportunities associated with development of a watershed-based stormwater permit in the Middle Rio Grande, New Mexico

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Challenges, Constraints and Opportunities Associated with Development of a Watershed-Based Stormwater Permit in the Middle Rio Grande, New Mexico

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A Professional Project Submitted in Partial Fulfillment of the Requirements
for the Degree of
Master of Water Resources
Water Resources Program
The University of New Mexico
Albuquerque, New Mexico

June, 2012

Acknowledgements

I salute Dr. Bruce Thomson, my committee chair for being available for my professional project, but also as my advisor through the Water Resources Program. His support was enormously valuable in my success as a student and will remain so into the future.

A sincere gesture of gratitude is extended to Dr. Maria Lane for her continuous support as a mentor through the years of my studies at the University of New Mexico. Her guidance encouraged my path in the field of water resources.

I also thank Sarah Holcomb. Her expertise in the subject matter of my project was invaluable. This project would have been impossible without her assistance and remarkable encouragement throughout the entire process.

Thank you to Steve Glass and Tim Karpoff for including me in the planning process for the MRG watershed-based permit. Your support was critical through this project. Your professionalism is deeply admired.

Thank you to all participating stakeholders, especially the interviewees from the Middle Rio Grande pilot project. The data I collected from you was essential to my project. I couldn't have done it without you.

Finally, thank you to my friends and family, especially my sister Angela, who has never failed to know what was happening at every point during my studies. To Prytania Jobs, for all the time she spent quietly encouraging me as I sat at dining room table studying and to Richard Bartel, for his assistance in editing my report and for his love, which was the greatest support of all.

Abstract

In 2010 the Environmental Protection Agency chose a large watershed surrounding Albuquerque, NM for the implementation of a watershed-based NPDES stormwater permit. This region was one of three in the country selected for development of a watershed-based permit in response to recommendations published by the National Research Council in 2006. The other two pilot projects were located in urban areas in Minnesota and Wisconsin.

The Middle Rio Grande (MRG) watershed is much larger than the other two regions and has more complicated hydrologic, jurisdictional, and stormwater management issues that make development and implementation of a watershed based permit more challenging. The 21 entities considered for the permit in the Middle Rio Grande have varying administrative responsibilities for stormwater management and a wide range of experience with the NPDES stormwater program.

This document describes the political, economic, regulatory and social challenges that must be addressed for successful implementation of a watershed based permit in the MRG region. Data collected through interviews and during stakeholder meetings was analyzed. This analysis identifies the concerns and reservations expressed during the planning process for the draft permit. Recommendations of possible management strategies for equitably allocating responsibilities under a watershed-based stormwater permit are provided.

It was found that cost-sharing is difficult to implement in large watersheds with a variety of land-use practices and multiple jurisdictions, some of which overlap. It was also found

that where the watershed-based approach for stormwater management has been successful, it relies heavily on community involvement. It is recommended that participating stakeholders develop joint Stormwater Management Plans based on geographic proximity, rather than on impact. This will allow entities to more easily manage stormwater both administratively and politically. It is also recommended that stakeholders develop cost-sharing and credit-trading programs that are based on one of the two following criteria 1) geographically defined SWMPS or 2) a watershed-wide stormwater utility or organization that can establish either tax-based or citizen-based funding mechanisms.

Keywords: Municipal Separate Storm Sewer Systems (MS4s), National Pollution Elimination Discharge System (NPDES), Stormwater Management Plans (SWPMS) Total Maximum Daily Load (TMDL), Minimum control measures (MCMs), Best Management Practices (BMPs), Low Impact Design (LID), 303(d) pollutants, Rio Grande Compact, E-Coli, PCBs, Temperature, Dissolved Oxygen, stormwater, watershed, water rights

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Acronyms

ACE	Army Corps of Engineers
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
BMP	Best Management Practice
BOR	Bureau of Reclamation
CGP	Construction General Permit
CWA	Clean Water Act
EPA	Environmental Protection Agency
ESA	Endangered Species Act
GI	Green Infrastructure
GWQB	Ground Water Quality Bureau
LID	Low Impact Development
MCM	Minimum Control Measure
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
MS4	Municipal Separate Storm Sewer System
NDC	North Diversion Channel
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
OSE	Office of the State Engineer

SSCAFCA	Southern Sandoval County Arroyo Flood Control Authority
SWMP	Storm Water Management Plan/Program
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UNM	University of New Mexico
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBP	Watershed Based Permit
WLA	Water Load Allocation
WQS	Water Quality Standards

Introduction

In 2006 the EPA commissioned the National Research Council (NRC) to assess the National Pollution Discharge Elimination System (NPDES) stormwater permitting program because of concerns regarding its effectiveness at controlling non-point source pollution in urban areas. The NRC (2008) recommended that the nation's stormwater program should be revised in order to address the impacts of urbanization on the nation's receiving waters. The NRC recommended that the EPA revise its stormwater program by implementing stormwater discharge permits based on watershed boundaries (NRC, 2008), rather than political boundaries.

In response to the NRC's report, in 2010 the EPA initiated three pilot projects to assess the practicability of issuing watershed-based Municipal Separate Storm Sewer Systems (MS4) permits for urbanized areas. One of the three pilot projects was established in the urbanized reach of the Middle Rio Grande (MRG) in New Mexico. The other two pilot projects were in Minnesota and Wisconsin (Figure 1). EPA Region VI intends to issue the draft stormwater discharge permit for the region by the end of 2012.

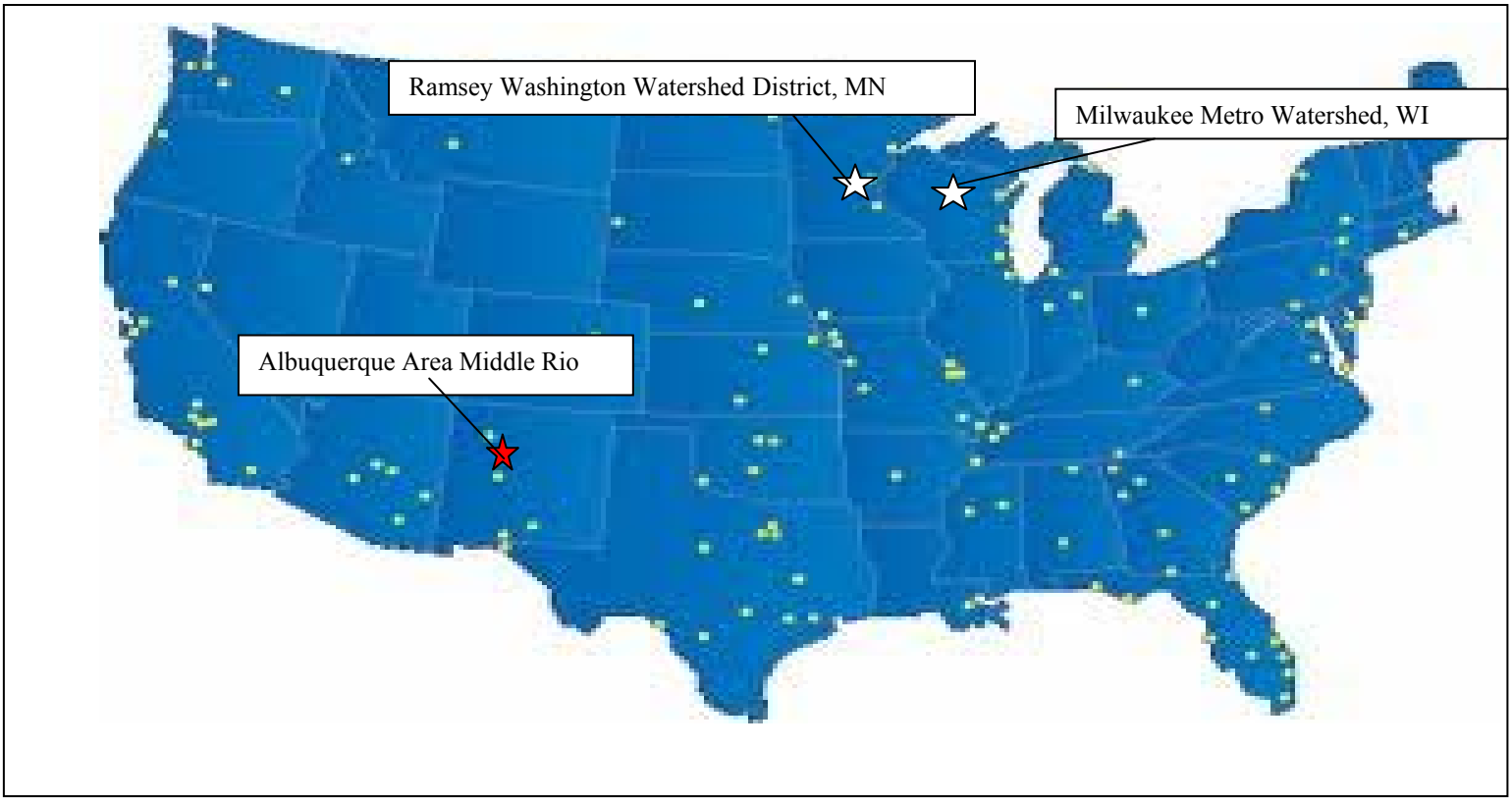

Figure 1 Watershed pilot projects

The conservation movement in the in the 1930s was the catalyst for recognizing environmental interactions within a watershed area (Darghouth, 2008).Some states and local governments had successfully implemented a watershed –based approach well before the NRC's report. A few examples are the Rouge River Project, Michigan (RRP, 2012) and Wisconsin's environmentally sensitive area designations (Wisconsin Department of Natural Resources, 2012). The EPA initiated the pilot programs in New Mexico, Minnesota and Wisconsin to test the effectiveness of the watershed-based paradigm beyond those few programs implemented on a voluntary basis. If successful, it is anticipated that eventually all stormwater permits will be issued on a watershed basis. This expectation is reflected in comments made by the EPA's representative during stakeholder meetings that were held for the New Mexico Middle Rio Grande (MRG) pilot project (Smith, 2012).

The goal of the watershed-based MS4 pilot project in the MRG watershed was to identify government and non-government organizations with significant stormwater management responsibilities in the urbanized area, so that water quality protection activities may be shared under one permit. This is to be accomplished by coordinating and equitably distributing Best Management Practices (BMPs) for stormwater quality control defined under NPDES stormwater discharge permits (for MS4 discharges). For this cooperation to be successful, Wasteload Allocations (WLA) assigned to the MS4s must be met. WLAs were defined under the Total Maximum Daily Load (TMDL) established in 2010 to address the Pollutants of Concern (POC's) on the 303 (d) list of

impaired water bodies. The impaired water bodies in the region are two segments of the Rio Grande from the bridge in the Town on Bernalillo to Alameda Boulevard, and from Alameda Boulevard to Isleta Boulevard. Las Huertas Creek in Placitas, NM and Tijeras Arroyo in Tijeras, NM are also impaired according to their designated uses (figure 2).

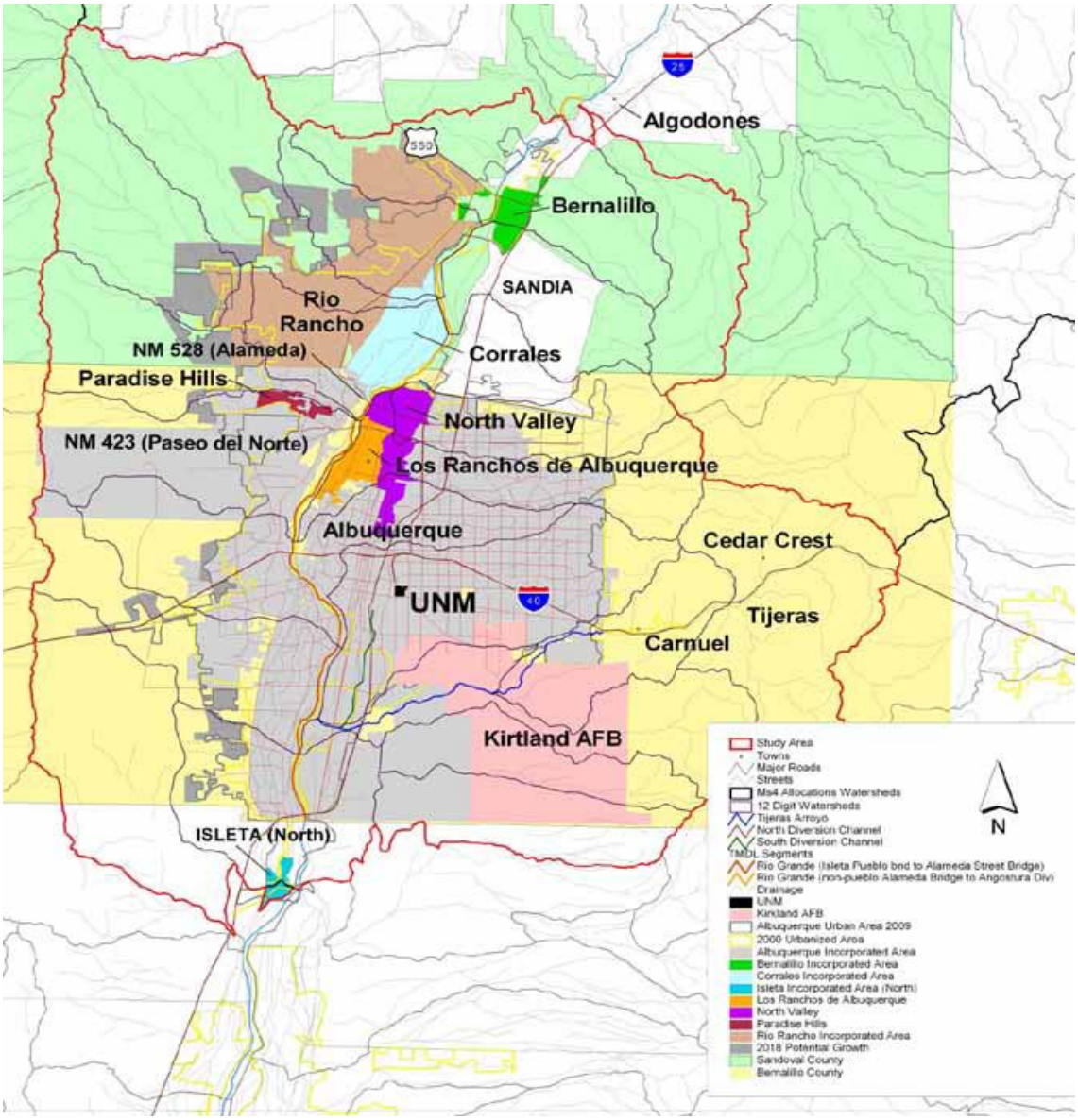

Figure 2 MRG watershed boundaries and participants

The process to develop a stormwater discharge permit for the middle Rio Grande watershed was launched by EPA Region VI as a pilot project to demonstrate the effectiveness of a watershed-based permit (WBP) for urbanized areas in arid climates ; however there were some significant challenges from the very beginning. The Middle Rio Grande region of New Mexico has political, cultural, geographic and climatic characteristics that are much different than the other two pilot watersheds thus making the MRG pilot project particularly challenging. For example, unlike the other pilot projects, the middle Rio Grande watershed is quite large. It is larger than 700 square miles while the other pilot project areas are less than 150 square miles apiece. The Middle Rio Grande watershed area stretches from the Angostura Diversion Dam near Algodones, NM on the northern boundary, to the Isleta Diversion near Isleta Pueblo on the southern boundary, and from the city of Rio Rancho on the western boundary, to the Village of Tijeras on the eastern boundary (figure 2). This was one of the identified challenges for the MRG pilot project.

Additional important differences between the MRG WBP and the other pilot permits include: the arid climate, the number and variety of participating entities, administrative mechanisms and the applicability of stormwater infrastructure. The MRG pilot project area also encompasses three Native American Pueblos which have their own water quality regulations under the Clean Water Act.

Table 1 The three pilot projects

Pilot Project	Ramsey-Washington District, MN	Milwaukee Metro Watershed District, WI	Middle Rio Grande Watershed, NM
Population	165,000 (Ramsey-Washington, 2011)	594,833 (US Census Bureau , 2010 City of Milwaukee population)	794, 125 (Holcomb)
Annual Precipitation	32.59 inches	32.9 inches	9.47 inches (Holcomb)
Size	56 square miles (Ramsey-Washington, 2011)	136 square miles (Milwaukee, 2011)	700+ square miles
Primacy over NPDES stormwater program	Yes	Yes	No
Number of co-permittees	12 governmental entities (Ramsey-Washington, 2006)	20 governmental units (Milwaukee, 2011)	21 governmental and non-governmental entities

Moreover, the arid climate of central NM is characterized by long periods of drought punctuated by short, but intense precipitation events. Further, the watershed is dominated by steep slopes with sandy, erosive soils, and little vegetation. These two factors complicate stormwater management because most stormwater mitigation techniques are developed for wetter climates where stormwater occurs more frequently and in smaller relative quantities. This means that Low Impact Development (LID) options for stormwater management may be fewer for the MRG area because they are inappropriate for the hydrologic characteristics and the nature of the MRG watershed.

Perhaps the most significant difference between the MRG and the other pilot watersheds is that the MRG watershed is its political and jurisdictional complexity. There are twenty-one entities that have been proposed as co-permittees in the basin, including state, federal, and local entities that have varying levels of authority and may also have conflicting regulations (Table 2). Three of the potential co-permittees are Native

American Pueblos which are considered to be sovereign nations under the Clean Water Act which introduces further complexity to the process. These, and other constraints, are discussed in following sections.

Objectives

As will be discussed in subsequent sections, most of the entities in the MRG identified as possible co-permittees have no existing stormwater management programs whatsoever. Furthermore, there is little current collaboration among them in providing most infrastructure and administrative services. There has thus been a significant amount of concern about how the responsibilities of a watershed based permit would be allocated and whether it could be fairly and equitably administered. The overall intent of the pilot project is to facilitate development and implementation of an effective watershed based stormwater discharge permit by identifying and articulating the challenges and concerns that local stakeholders have regarding the program.

The principal objectives for this report was to aid this process by the following measures:

a) Identify regulatory and non-regulatory constraints that may influence the development of a watershed-based permit . This may prevent conflict between agencies and stakeholders in the future.

b) Identify opportunities for collaboration to develop and implement Best Management Practices (BMPs) under the six Minimum Control Measures (MCMs) that are required by the EPA for stormwater discharge permits. These opportunities are addressed through

both cost-sharing and credit-sharing concepts that were being developed by the stakeholder group during the planning process.

c) Address methods of equitable cost-sharing for stormwater management programs in the MRG watershed. The stakeholders developed an 'economies of scale' concept to enable cost-sharing for stormwater management.

d) Summarize stakeholder concerns that have been expressed during meetings and interviews and recommend stormwater management approaches that have worked well for entities that have already applied concepts identified by the EPA for watershed-based stormwater management approach.

Chapter 1 Background

1.1 History of the National Pollution Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) was mandated by the Federal Water Pollution Control Act Amendments of 1972 which subsequently evolved to become the Clean Water Act. The 1972 Act recognized both conventional and toxic pollutants discharged from point sources. The CWA was amended in 1987 to bring stormwater under the NPDES permitting program (Copeland, 2010). This amendment is known as the Water Quality Act. Point sources are defined as "discrete conveyances such as pipes, ditches, channels, tunnels, and containers. It also includes vessels or other watercraft from which pollutants are or may be discharged" (NPDES, 2001). The NPDES program sets national standards on effluents to provide consistent protection of the nation's water throughout the country(Copeland, 2010).

In1987 stormwater was administratively recognized as a major source of impairment to the surface waters . Copeland (2010) summarized the strategy set forth under the CWA for individual states to get impaired waters back into compliance with state water quality standards (WQS). A system by which WQS can be met is for a state environmental regulatory agency to develop Total Maximum Daily Loads (TMDLs) for pollutants that cause impairment:

" For each of these waters, the act requires states to set a total

> maximum daily load (TMDL) of pollutants at a level that ensures that applicable water quality standards can be attained and maintained. A TMDL is both a planning process for attaining water quality standards and a quantitative assessment of pollution problems, sources, and pollutant reductions needed to restore and protect a river, stream, or lake".

The act created schedules for industrial and municipal stormwater discharges to be regulated under the NPDES program (EPA, 2012.).

Under the CWA the EPA set national effluent quality limits on an "industry-wide (technology-based) basis and on a water quality basis that ensure protection of the receiving water" (EPA, 2012.). Any entity or individual seeking to discharge pollutants including municipal or industrial stormwater discharge must first acquire an NPDES permit (CWA, 1987). If these measures are not followed, the discharge is not legal and enforcement action may be taken. The legislative measures under the CWA not only authorized WQS to be set at the state level, but it also authorized the EPA to decentralize the whole NPDES program by giving administrative authority to the individual states if they can demonstrate sufficient financial and technical commitment to manage the program. This is referred to as primacy over the NPDES process. All but four states and some U.S. territories have been given primacy over CWA programs. The EPA, however, still maintains the ultimate oversight of the program:

> "State implementation is a fundamental concept that runs throughout the Clean Water Act and is also a cornerstone of the NPDES program. A state's authorization to implement this program allows state managers to set priorities and tailor the program to meet the challenges facing the waters in that state and to satisfy the desires of its citizens. EPA works closely with the states to ensure a level of national consistency and assist states in meeting their environmental goals and objectives. As co-regulators, the authorized states play a unique role by helping to shape and develop the national program" (EPA's NPDES Strategic plan, 2001).

The four states that do not have primacy are New Mexico, Idaho, Massachusetts and New Hampshire. The lack of primacy over the NPDES program in New Mexico gives EPA more leverage over permit design and implementation; this may have been a factor in choosing the MRG area to for the watershed based pilot project.

1.2 Municipal Separate Stormwater Sewer Systems (MS4s):

The 1987 WQA established criteria for Municipal Separate Storm Sewer Systems (MS4s). MS4s can be defined in terms of the conveyance system which discharges wastewaters into the waters of the U.S.:

> "A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): Owned and operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States; Designed or used for collecting or conveying stormwater; Which is not a combined sewer; and Which is not part of a publicly owned treatment works (POTW)." (Protection of Environment, 1977.)

In 1990, EPA implemented "Phase I" of the national stormwater program by requiring NPDES permits for MS4s serving populations of 100,000 or more. In 1999, the EPA implemented "Phase II" of the MS4 (small MS4s), which requires permits for discharges from smaller municipalities in urbanized areas. The Phase II program required small MS4s (sMS4s), to "apply for coverage before March 10, 2003. [These permits] will expire December 9, 2007" (NPDES, 2011).

States with primacy for the NPDES program usually work in conjunction with the federal government to develop and fund stormwater management plans (SWMPs). For both Phase I and Phase II the EPA has offered a variety of grants for states to make sure the program meets control measures (EPA, 2011.) Both NPDES Phase I and II permits require communities to develop and ensure Best Management Practices (BMPs) (Martin et. al., 2004) The lack of adequate funding to meet the BMP criterion has led to tension between local, state, and federal governments (Copeland, 2010).

The six minimum control measures required for Phase I and II permits are:

1. Public education and outreach
2. Public participation/involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/good housekeeping.

The principal difference between Phase I and Phase II MS4 permits, is that Phase II permittees may not have to conduct water quality monitoring except for where there is a TMDL or 303(d) listed impaired stream. The MRG currently encompasses phase I and phase II MS4s, as well as jurisdictions that have not yet obtained any type of MS4 permit. All MS4 permits that fall within the project area will be replaced with the watershed-based MS4 permit (see 2.4 for all entities and associated permits).

1.3 The watershed approach

The NRC, in its review of EPA's stormwater program, recommended that discharge permits be issued on a watershed basis rather than based on political boundaries. The

EPA defines a watershed approach to permitting according to the following characteristics (EPA, 2012)

- Is hydrologically defined
- geographically focused
- includes all stressors (air and water)
- Involves all stakeholders
- includes public (federal, state, local) and private sector
- is community based
- includes a coordinating framework
- Strategically addresses priority water resource goals (e.g. water quality, habitat)
- integrates multiple programs (regulatory and voluntary)
- based on sound science
- aided by strategic watershed plans
- uses adaptive management

In the case of the watershed-based stormwater permit pilot project in the MRG area, the EPA strategized a bottom-up approach to accomplish the goals set forth by the NRC for the permit. This means that the EPA initiated a planning process that involved ideas developed by local stakeholders that were meant to influence the federally instituted permit watershed-based permit. The watershed approach was developed so that citizens and government officials can better understand the interconnectedness of human and natural impacts on the region's water quality. This understanding may aid in prioritizing and coordinating appropriate environmental efforts and goals for all stakeholders and government officials. The approach also includes administrative, financial and social benefits. For example, coordinating efforts to protect the environment will result in less duplication of administrative and environmental actions which also translates to less financial cost (EPA, 2012).

The watershed approach is a process that has been underway in the nation since the early 1990s and was first implemented in Michigan as a voluntary effort in 1997 called the Rouge River Project (RRP, 2012). The stakeholders in the Rouge River project saw the watershed approach as a more flexible and efficient way to share resources and costs associated with stormwater management. Acting on the NRC's report in 2006, the EPA was able to formally address stormwater management through a watershed approach.

1.4 Low Impact Development

Although there is not yet policy mandating advanced design technology for new stormwater infrastructure, many states now work with the EPA to make sure that their SWMPs meet environmentally suitable standards through promoting Green Infrastructure (GI) and Low Impact Development (LID) for stormwater runoff (EPA, 2007 and LID, 2011). Achieving the six minimum control measures may become more costly for states and local governments as GI and LID are recognized as BMPs under the watershed-based MS4. The Applicability of LID BMPs to the MRG Albuquerque area is discussed in following sections.

1.5 Construction activity

Measures four five of the minimum control measures for an MS4 permit address construction activities. This is in recognition of the large impact that construction has on stormwater. Current practice requires development of Stormwater Pollution Prevention Plans (SWPPP) for construction sites:

> "Sediment runoff rates from construction sites are typically 10 to 20 times greater than those from agricultural lands, and 1,000 to 2,000 times greater

> than those of forest lands. During a short period of time, construction activity can contribute more sediment to streams than can be deposited over several decades, causing physical and biological harm to our Nation's waters" (EPA, 2000).

Like MS4s, runoff control provisions are divided into in Phase I and Phase II according to the size of operation. Phase I construction permits are for activities that disturb over five acres and Phase II construction permits were created for smaller construction sites (1-5 acres). Phase II construction permits were developed because the impact construction activities can have on stormwater discharge, and subsequent impact on surface waters, can be severe regardless of the size of the disturbed site.

Stormwater runoff protection is one of the BMPs found within associated Construction General Permit (CGPs).These permits are issued by the EPA and administered by both the EPA and the MS4s in which they are located. However, they are separate from MS4 permits, which is one of the drawbacks of not having primacy over the NPDES programs. Since the EPA and MS4s both have regulatory authority over these sites , enforcement is sometimes problematic. Even though there are local regulations for construction activities included in SWMPS and other planning and zoning regulations that focus on construction and water quality, there are not enough local resources to make sure they are in compliance with their SWPPP. Insufficient resources include funding and training of necessary employees to manage these sites.

Many BMPs have been developed to improve stormwater quality during construction, however funding to implement and monitor these practices may become more of an issue as standards become more stringent for stormwater management in the MRG. To date, national rulemaking to institute a plan to reduce stormwater discharges from construction

activities has not been finalized. The rules may more involve the EPA in monitoring these sites under the new permit. This would be beneficial to the MRG stakeholders who cannot enforce EPA policy and have not passed ordinances to deal with stormwater quality at construction sites. However, if more regulatory authority is granted to local entities under the new permit, funding and manpower will become an additional challenge.

Chapter 2 New Mexico: a special case for MS4 watershed-based permit

2.1 Hydrology of the Middle Rio Grande

The MS4 guidelines apply to all permit holders within the nation. They do not have specific measures suited to varying hydrologic regions. A watershed-based MS4 permit in New Mexico should recognize local hydrologic and institutional conditions. This is especially important if New Mexico is the first example for this type of permit in an arid region.

Desert hydrology is often characterized as long periods of drought interrupted by short but intense precipitation events. This allows contaminants to accumulate on the land surface for a long period of time then flush rapidly into receiving waters. Furthermore, it limits vegetation growth which would to slow storm flows and capture some contaminants. Storm events thus produce very large peak flows that transport accumulated contaminants quickly across the land and through natural and man-made channels to the receiving waters.

Generally stormwater in arid environments have little chance to infiltrate into soils because storm events are of short duration and high intensity. When runoff occurs it carries with it all of the pollutants that have accumulated during dry weather. This is particularly problematic for urbanized areas which can accumulate large amounts of anthropogenic contaminants, many of which are problematic in aquatic environments. The several jurisdictions that make up the political boundaries of the MRG have both natural and man-made conditions that affect runoff such as slope, drainage area, surface material (impervious coverage), arroyo channelization and population density. There are is also dry weather runoff, often referred to as nuisance flows, that is produced by wastewater effluent, excessive landscape watering, water well flushing and other activities.

2.2 Low impact development in the MRG Albuquerque area

Vegetation is often used as a LID method for stormwater management (Caraco, 2000). However, in arid climates the use of irrigation for LID BMP implementation is avoided, because water resources are scarce and must be conserved. Nonetheless wetlands construction and other practices that require vegetation are some of the only existing LID methods for stormwater management. These methods are encouraged by the EPA, consequently wetlands construction has been implemented in the Albuquerque area for stormwater management (Kelly, 2009). Keeping wetland vegetation alive between infrequent storm events in NM requires irrigation which results in high water consumption that is not appropriate for the region. (Acharya et. al., 2010). Wetland

construction projects also attract water fowl that contribute to high fecal bacteria concentrations (*E-Coli*). The biggest challenge related to wetlands construction may be the high flow volumes associated with storm events. For example, the capacity of the North Diversion channel which drains a large portion of northeast Albuquerque is about 1 acre foot per second (AF/s) (44,000 cubic feet per second (cfs)) with flows that can exceed .25 AF/s (12,000 cfs). A wetland pond to capture one hour of runoff from a 12,000 cfs storm would need a capacity of approximately 1,000 AF, which would be one of the largest bodies of water in the New Mexico portion of the middle Rio Grande.

The New Mexico legislature does not place a priority on stormwater management. Moreover where incentive based systems are successful, such as Leadership in Energy and Environmental Design (LEED) programs, they are generally focused on energy conservation rather than water quality. For LID, appropriate design technology and incentive –based systems are both severely lacking for the region. If GI/LID becomes mandatory, it will apply to both new construction and the rehabilitation of old infrastructure. This would result in an unmanageable constraint for local stakeholders and governmental officials responsible for complying with the criteria defined under a NPDES watershed-based stormwater permit.

2.3 The arroyo systems

The Albuquerque Metropolitan Arroyo Flood Control Authority's (AMAFCA) North Diversion Channel (NDC) is the largest man-made arroyo in Albuquerque draining 40 square miles of urban area. The channel conveys water from arroyos flowing west from the west flank of the Sandia Mountains and transports it to the Rio Grande near the

southern boundary of the Sandia Pueblo (Figure 4). The diversion channels that run through the MRG urbanized area were originally constructed to protect life and property from floods; however much of the agency's current focus is now on management of stormwater quality. Not only does stormwater carry with it the pollutants that are monitored under the MS4 permit, but the network of arroyos through the urbanized area also carries with them large amounts of urban debris (Figure 3).

Another way arroyos may be detrimental to adjoining water bodies is by the high rate at which they convey water. The rapid flow makes it more difficult to clean this water before it reaches the Rio Grande and it may also raise the temperature of the water before it reaches the river, contributing to thermal pollution. It is also difficult to capture debris such as yard waste, garbage and litter. The USGS monitors flows and surface water quality from the NDC under contract from AMAFCA (Figure 5).

AMAFCA, and its sister agencies Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) and East Sandoval County Flood Control Authority (ESCAFCA) have developed storm water quality features to catch and filter out debris and pollutants before they meet the Rio Grande (Coonrod, 2010). These include settling basins with ported outlets, screens, and small wetlands to capture the first flush from storm events. Urban pollutants and debris are not only a threat to water quality for human use, but also for wildlife habitat (US DOI, 2011).

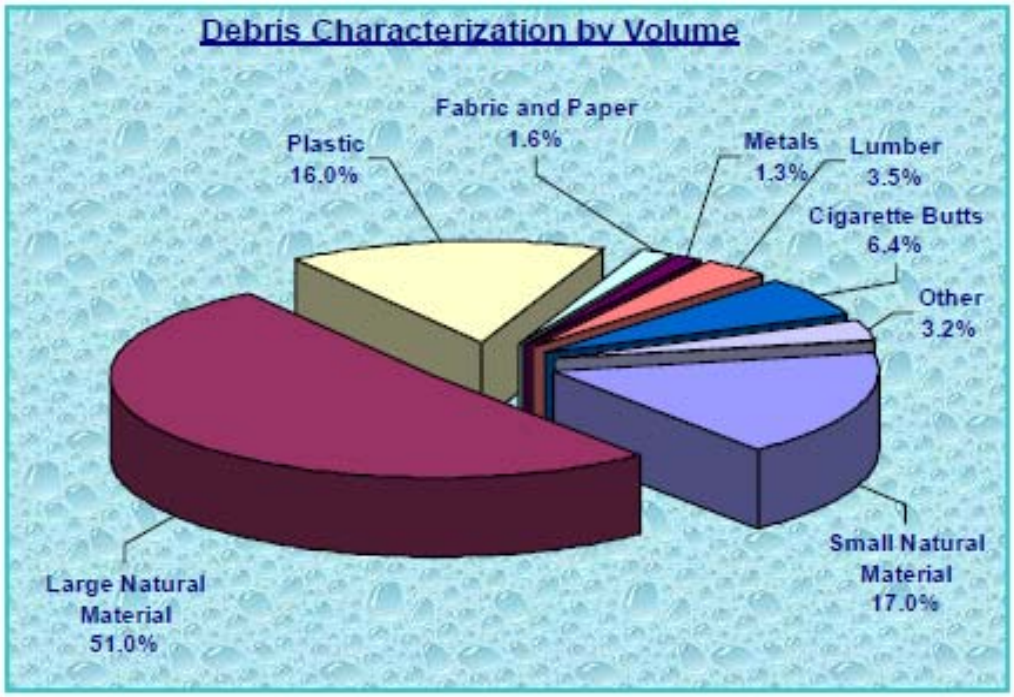

Figure 3 Debris found in NDC (ASCG, 2005)

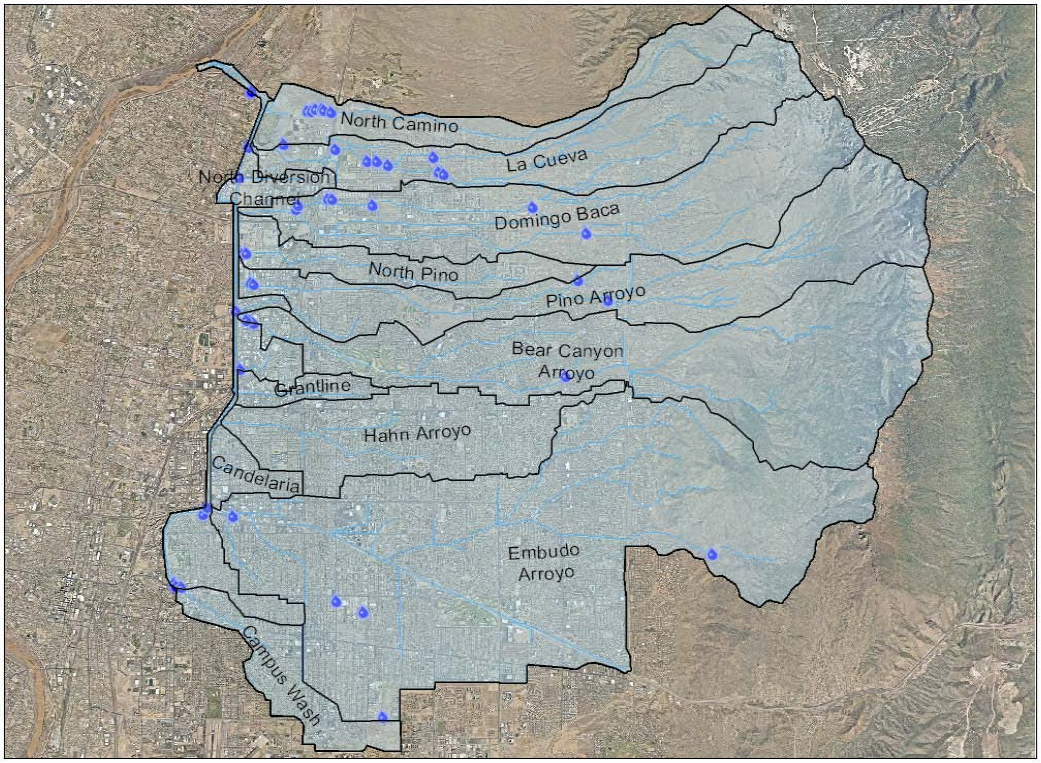

Figure 4 Watershed of the North Diversion Channel (NDC) (Hoover, 2010)

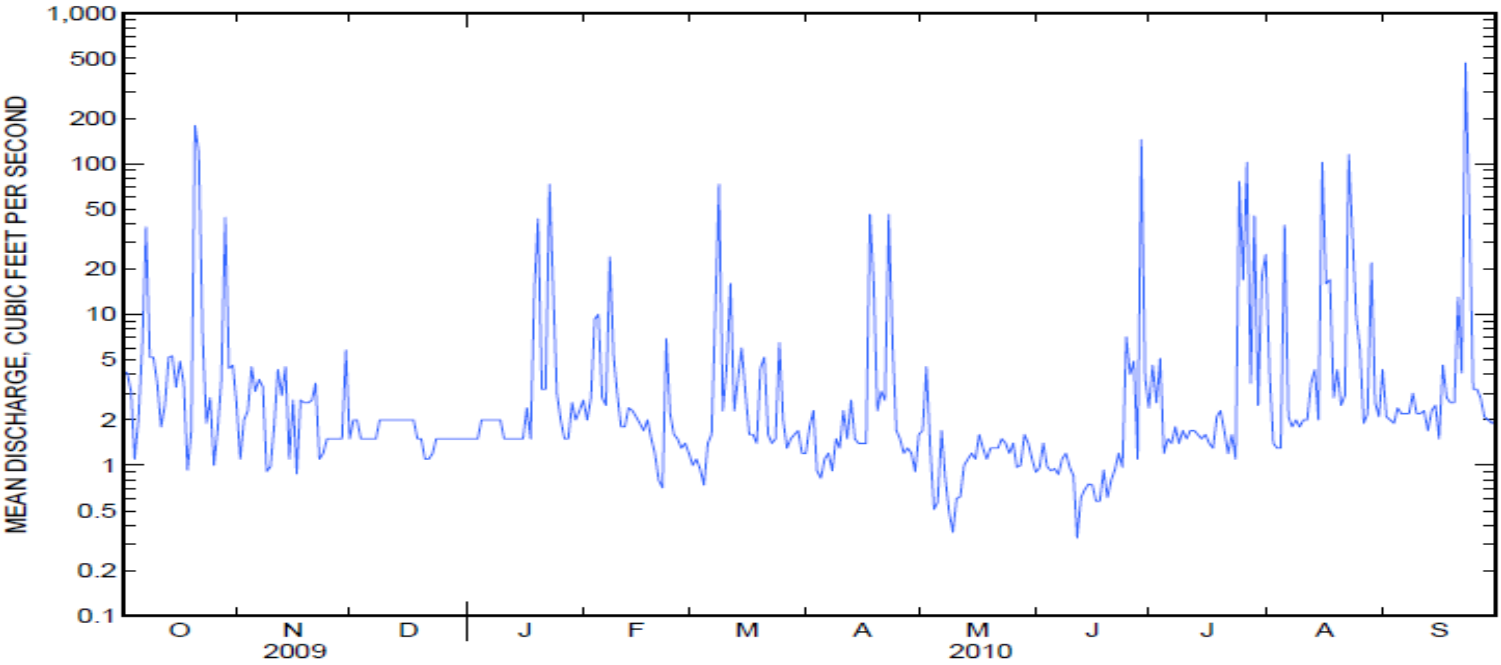

Figure 5 North floodway channel at Albuquerque, NM (USGS,2010)

2.4 Administrative framework for the Albuquerque MRG area

In the Albuquerque Middle Rio Grande area a total of twenty-one entities have been considered for participation in the watershed based permit (table 1). These encompassed local, state, tribal, and federal entities. Some of these entities had existing Phase I or Phase II MS4 permits when the pilot project was first initiated in 2010. If these entities had also then followed NPDES guidelines and filed a Notice of Intent (NOI) as a part of the process in establishing an MS4 permit, then they had existing stormwater management plans/programs (SWMPs). These entities have more experience

implementing BMPs, and a mechanism to fund the program and/or knowledge of existing mechanisms to get grants for such programs.

However, New Mexico was one of the last states to receive NPDES MS4 permits and Albuquerque was the last city in the nation to receive a phase I MS4 permit (Penttila, 2011). Therefore most of the entities in the MRG region have little or no experience with the MS4 process and its requirements.

Those entities that had not been previously required to file a Notice of Intent for a prior NPDES permit were regarded as Residual Designation or 'potential designation' entities by the EPA during the planning process. In the MRG 'Residual designation' entities included Placitas, Tijeras and DOE/Sandia Labs. These entities were included under the permit because they are either physically connected to existing MS4s or are expected to grow in population, thereby contributing to a pollutant load in the watershed (EPA, 2000). In the case of the MRG WBP pilot project the 303(d) listing is a factor in residually designating those areas.

Placitas and Tijeras were residually designated areas. Placitas is a Census Designated Place (CDP), meaning that it is unincorporated and has no municipal government or legal capacity to handle utility issues such as stormwater and wastewater management. The management of Placitas area storm water quality is the responsibility of Sandoval County and ESCAFCA.

The WBP will conform to the minimum control measures (MCMs) under a MS4 phase II. The general phase II MS4 will act as a regulatory guide for the WBP. When finalized, the watershed -based MS4 permit will supersede the existing phase I and phase II MS4 permits.

Table 2 Entities under the NPDES WBP MRG pilot project

Jurisdiction/Agency	**Permit Status (Traditional)**	**Population According to 2010 Census Bureau**
City of Albuquerque	Current MS4 Phase I 2003-2008. Issued again in 2012.	545,852
City of Rio Rancho	Current MS4 Phase II Issued in 2007-Expired 2012.	87,521
Bernalillo County	Current MS4 Phase II Issued in 2007-Expired 2012	662,456 (this includes City of Albuquerque)
Sandoval County	Current MS4 Phase II Issued in 2007-Expired 2012	131,561
UNM	Current MS4 Phase I 2003-2008. Issued again in 2012	Transient and residential populations undefined by Census Bureau
AMAFCA (ABQ Metro. Arroyo Flood Control Authority)	Current MS4 Phase I 2003-2008. Issued again in 2012	N/A
SSCAFCA (South Sandoval County Arroyo Flood Control Authority	Current MS4 Phase II Issued in 2007-Expired 2012	N/A
ESCAFCA (East Sandoval County Arroyo Flood Control Authority)	Currently no MS4	N/A
New Mexico Department of Transportation District III (NM DOT)	Current MS4 Phase I 2003-2008. Issued again in 2012	Traffic population undefined by Census Bureau
Town of Bernalillo	Current MS4 Phase II Issued in 2007-Expired 2012	8,320
Village of Tijeras	Currently no MS4	474 (2000 Census)
Village of Carnuel (Bern, Co)	Currently no MS4	1,232
Los Ranchos de Albuquerque	Current MS4 Phase II Issued in 2007-Expired 2012	6,024
Village of Corrales	Current MS4 Phase II Issued in 2007-Expired 2012	8,329
Village of Placitas	Currently no MS4	3,452 (2000 Census)

Pueblo of Sandia	Currently no MS4	4,414 (2000 Census)
Pueblo of Isleta	Currently no MS4	559 (2007)
\Pueblo of Santa Ana	Currently no MS4	479 (2000 Census)
Sandia National Labs/US DOE	Currently no MS4	Transient population
Kirtland Air Force Base	Current MS4 Phase II Issued in 2007-Expired 2012	Residential population undefined by Census Bureau

In addition to the NPDES stormwater program being relatively new in the MRG area, MS4s have always been permitted on a case by case basis. This means that there has been little jurisdictional overlap for stormwater management programs except for those entities combined under the phase I Albuquerque permit, or under the inter-jurisdictional Flood Control Authorities. Among the entities, there are inherent challenges to cooperating under an overarching stormwater permit.

The watershed entities include traditional municipalities and sovereign Native American governments, as well as non-governmental entities that have varying roles within the watershed. These roles include flood control, education and transportation. Some of these entities have the capacity to enforce policy and some do not. Also, population is hard to define for entities that do not have residents (UNM, NM Dept. of Transportation, Kirtland Air Force Base, and Sandia National Laboratories) which makes allocating responsibility difficult.

2.5 Water quantity issues

a) The doctrine of prior appropriation

Because of New Mexico's arid climate, the volume of storm water from precipitation events is important and regulations have been established which address it. New Mexico Water Law adheres to the system of prior appropriation (first in time, first in right) that deals specifically with water *quantity*. In 1907 the territory of New Mexico adopted a water code similar to existing western water codes found in Wyoming and Colorado. The most prominent parallel was that the permitting system was assigned to the State (territorial) Engineer (Davis, 2005). In New Mexico this authority is the Office of the State Engineer (OSE). Administration of water rights in NM was first codified in the 1907 territorial water code which in amended form remains the governing water law (Laws of New Mexico 1907, Chap. 49 § 1-73 and § 57, 59-61,). State law gives the OSE authority over both surface and groundwater resources (OSE, n.d.).

The doctrine of prior appropriation operates according to the 'beneficial use' of water by which the OSE administers water rights. Beneficial uses are founded in "a series of judicial decisions characteriz[ing] it as including irrigation, domestic, commercial and industrial uses" (Basic Water Law Concepts, 2011). Senior water rights were allocated to those who first put beneficial use to surface water. Junior water rights were given to those came later in chronological order. The responsibility of the State Engineer is to ensure that senior water rights are not diminished by new/junior uses. In times of drought it is possible in principle for senior water users receive their full share of water

while junior water users get none (ibid). By design, the WBP may require conditions for stormwater management that interfere with this system of water allocation.

After 1907 permits issued by the state engineer were required for any new uses of surface water (ibid). Unappropriated waters must be found in order for new appropriations to take place through the state engineer. Currently virtually all water resources in the state have been appropriated (Barroll, 2003). In principle one can transfer existing water rights to a new use by purchasing it from a willing seller. "When a water right is sold, it retains its original appropriation date and is limited to the amount of water historically consumed for that use" (Basic Water Law Concepts, 2011). Water rights adjudications may be challenging as the population grows in New Mexico, expanding the urbanized area. In the Middle Rio Grande, very few water rights adjudications have been settled. In the future stormwater may be more valued by the OSE . In a region where water rights are not completely delineated conflicts over how stormwater is managed may ensue.

b) Rio Grande Compact

In addition to water rights and the conditions of prior appropriation, New Mexico also has to comply with the terms of the Rio Grande Compact as well as OSE dam storage regulations.

An interstate compact is congressionally approved agreement that establishes policies and procedures for distribution of water among participating states: "the Rio Grande

Compact was passed as Public Act No. 96 by the 76thCongress of the United States and approved by the President on May 31, 1939" (Report of the Rio, 2008). The compact is between the states of Colorado, New Mexico, and Texas. It was created to determine how best to divide transboundary surface waters of the Rio Grande between the three states. The compact is relatively antiquated particularly because delivery obligations (water quantities adjudicated for each state) were decided when the region was relatively wet compared to the arid climate that has since returned (Guame, 1999). The compact also failed to consider pumping water from the ground that has increased due to urbanization, because the connection between groundwater and surface water was not yet made and population growth was unpredictable.

Although management strategies and projects have been developed between the states to ensure that certain water needs are met, they must always follow the terms of the original compact. Currently, there is no state authority in the compact that is willing to negotiate any change in these terms (Gordon, 2008).

c) Dam Safety Bureau Administrative Code 19.25.12.11 (B)

There are state codes and regulations in place to protect water quantity in the Rio Grande (Barroll, 2003). The Office of the State Engineer (OSE) is charged with administering water rights and its use in NM and its sister agency, the Interstate Stream Commission (ISC) is assigned responsibility of maintaining compliance with interstate stream compacts. Some of these codes may have significance to the WBP.

One of the responsibilities of the OSE is ensuring that water rights are protected for downstream users. Since stormwater constitutes a significant amount of flow in the state's streams and rivers, regulations are in place to ensure that it is not appropriated without a water right and also that evaporation and infiltration losses are minimized. New Mexico Administrative Code 19.25.11 (B) states that a flood control dam or pond cannot hold water for more than 96 hours without a water right. In addition, large dams (those taller than 25 ft or with a design capacity greater than 50 AF) are subject to safety and operation criteria established by the Dam Safety Bureau of the OSE. These are referred to as "jurisdictional dams". There are over 20 jurisdictional dams in the MRG watershed and many smaller dams and stormwater ponds that are subject to the 96 hour rule.

One of the common stormwater management strategies that is used both for limiting peak runoff and for providing treatment of stormwater flows is capturing some or all of the stormwater and retaining it in ponds or constructed wetlands to facilitate treatment by settling, biological degradation, and exposure to sunlight. This treatment option generally cannot be used in NM because of: 1) the 96 hour rule which prohibits stormwater retention for any reasonable length of time, 2) the hydrologic characteristics of the arid climate which do not provide continuous low flows to maintain vegetation in a wetland pond, 3) the intensity of NM storms which result in very large runoff events, and 4) the dam safety rules which govern design and operation of large dams.

Although only a few stakeholders were aware of the implications of this the state water code on stormwater management, it was expressed during several stakeholder meetings.

d) Stormwater Retention

According to the Office of the State Engineer, any new development, including household stormwater harvesting and landscaping that may slow stormwaters, cannot impede runoff from its "natural, predevelopment state" (Downey, 2009). This is note-worthy because it affects Low Impact Development (LID) approach preferred by EPA for stormwater management:

> "The LID approach attempts to match the predevelopment condition by compensating for losses of rainfall abstraction through maintenance of infiltration potential, evapotranspiration, and surface storage, as well as increased travel time to reduce rapid concentration of excess runoff. Several planning considerations combined with supplemental controls using LID integrated management practices can be used to compensate for rainfall abstraction losses and changes in runoff concentration due to site development" (Low-Impact development, 1999).

Therefore, if the OSE supports methods to prevent rainfall abstraction (retaining the maximum amount of water held in the soil in a natural, predevelopment state), they are essentially supporting LID. However, there have been no measurements made by the OSE to determine predevelopment flow or 'abstraction losses.' Without numbers associated with 'predevelopment runoff rate' the OSE statements supporting predevelopment flow seems ambiguous. Moreover, it could be implied that the OSE may also support a land disturbance that would generate *more* runoff than what would have occurred before disturbance. This would contradict the EPA's motive to develop a

predevelopment standard for runoff for LID . LID for stormwater runoff advocates retaining water on site so that it is of better quality before it reaches a receiving water body.

The city of Albuquerque used rainfall volume against probability statistics (Figure 7) of a 10 year storm (10% probability rate of occurring) to achieve the predevelopment runoff rate of 0.44. This is the natural runoff rate for a first flush of stormwater and is consistent with LID technologies. This rate is consistent with most states stormwater management manuals (Battiata et al, 2010).

Albuquerque Precipitation Statistics 1891-2010

Number of Events per Period

Period	Yrs of Record	Precipitation Range					
		0.1"	0.25"	0.5"	0.75"	1"	1.5"
1891-1910	20	414	192	67	29	16	3
1911-1930	20	504	233	70	19	11	4
1931-1940	10	0	225	0	0	7	0
1951-1970	20	443	0	62	0	10	0
1970-2010	40	79	532	291	102	34	18
Totals	110	1440	1182	490	150	78	25
Percentages		42.79%	35.13%	14.56%	4.46%	2.32%	0.74%
Accumulated		42.79%	77.92%	92.48%	96.94%	99.26%	100.00%

Events per Year		13.1	10.75	4.45	1.364	0.709	0.227
Rainfall Volume		0.1	0.25	0.5	0.75	1	1.5

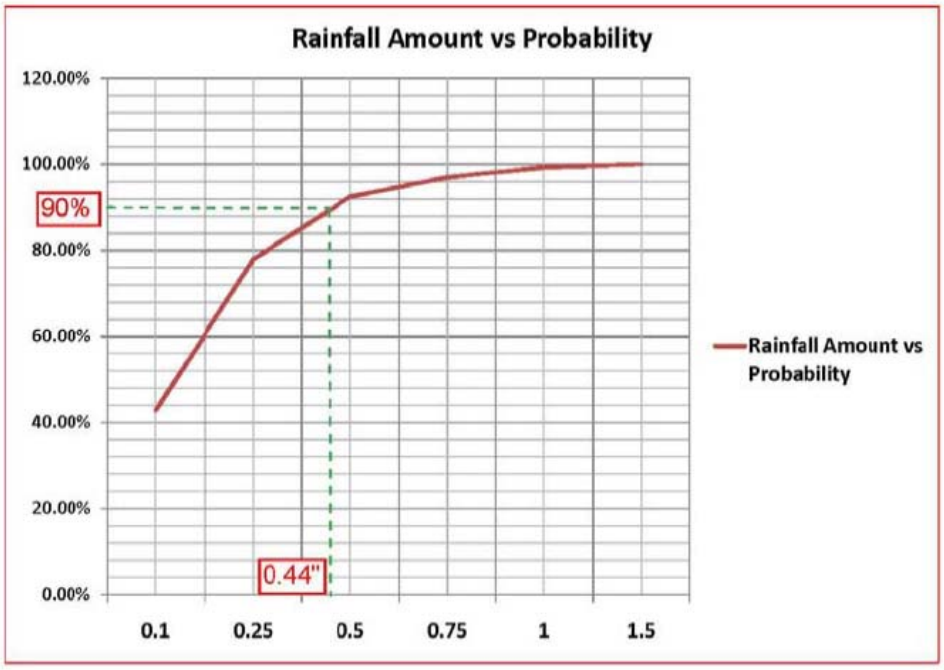

Figure 6 Runoff Reduction Rate (Penttila, 2011)

As the population in the Albuquerque area grows, impervious surface coverage and pumping is also expected to grow. This means that less water may be available in the Rio Grande for compact obligations and endangered species. This lesser quantity may be coupled with poor water quality if water quality standards are unenforceable due to conflicting regulations.

During the planning process for the WBP, permit holders were primarily concerned with New Mexico Administrative Code 19.25.12.11. (B), (96 hour holding rule), as well "predevelopment flow" for construction sites. Low Impact Development practices may be mandated under the WBP and both of these regulations may impair an entity's capability to regulate these practices.

2.6 Water quality standards

a) Total Maximum Daily Loads

Water *quality* standards are set pursuant to section 303 of the Clean Water Act, based on the state-identified designated uses of the reach of stream. These uses result in the development of numeric and descriptive criteria for water quality that are approved by the New Mexico Water Quality Control Commission (WQCC) and subsequently approved by the EPA.

Table 3 Impaired waters of the MRG

Water Body	**Designated Uses**	**Designations not fully supported by quality of water**
Middle Rio Grande reaches (20.6.4.105, NMAC)	Irrigation, Marginal Warmwater Aquatic Life, Livestock Watering, Public Water Supply, Wildlife Habitat and Secondary Contact	Secondary Contact and Marginal Warmwater Aquatic Life
Tijeras Arroyo (State of NM WQCC, 2008)	Aquatic Life, Livestock Watering , Secondary Contact, Warmwater Aquatic Life and Wildlife Habitat	Aquatic Life and Warmwater Aquatic Life
Las Huertas Creek (State of NM WQCC, 2008)	High Quality Coldwater Aquatic Life, Irrigation, Livestock Watering, Wildlife Habitat and Secondary Contact	High Quality Cold Water Aquatic Life

In addition to the NM WQS, the Native American Pueblos have established their own designated uses which include ceremonial use with associated water quality standards. (Pueblo of Sandia Water Quality Standards,2010).

Every two years the state evaluates each of the stream reaches in the state and determines whether they meet their designated use. The state creates the list, called the 303(d)/305(b) Impaired Waters list in accordance with water quality limited waters. The EPA needs to approve this list before it can be applied to TMDL monitoring and pollutant reduction activities under the NPDES MS4 program. If a body of water is found to be impaired, the state establishes a Total Maximum Daily Load (TMDL) for pollutants of waters where CWA effluent standards are "not stringent enough to assure attainment with any applicable water quality standard" (EPA Region 6, 2008). A TMDL is a limit on the daily mass loading of contaminants which affect the quality of receiving body of water and cause impairment. This sum must "include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated" (EPA TMDL, n.d.).

The MS4 watershed-based permit must recognize the stream impairments identified in the 303 (d) list and must account for TMDLs developed for these impaired reaches. The permit will require monitoring for the pollutants identified as impairing these waters. The watershed-based MS4 will concentrate on the following 303(d) pollutants: Coliform bacteria *Escherichia coli (E* coli), temperature (thermal pollution), Polychlorinated biphenyls (PCBs) impairment by low dissolved oxygen and gross alpha.. In addition to

these pollutants, Las Huertas Creek and Tijeras Arroyo will also be monitored for Nitrogen and Phosphorous. Challenges associated with each of these pollutants will be discussed in subsequent chapters.

In the case of some areas within the MRG project area, pollutants within the watershed may not necessarily originate within that jurisdiction/organization, but instead were produced outside the watershed. This may cause administrative issues over management of the contaminants. Identifying the source of pollutants, what to do if they are found to originate outside of the watershed, and how to fund the monitoring program for the watershed were all challenges stated during the MRG planning process. However, as identified by the EPA, these types of issues are much easier to mitigate through a watershed approach to stormwater management.

b) The Endangered Species Act (ESA)

The U.S. Fish and Wildlife Service is an integral agency in administering U.S. federal laws and policies that protect, conserve and enhance habitats of the U.S. Because it is federal legislation, the ESA gives the USFWS more leverage over surface water quality than that of local agencies. The USFWS can ultimately ensure instream flow for an endangered species by applying for water rights under beneficial use. This tactic was first used in 2001 in an effort to protect the silvery minnow (USFWS, 2007), but this practice was not yet officially regulated under state law. Then in 2005 'beneficial use' of water found under the doctrine of prior appropriation, was expanded to include 'fish and wildlife' uses of surface waters (NMAC § 19.26.2.7). Therefore the USFWS may have

influence over both water quality and water quantity as required for species protected under the ESA.

Chapter 3 Additional political considerations of the Middle Rio Grande area watershed-based permit

Many political and non-political jurisdictions were involved in the EPA's Middle Rio Grande watershed-based stormwater permit pilot project. Ideas of stormwater management sometimes differed among the EPA representative's and those at the local level; however there was consideration for water quality at all levels of government and among local stakeholders. Minimum control measures one and two require citizen participation. This necessitates direct involvement of elected governmental bodies, so that they may target citizens through political operations and associated legislative activities. Political action may be necessary for funding and establishing a watershed-based approach for stormwater management.

Following are descriptions of the federal, state and local entities that were involved in the planning and political processes of an EPA mandated watershed-based stormwater permit pilot project in the MRG area. This section is intended to illustrate governmental hierarchy, identify influential laws and regulations, as well as the general interactions among governments and stakeholders during and after the planning process.

Table 4 Water Policy significant to the MRG

Regulation	Regulatory Authority	Administrative Authority	Description
Clean Water Act (1972)	Federal	EPA	NPDES watershed-based MS4 permit
Endangered Species Act (1973)	Federal	US Fish and Wildlife	protect and enhance fish, wildlife and plants and their habitats
40 CFR122.26	Federal	EPA and NMED	NPDES MS4 state programs
40 CFR 122.34 (c)	Federal	EPA	MCM qualifying program
40 CFR 130.7	Federal	NMED SWQB	TMDLs
Rio Grande Compact	Federal	Office of the State Engineer	Between CO, NM, TX
NMAC 19.26.2.7	State	Office of the State Engineer	'beneficial use' was expanded to include 'fish and wildlife' in 2005
NMAC 19.25.11	State	Office of the State Engineer	Dams-96 hour rule
Doctrine of Prior Appropriation	State	Office of the state engineer	First in time, first in right based on 'beneficial use'
NMAC 20.6.2.5002	State	NMED GWQB	Underground infiltration for industry is considered class V well and needs permit

3.1 Federal Agencies and their significance under the MRG WBP

United States Environmental Protection Agency (EPA)

The Environmental Protection Agency is a federal agency enacted by President Richard Nixon in 1970. The EPA is responsible for protecting human health and the environment. When scientific information shows a degradation of environmental health, the EPA is required to act to protect further damage of ecosystems and potential impacts on humans (EPA, 2012). The EPA encourages local governments (states and tribes) to enforce their own regulations that are based on national standards.

The planning process for the MRG WBP involved representatives from each participating entity to be fully engaged by participating in a series of stakeholder meetings, so that each individual entity's interests and needs could be met under the new permit. The meetings included continuous interaction, feedback, and cooperation with the region's administrator of the project in establishing a permit draft since 2010.

The primary EPA contact for the MRG pilot project was available for meeting stakeholders and other entities. EPA Region 6, which the overseeing office for New Mexico, is located in Dallas, Texas. The distance between the EPA office and the MRG watershed and its constituents lead to constraints regarding an understanding of the many geographical and political complexities in the MRG. Also limited were the relationships

between stakeholders and the EPA, as well as planning expectations and deadlines. Often the EPA's expectations and the expectations of the participants were incongruent.

Fear that the EPA would not take into full consideration the uniqueness of each stakeholder's economic, cultural, geographical, political and administrative capacity to comply with a WBP was a significant concern throughout the planning process. This point is considerable since inter-governmental collaboration is one of the parameters sought to be resolved through a *watershed approach* for an NPDES stormwater permit. This distance between the EPA and the MRG may cause future complications that inhibit the watershed based approach.

U.S. Fish and Wildlife Service (USFWS)

The Endangered Species Act is perhaps the most important federal legislation that determines the role of the USFWS in the MRG. USFWS assistance is critical for the EPA to enact the watershed- based approach in accordance to regulations such as the ESA. However, laws and other objectives administered by the USFWS may contradict other federal water laws that govern water use in New Mexico. For example, the Silvery Minnow (*Hybognathus amarus*) and the Southwestern Flycatcher (*Empidonax traillii extimus)*, are both protected under the Endangered Species Act, whose survival may be effected by stream water quality and will thus influence the WBP.

The USFWS has addressed the issue of allowable pollutant loads in the Rio Grande. In 2011, the Albuquerque branch of the USFWS published their 'Biological Opinion' on the

NPDES MS4 permit for Albuquerque (USFWS, 2011). The report is based on 'reasonable and prudent measures', as well as conservation recommendations, based on Dissolved Oxygen, PCBs, Total Suspended Solids (TSS) and other sediments. These pollutants were covered under the report in lieu of covering a multitude of pollutants that could potentially impair the habitats of species protected under the ESA. By this measure the USFWS endeavored to address the entirety of pollutant loads by focusing on Total Suspended Solids (TSS); most of the causes of impairment in the MRG are believed to be the result of pollutants which are transported as sediments or adsorbed to sediments. The USFW stated that concentrating on "suspended solid and sediment sources and stormwater transport pathway in the storm runoff events from urban area basins" (USFWS, 2011) is the method that will most effectively protect habitat. According to data collected from a USFWS representative during an interview for this report, this strategy will continue to be implemented under the watershed-based stormwater permit.

Native American Pueblos: Sandia, Isleta and Santa Ana

The Pueblos of Sandia and Isleta have established their own designated uses and associated water quality standards (Appendix B). Water rights attributed to the Pueblos are "largely undefined and may have senior priority to other uses on fully appropriated streams" (Barroll, 2003). These entities are not subject to the state's legal component of *beneficial use*. Moreover, they do not need to use their water in order to retain their rights . Since the Pueblos exercise sovereignty, they generally are not subject to NM state regulatory programs; however they are subject to the CWA, the ESA and other federal environmental laws. The tribes have cooperated with federal agencies under the

Endangered Species Act (Parametrix, 2007), however there has been conflict surrounding the tribes and implementation of the ESA (Lorenzo, 2000). Challenges may or may not arise about the new WBP between the tribes, federal regulatory agencies and other stakeholders. Population growth in and outside of the tribes may lead to increased reluctance to outside regulation of their water resources. They may feel more pressure to exercise their paramount rights to water as their needs increase, along with the needs of outside populations.

No tribal entities participated in interviews for this report. Contact was attempted, but no responses were received. There were also questions among the stakeholders about Pueblo participation in the WBP, directed toward the EPA , but no formal answers were given from the EPA staff. The absence of discussion was believed to be due in part to confidential negotiations between EPA and the Pueblo governments over the watershed-based permit.

The regulatory conundrum

There are many intersecting federal and state regulations that complicate water management in New Mexico. For interstate compact provisions require delivery of water to the Lower Rio Grande and Texas regardless of how much water is available in the Rio Grande. This may pose difficulties between the OSE, the USFWS, other federal agencies and stakeholders when managing stormwaters under the WBP. Moreover, as the population grows the water 'quantity vs. water quality' paradox may be exaggerated, especially during drought years. Storm water management strategies such as retention

ponds and constructed wetlands result in less water reaching the river. This impacts aquatic environments as well as deliveries to Texas.

Interagency conflict is especially challenging in a region as politically complicated as the MRG. What agency takes precedence in decision making is a great challenge. EPA's goals for the protection of stormwater through a watershed-based permit may further complicate the relationships between governmental agencies. The optimum challenge under the watershed-based stormwater permit will be to create partnerships between federal agencies and local policy makers that delineate common goals, then to establish those goals in the interest of the MRG Albuquerque area stakeholders far into the future.

3.2 State Agencies and their Role under the Albuquerque MRG WBP

New Mexico Environment Department (NMED)

The New Mexico Environment Department was created in July 1991 through the conditions proposed by the Department of the Environment Act by the 40th Legislature (Laws of 1991, Chapter 25). NMED's mission "is to provide the highest quality of life throughout the state by promoting a safe, clean and productive environment" (NMED mission, n.d.). The New Mexico Environment Department is composed of several sub-departments including those that are specifically responsible for water quality such as the Surface Water Quality Bureau and the Ground Water Quality Bureaus. Both bureaus are within the Resources Protection Division of NMED.

a) Surface Water Quality Bureau (SWQB)

The Surface Water Quality Bureau addresses issues of surface water quality in NM and establishes TMDLs that are subsequently reviewed and approved by the EPA (40 CFR § 130.7). This strategy is employed to ensure water quality meets the standards set in the statutory requirements of Section (§) 303(d) (EPA Clean water act section 303) and requirements of §305(b) (Water Quality Reporting, n.d.) and 314 of the federal Water Pollution Control Act (Clean Water Act title 33§ U.S.C. 1251). This strategy is critical to the NPDES MS4 permitting system as it has functioned in the past, and it will continue to be utilized under the watershed-based MS4 stormwater permit.

The SWQB has assisted the EPA in administering the CWA section 402 NPDES stormwater program, primarily by providing review and comment of draft permits, and by facilitating stakeholder involvement in the permit development process. Although the EPA is the regulatory authority for the stormwater program in New Mexico, the SWQB aids in the regulation of stormwater discharges. They monitor water quality, and perform inspections on an eight year rotating basis. They have been qualified by the EPA to perform inspections under the NPDES program. The SWQB is also the local connection for any agency or person seeking guidance or information on the federal program. A representative of the NMED SWQB was principal coordinators of the planning process for development of the watershed-based stormwater permit pilot project in the MRG.

b.) Ground Water Quality Bureau (GWQB)

The Ground Water Quality Bureau addresses and regulates ground water quality standards "as mandated by the Water Quality Act and the Water Quality Control Commission (WQCC) regulations (20.6 NMAC), and to identify, investigate and clean-up contaminated sites which pose significant risks to human health and the environment" (Ground Water Quality Bureau, n.d.).

The interaction that stormwater has with ground water is of concern to the GWQB when stormwaters from an industrial source are being infiltrated into the ground (NMAC 20.6.2. 5002; (b), 1995). Underground infiltration of stormwater by an industry is considered 'underground injection' by the GWQB and is therefore under the scrutiny of the Water Quality Control Commission regulations (NMAC 20.6.2.5002, 1995) as a class type V well:

> "the purpose of controlling discharges from underground injection control wells is to protect all ground water of the State of New Mexico which has an existing concentration of 10,000 mg/l or less TDS, for present and potential future use as domestic and agricultural water supply, and to protect those segments of surface waters which are gaining because of ground water inflow for uses designated in the New Mexico Water Quality Standards. Sections 20.6.2.5000 through 20.6.2.5299 NMAC include notification requirements, and requirements for discharges directly into the subsurface through underground injection control wells" (NMAC 20.6.2.5, 1995).

Infiltration of stormwater from retention facilities thus constitutes underground injection which may place it under the jurisdiction of the GWQB. Permits were only required for industrial stormwater injection during the writing of this report, therefore residential homes would be exempt under the WBP. However, residential households may be regulated by the GWQB in the future.

For instance, septic systems at residential homes may be under more scrutiny as monitoring for 303(d) pollutant Coliform bacteria *Escherichia coli (E* coli) becomes further regulated under the new permit. The detection of *E coli* in specific circumstances may implicate faulty septic systems. The EPA has recognized the failure of septic systems to harm water resources and has enacted preventive measures to eliminate these failing systems. The Minimum Control Measure 'Illicit Discharge Detection and Elimination' for the NPDES stormwater program (Preventing septic, n.d.) has guided this BMP. It may be found that large storm events carry these polluted waters to the Rio Grande acting as a source of impairment to the nation's waters.

The watershed-based stormwater permit may require the New Mexico Environment Department and counterparts to more intensely regulate surface and ground water interactions as they are related to stormwater discharge. NMED has been involved in the EPA's NPDES stormwater program since its establishment in New Mexico.

Interagency collaboration may become more developed if EPA's role in administering NPDES permits lessens, as it has in other states. Therefore, relationships within NMED (between the SWQB and the GWQB), the relationship between NMED and the local permit stakeholders, as well as these agencies' relationships with other political actors, may also transform after the implementation of the new stormwater permit.

Office of the state engineer (OSE)

The State Engineer is responsible for administering water resources in NM, and his office has developed a water rights and permit system to accomplish this. In addition, the State Engineer serves as secretary of the Interstate Stream Commission, which is responsible for "protecting New Mexico's water under eight interstate stream Basins, ensuring the state complies with each of those Basins, as well as water planning" (OSE, 2012). Compact obligations and water rights are the two largest influences over the OSE's management of water resources.

3.3 Local Participants in the Proposed Watershed Based Permit

Before the initiation of the watershed-based pilot project in 2010, inter-jurisdictional cooperation among the proposed participating entities for stormwater management in the MRG was not mandated beyond the NPDES MS4 Phase I permit. MS4 permits were the only factor in determining experience with stormwater management.

However, because some entities did not have MS4 permits, did not mean that they did not contribute to the system of total pollutant loads. In addition to urban runoff, some of the smaller jurisdictions have irrigation canals and hard infrastructure that may convey pollutants to the Rio Grande. Besides that fact, some entities have large areas of irrigated agriculture exempted from regulations under the NPDES program (see Appendix E: definitions), all entities contribute to a pollutant load in the watershed. They accumulate pollutants between storm events that eventually reach receiving waterbodies. These entities also contribute to dry weather runoff or 'nuisance flows' that are carried by sewer systems or other flow paths to the river.

The largest political consideration for local stakeholders was the sparse foundation of resources from which to develop a watershed-based approach to stormwater management. This included a lack of both funding and other administrative related capacities. Coupled with this fact was that most of the local stakeholders were not actual policy makers, but instead employees of policy makers. In other words, most were only able to offer suggestions to the policy makers. Many legal requirements that surround water resources in the state of New Mexico have been created at the federal level of government that the MRG participants have no influence on, nor access to. For some stakeholders, the political hierarchies made them feel inconsequential to the policy making process as observed during the data collection period for this report.

The varying operational functions, administrative capacities, permit experience and other factors may pose challenges when determining resource commitment during the final phases of permit drafting. Planning, coordination, and collaboration between previously unrelated jurisdictional entities are critical to ensure the success of regional permits for managing stormwater flow into the Rio Grande.

Chapter 4 Data Collection and the planning process

The number of entities that are represented under the new permit had changed from 17 (without the tribes) to 21, to 20, to 19, since the planning process began in 2010. At the

end of this particular study, the number of participating entities (according to the EPA) was not yet determined, because the tribes were in government-to-government consultation over the WBP. In addition, the involvement of New Mexico Expo, the MRGCD and others was not well defined at every point during the planning process. The interview dataset for this report was 12. This was achieved through interviewing every willing representative. A representative from U.S. Fish and Wildlife was also interviewed for this report and was included in the dataset number 12. The dataset in its entirety was 16 entities that were present during the stakeholder meetings from November 2011-May 2012. Data was also gathered from two additional ad-hoc meetings that focused on developing a matrix to determined 'sector' placement for entities. This data does not include the tribes, or New Mexico Expo, because they did not voice opinion during the planning process. Perspectives from all local entities (not including the tribes) were attained through the total accumulation of data acquisition from November 2011 to May 2012.

4.1 Resource allocation

Unlike the other pilot projects initiated by the EPA in Minnesota and Wisconsin, New Mexico has never had primacy over their NPDES permitting program. This means that New Mexico has not demonstrated the financial and technical commitment to manage the program. Minnesota and Wisconsin had already implemented NPDES stormwater programs when the pilot projects were initiated and so therefore had a foundation of resources from which to work. New Mexico did not have the same resources for implementing a stormwater management program. Consequently the response of the local

stakeholders to the EPA's authorizing a watershed-based stormwater permit was not always positive.

With primacy, Minnesota and Wisconsin had more options for implementing BMPs. Regulation 40 CFR § 122.34(c) allows for any existing program that currently employs the minimum control measures to replace those responsibilities mandated under the new permit. That is, if authorized by the EPA as sufficient practices. Since Minnesota and Wisconsin had primacy, they also had to surpass fewer financial and administrative burdens in order to transition to a NPDES WBP. Furthermore, 40 CFR § 122.34(c) states:

> "If an existing qualifying local program requires you to implement one or more of the minimum control measures of paragraph (b) of this section, the NPDES permitting authority may include conditions in your NPDES permit that direct you to follow that qualifying program's requirements rather than the requirements of paragraph (b) of this section. A qualifying local program is a local, State or Tribal municipal storm water management program that imposes, at a minimum, the relevant requirements of paragraph (b) of this section."

Except for the Middle Rio Grande Storm Water Quality Team, the Ciudad Soil Water Conservation District, the Mid-Region Council of Governments, and joint activities shared under existing MS4 phase I permit holders, the MRG area stakeholders did not have a mechanism to reach across political boundaries for stormwater quality undertakings. New Mexico also did not have state implemented stormwater programs; consequently it also did not have a funding scheme in place to aid in implementing an NPDES watershed-based stormwater program. Funding was the single most discussed issue at the stakeholder meetings, as well as during the author-led interviews.

4.1.2 Economies of scale and cost-sharing

During the planning process the stakeholders discussed the concept of 'economies of scale,' by comparing the expansion of the watershed to the expansion of a business enterprise. Although the watershed-based permit will be more expensive for stakeholders than if no change in the NPDES program had occurred, a change to the NPDES stormwater program was seemingly inevitable and therefore the stakeholders were searching for a method to efficiently allocate costs. Thus the concept of economies of scale was introduced.

For the MRG area a change in the NPDES stormwater program was prompted by both the NRC report and also by the EPA Region VI Administrative Orders sent to the City of Albuquerque twice in 2011 for violating provisions under the Clean Water Act over stormwater discharges (Bryan, 2011). The federal mandate for compliance under watershed-based NPDES permits was proceeding in the MRG, regardless of resource availability and willingness of stakeholders; the will of the federal government to improve the nation's impaired waters through a WBP, was unavoidable.

The certainty of this transition was recognized among some of the involved stakeholders. These stakeholders then chose to cooperate to delineate responsibilities under the upcoming permit utilizing the notion that cooperation would lead to a more efficient use of resources. Thus, more entities would cooperate to administer BMPs and to share costs. This expansion would essentially provide more input into the system and organize tasks to avoid administrative overlap. Avoiding administrative overlap was understood to

lower future environmental and financial burdens as was identified through the watershed approach

4.2 Sector method based on impact analysis and watershed matrix

Given the large size of the MRG watershed, the EPA decided to divide the entities into sectors as a means to allocate resource responsibilities more easily. Thereby creating a situation where entities could potentially develop joint-SWMPS based on sector demarcation. This would facilitate cost-sharing and BMP activity implementation associated with the WBP. To help achieve this goal, Jessica Bennett, a graduate student working under a grant provided by Ciudad Soil and Water Conservation District, began developing an algorithm. This algorithm incorporated the jurisdictions' perceived impacts on receiving waters. Sectors were defined by the relative impact an entity had on the watershed given their slope, population density, distance from the Rio Grande, impervious surface coverage, and drainage area. The latter (drainage area) was used as a multiplier for the other characteristics. Those with similar scores were in the process of being placed into the same sectors during the writing of this report.

The 'sector' method was the method chosen by the stakeholders to best employ the concept of economies of scale for cost sharing and BMP implementation. At the end of May 2012, sectors were in the process of being delineated. From interviewing

stakeholders, the author of this report was able to weight impact factors relative to one another (figure 8).Ms. Bennet integrated these results into her algorithm for one case of sector analysis that may or may not be used for the final draft permit. The following table (Table 5) is an example of sectors, which was the result of several meetings during the planning process that included all actors mentioned above:

Table 5 Example of sectors for the MRG WBP

A	B	C	D	E	F
Large Municipal	Medium Municipal/ County	Small Municipal	State	Federal	Tribe
Albuquerque	Rio Rancho, Sandoval Cty, Bernalillo Cty	Corrales, Bernalillo, Tijeras, Los Ranchos de Albuquerque	NMDOT, NM EXPO, UNM, Flood Control Authorities	Kirtland, Sandia Lab	Sandia, Santa Ana, Isleta

Although this table may not represent the final sector definitions, it is a working case for the purposes of this report. Those that fall into the same sectors would be responsible for implementing the same BMPs and have the opportunity to share the cost of those activities. For sectors, BMP activities would be divided into categories of 1) basic 2) advanced 3) enhanced. All entities would have to implement the basic activities for each MCM. Those entities with a greater impact on the watershed would also have to implement

Advanced and/ or Enhanced activities to mitigate that impact. It was also discussed that those entities within the same sector may have the opportunity to participate in a joint SWMP, which would employ the concept of a watershed-based approach.

Another approach, referred to as the matrix approach, was initiated to define sectors outside of the impact algorithm. A stakeholder group worked to develop a matrix that defined each individual entity through a variety of aspects that were not limited to impact. They added infrastructure and administrative capacity components (see 6.5). This was an attempt to gain a more holistic understanding of individual entities, before separating them into sectors. This was presented as an alternative to the impact method. However it was also to be being developed as a possible method by which to determine what BMPs each entity would have to implement.

4.3 Credit system an alternative approach to cost-sharing?

During the planning process, resource allocation was primarily defined in terms of monetary cost-sharing. However, at the last two stakeholder meetings, an alternative approach for sharing the allocation of resources was addressed. Stakeholders proposed a *joint credit system*. Although credits were not completely defined, the EPA region 6 project administrator stated that an entity may receive 'bonus points' in a credit system for a participating in a joint SWMP. This would be one method by which an entity or sector could accumulate credit.

The stakeholder group advocated that the credit system be employed for the WBP under the conditions that if an entity falls short of a BMP goal established under a joint SWMP,

that they may request that another entity in their SWMP shares accumulated credit per WBP guidelines. For example, if another entity has exceeded goals under any one of the six MCMs, that they can use those activities as credit towards an entity within the same SWMP that has fallen short of their BMP objectives (see section 6.4). However it was unclear as to how a joint SWMP would operate under this scenario. Generally a SWMP only has one set of goals; therefore those that share a SWMP would share the same set of goals. Thus every entity within the sector may be lacking the same BMPs to meet goals.

Chapter 5 Stakeholder Interviews

5.1 Conditions of interview summaries

Eleven of the participating stakeholders were interviewed for this report. All entities were contacted for interviews, but only eleven agreed to interviews. In addition to the entities that will be represented under the watershed-based permit (WBP), a representative from U.S. Fish and Wildlife (southwest region 2) was also interviewed in order to grasp intersection of the Endangered Species Act with the WBP. Following are the stakeholders that data was collected through interviews (including US Fish and Wildlife):

1. Town of Bernalillo
2. Los Ranchos De Albuquerque
3. Village of Tijeras
4. SCAFCA
5. Bernalillo County
6. UNM
7. NMDOT
8. DOE/Sandia National Labs
9. KAFB4
10. The City of Albuquerque
11. AMAFCA
12. USFWS

A summary of the eleven stakeholder interviews are located in Appendix B. The degree of variation among interview summaries is based on the following criteria: individual experience with NPDES permit obligations are largely inconsistent or non-existent; SWMPs do or do not exist for individual entities; the nature of the interviews themselves gave way to varying results due to what was emphasized/relayed by the interviewee.

Furthermore in the interview summaries (Appendix B) the largest variation in opinions are those under the sub-section that discuss the BMPs under the six Minimum Control Measures (MCMs) for individual entities. Many Best Management Practices (BMPs) that are currently employed by individual entities are not listed, or the sub-section for MCMs is non-existent. This is due to the following factors: the time duration of the interviews did not allow for a complete detailed account for BMPs (there are quite a few for larger entities and those that held current MS4 permits); understanding of the implementation of BMPs and/or the existence of them is not fully understood; the BMPs themselves are intrinsic to the functionality of the entity but have never been formally recorded; or they are done in conjunction with neighboring entities under an existing MS4 permit or through an outside organization such as the Middle Rio Grande Storm Water Quality Team (MRGSQT). If the MCM sub-section does not exist there may be BMPs listed under 'Present stormwater management efforts'. In the case that a SWMP or MS4 permit currently exists for an entity, a detailed account of BMPs under the MCMs is available through their SWMP and/or related documents outside of this report (City of Albuquerque, 2012 ; AMAFCA, 2012; MRGSQT, 2012).

These particular circumstances of data collection only further exemplify the nature of the MRG watershed-based permit challenges and opportunities. These particular circumstances also made it ineffective to summarize the interviews in reference to the interview questions. The list of questions, though, generated the discussion during the interview process; therefore they are provided in this report (Appendix A).
(A summary of the interviews is contained in Appendix C).

5.2 Foreseen challenges

There were many concerns about the WPB mentioned during the interviews. Although each entity is unique in their administrative capacity, political status, function and physical characteristics, when the interviews were cross-analyzed, stakeholders' concerns were similar. The similarity of different entities' concerns may be due to the fact that although some entities may have had more experience with the MS4 program, it was still relatively new in the MRG area.

5.2.1 Funding

Funding for the WBP was a concern for every interviewee. Costs associated with monitoring programs for pollutants, oversight of construction programs, LID rules, new infrastructure, rehabilitation of old infrastructure and hiring new employees to administer the NPDES WBP activities were among the top concerns.

5.2.2 Total Maximum Daily Loads and natural processes

Pollutant loads were discussed by all interviews. Sediment is something that is caused by land disturbances and also through natural processes in arid climates. Soils lack layers that are found in wetter climates, therefore are less stable against erosion. They also do not have dense vegetative cover to help impede runoff. Therefore, unlike in other regions, erosion and sediment accumulation are made much easier by fluvial, Aeolian and alluvial processes. Sediment transport of adsorbed contaminants is a major mechanism by which 303(d) listed pollutants may be carried to receiving waters. Aside from construction activities that produce sediment, stakeholders were at loss as to what else could be controlled to reduce this load.

An arid climate with warm water during the summer and high altitude cover also contributes to a lower dissolved oxygen content in water. Stakeholders are at odds with what BMPs exist and that will work effectively at lowering water temperature. Since planting riparian vegetation is not appropriate for a water constricted region, research will need to be conducted in order to find the necessary BMPs for the TMDL (scheduled for 2016) associated with temperature.

Warm temperatures also induce the growth of *E-coli* in water. *E-coli* is a naturally occurring bacteria that resides in animals' digestive systems. It is released from the body along with fecal matter, after which it finds its way into the MRG watershed. In 2002 a Bacterial Source Tracking (BST) study, funded by NMED, Bernalillo County, and AMAFCA, was conducted in the MRG basin from the Angostura Diversion to the Isleta

Diversion Dam. Results from the study "showed that avian sources were the largest contributor to bacteria in this portion of the Rio Grande, followed by dogs and cats, other wildlife, humans, and livestock" (WQCC, 2010) . This point was argued heavily by some of the interviewees as a major challenge for the TMDLs under the WBP.

Furthermore, *E-coli* will continue living at temperatures after excretion from a host if outside temperatures are consistent with their original environment (Nguyen, 2006). Mammals mean internal temperature is 37° Celsius or 99° Fahrenheit and it has been found that this is a favorable temperature for the growth of *E-Coli* (Copper, 2001). The NMED SWQB published a report *Air-Water Temperature Correlation* (2011), that maximum weekly average (water) temperature is equal to July average air temperature. Continuous monitoring of temperature and other parameters in the MRG by the USGS and others show that water temperatures in the river typically exceed 25 °C which is believed to contribute to high concentrations of coliform bacteria from water fowl and aquatic mammals. Monthly monitoring data by the Bosque Ecosystem Monitoring Program (Eichhorst, 2010) along the reach of the river from Algodones to Isleta show only a slight increase in coliform bacteria as the river flows through the urbanized area which supports this conclusion.

The entities in the MRG WBP will be able to target faulty septic systems and pet owners for the presence of *E-Coli*, but cannot control water fowl and aquatic mammals or the climate. Finding BMPs that are applicable for bird feces reduction will be challenging. In

addition to the negative impact of high temperature on *E-Coli* loads, waters of high thermal magnitude do not support aquatic life pursuant to Clean Water Act 303 (d)/305 (a) list of designated uses.

Temperature, Dissolved Oxygen, and E-Coli are three of the five TMDL pollutants associated with the new permit. Each pollutant, in and of itself has inherent challenges for pollutant load control. The most interesting factor about these specific pollutants is their interrelation. Perhaps a BMP suitable for temperature control could mitigate the effects of the others; however, this may be the most challenging TMDL to manage.

PCBs and gross alpha were the least discussed pollutants associated with TMDLs under the WBP. Gross alpha had not yet been listed during the data collection period for this report. The manufacturing of PCBs was banned in the United States in 1929, however they are still found in the environment and although their concentrations meet EPA water quality standards, they do not meet state standards for state human and wildlife health (NMED, 2010). The way by which these pollutant loads are getting into Rio Grande is by attaching to fine sediments that are transported by stormwater events (ibid).

5.2.3 Construction and low impact development

Another challenge identified by during stakeholders meetings was the possibility of unequal distribution of BMP measures required for LID amongst the entities in the MRF

watershed . The fear was that this would result in imbalanced development in the MRG area. Developers generally choose to build where the least restrictions are in place for construction requirements.

5.2.4 Administrative capacity

Policy formulation and enforcement were seen as major constraints for implementing BMPs, especially for construction sites and illicit discharge. This was particularly true for those entities that had no administrative capacity or capacity to enforce policies. This was also discussed as a constraint for some of those municipalities that had capacity to create and enforce policy, because they did not have experience with the MS4 program. Those without experience generally did not have stormwater infrastructure in place. This was also discussed as a possible challenge under the WBP, depending on what the new mandates. Those entities that had previous experience with NPDES stormwater permits, did not stress constraints under administrative capacity as extensively.

5.2.5 Compliance schedules

Compliance schedules for filing a Notice of Intent (NOI) for a SWMP and also for monitoring programs under the new permit were of concern by the interviewees. It was agreed that these schedules needed to be customized based on individual entities' administrative capacity and permit experience. During the stakeholder meetings, though, these schedules were also discussed in terms of sectors.

5.2.6 Non-participants

Concern was also expressed over equitable sharing of resources in the event that some entities fail to participate in development, management and implementation of SWMPs under the watershed-based permit. The concern was that non-participation would internalize negative impacts for the entire watershed effort.

5.3 Foreseen Opportunities

During the interviews, various levels of support for the WBP were expressed by individual stakeholders , but overall they were more positive than those that were displayed at the stakeholder meetings. Generally, rather than exhibiting frustration and concern over the potential costs and political consequences of a WBP, the outlook was more positive and at times eagerness was demonstrated towards the notion of a WBP.

5.3.1 Shared responsibility

The idea of sharing responsibility for stormwater protection collaborating on some SWMPs was widely accepted among interviewees, particularly for the MCMs that involved public participation, education and outreach. The idea of watershed-wide educational events such as public seminars; elementary school programs; as well as watershed wide broadcasts and media campaigns such as a "radio-shed" and informative websites were also mentioned during several interviews. A data base of historic hydrologic information about the watershed was also seen as an opportunity to address questions about temporal and spatial aspects. These aspects include historic pollutant

constituents and associated loads and flow paths as they have changed over time. Since these variables are largely dependent on the region's pattern and rate of urbanization they are critical to the performance of a WBP. A holistic understanding of these aspects is fundamental to a watershed approach and critical to the future health of the environment.

5.3.2 Cost-sharing

There were mixed opinions among the interviewees about cost-sharing. For those who were most overwhelmed by the permit proposal, especially those entities without prior experience with NPDES MS4 programs, cost-sharing was an accepted method of resources allocation. Three of the eleven stakeholder interviewees did not think that cost sharing was an effective approach for resource allocation. These interviewees felt that they already contributed enough costs associated with stormwater management for their jurisdictions and did not think that this would approach would be a fair. An opportunity for cost-sharing may benefit those entities with little resources if sharing a SWMP with entities that have more experience and/or resources for the WBP.

5.3.3 Low Impact Development

Developing a watershed-wide policy approach for construction and post-construction runoff controls was seen as an opportunity for stakeholders to work together to achieve compliance across political boundaries. This would minimize imbalanced development throughout the watershed.

5.3.4 Community and environment

The above ideas were seen as opportunities to avoid overlap in administration of BMPs and to spread costs across the watershed. Overall, protecting the quality of the Rio Grande the most significant benefit recognized by the interviewees. Protecting the general water quality by working under the same permit was a point of enthusiasm for some stakeholders. It was anticipated that a new environmental paradigm may be motivated through a WBP.

5.4 Reservations by participants

Not every interviewee was willing to reveal some aspects of their stormwater management programs. This is another aspect that did not allow for interview summaries to be developed under the interview questions. The following aspects are of importance should be noted.

1) Every entity did not agree to be interviewed for this report, however one of every 'type' or sector was interviewed, (table 2): Large Municipal, Medium Municipal/County, Small Municipal, State, and Federal. Thus, aside from the Pueblos, data should be an accurate representation of the varying perceptions among stakeholders.

2) Current annual funding for stormwater management quality efforts among entities spanned from $0.00- $600,000. These figures depend on a variety of internal aspects of each entity, such as taxing capabilities, experience with alternative funding mechanisms, MS4 status and type of entity (federal, state, local and non- traditional).

Chapter 6 Discussion and recommendations

To assist the participants in the WBP pilot project, it is imperative to recognize to challenges that were consistently expressed by stakeholders during the planning process. These challenges were articulated during stakeholder meetings and during interviews. In order for the discussion and recommendations in this report to be pertinent to the entire watershed, it was necessary r to expand upon concerns identified by the stakeholders and other participants in the MRG WBP planning process.

6.1 Internalizing externalities

> "One of the main attributes of watershed management is the potential to improve the management of externalities resulting from land and water interactions. An externality can be defined as the effect of one party's actions that impose a cost or benefit on another party, without that cost or benefit being accounted for in the market" (World Bank, 2001).

It is difficult to implement a watershed approach that operates on the production of positive externalities that are not being financially compensated for and where a method by which charging those stakeholders that create negative externalities within the system is not yet determined (Darghouth et. al., 2008). Although 'cost-sharing' and 'credit systems' were the terms stakeholders were comfortable using under the stipulation of resource allocation, a real cost-benefit analysis was yet to be applied for these methods in the watershed.

6.2 Cost-sharing

Development of an equitable method of sharing costs of stormwater quality protection measures is difficult for large watersheds, principally those that encompass many stakeholders and a variety of land-use practices (Darghouth et al., 2008). This is due to the following difficulties: getting individual stakeholders/entities to comply with costs they do not agree with, developing a record of which entity is paying for what environmental activity and, as mentioned, monitoring the phenomenon of the externalities associated with watershed activities. Therefore it is critical to implement "participatory applied research on costs and benefits of investments and on upstream-downstream interlinkages, together with good monitoring and evaluation are needed to build the knowledge required to underpin the chosen structure [resource allocation method]" (ibid).

To prevent a complicated cost-sharing system, the MRG WBP , stakeholders applied the 'sector' notion to cost-sharing. As discussed during stakeholder meetings, an entity would only share costs of BMP implementation with those in their sector. In effect this approach is meant to reduce the administrative complexity that may encumber a large watershed. However, the way by which sectors were divided during the planning process (based on impact), tended to group together those entities with similar administrative capacity. This would be problematic under the WBP, because the entities that have little to no resources may be in the same sector with those that are in a parallel situation. Therefore by default, they would need to look outside of their sectors for additional assistance. This would negate the sector-based system for cost-sharing.

The cost-sharing method chosen for the MRG BMP, it must be applied on a basis that includes the entire watershed. For example, an overarching watershed group, (such as the MRGSQT, Ciudad Soil and Water Conservation District, or Mid-Region Council of Governments) would be needed to collect funds through watershed-wide fundraising events . These funds could then be distributed based on need through an application process. The application process could be completed by individual entities or by designated sectors (see section 6.4).

An alternative method would be to identify an existing entity that has the ability to tax and manage funds for a large portion of the watershed such as the counties, AMAFCA and SSCAFCA For large projects, taxes may be the only sufficient method by which to gather enough funding. If there is no existing entity equipped to design this mechanism, the creation of another organization or utility may be an option to consider.

Since many of the environmental investments will cannot be measured as monetary benefits, it is important for stakeholders to remember the cost of negative environmental externalities on the watershed groups that will result in the need for more funding. A cost-benefit analysis for resource allocation methods needs to be performed for entities to receive the most utility for their stormwater management efforts. A cost-benefit analysis may not be successful until several methods or resource allocation are administered under the new permit.

6.3 Other costs

Cost associated with a WBP was a general concern; however there are expenses that can be avoided by applying a watershed-approach that is not directly defined in terms of cost. For example, activities to improve the health of the watershed through cooperative endeavors outside of a cost-sharing regime, such as volunteer programs and additional citizen-initiated activities (see section 6.8) would not only reduce future costs under the WBP by avoiding environmental degradation, but it would also encourage citizens to participate in BMPs, thus further reducing the burdens felt by individual entities. A social benefit would also result as coordination among citizens, stakeholders and political officials is established.

On the other hand, economic incentive are needed to encourage watershed management programs to protect stormwater quality throughout the region. There may be stormwaters-related efforts that have the potential for monetary reimbursement. One of these efforts is applied research for LID design standards suitable to an arid environment. Furthermore, the MRG Albuquerque area has the opportunity to assume leadership in the way of research and development of LID practices appropriate for the region.

6.4 Credit-trading system

Although a credit-trading system was not completely defined during the planning process at the time this report was written, following are examples that could be utilized if implemented on either a sector or watershed-wide basis.

Example 1): An entity may exceed their BMP goals under a minimum control measure; this could be reported to a watershed-wide service group that has developed a data-base that displays these exceeded MCMs as available credit under that MCM. An entity that has not met all BMPs under that same MCM could apply for that credit towards their SWMP goals. This is in essence cost-sharing without directly identifying the costs that went into the production of the activity.

Example 2): A general data-base that provides what resources each entity is capable of sharing, such as educational pamphlets or programs, assistance in developing SWMPS, lab equipment or access to university graduate programs, a "how to" develop and implement ordinances, or other administrative tasks. An entity may report that they have the resources needed for implementing a monitoring program (e.g. lab equipment or university students). Entities could then swap resources through a 'this for that' credit system. To avoid inequitable sharing of resources or a highly politicized watershed administration under a credit-trading system, it is recommended that an application process is implemented for credits and overseen by a third party that is unbiased towards the entities.

The credit-trading system, if applied in a sector-based permit system, may be problematic for similar reasons that were foreseen under cost-sharing. In other words, in a sector based scenario, those entities that have little resources from which to work, may find it difficult to share resources with others that also have few resources..

Considering the unknown consequences of cost-sharing for this type of watershed, especially under a sector-based system, a 'credit trading' system is recommended at this point. This type of system may reduce the burden felt by those entities without an established funding mechanism. It may prevent the conflict that could ensue from applying a market-based system to an environmental system, such as tension over the concern of inequitable spending. It would also provide the opportunity for each entity to utilize and share what they have in terms of available resources, rather than mandating an unmanageable economic criterion

6.5 The watershed matrix and associated application process

If an entity seeks to receive credit or funding through any variety of methods, it is important that they are able to demonstrate their individuality in both categories of 'impact' and 'administrative capacity'. During the interviews, the concept of 'impact' was discussed in terms of the following question:

"As representatives from NMED and Ciudad Soil and Water Conservation District try to determine resource commitment from permittees, they are looking at the following factors (below). Which of these do you think are most important in developing a fair and equitable method of sharing the costs of a stormwater quality management program?"

- Drainage area
- Slope
- Percentage of impervious cover
- Population density

Some interviewees had no opinion regarding this approach. The majority of them, however thought that 'percentage of impervious surface cover' and 'population density'

were the most important. This is interesting because 'population and population density' is what determines an 'urbanized area' according to the census bureau and is the criteria used by the EPA:

" An ***urbanized area*** is a land area comprising one or more places — central place(s) — and the adjacent densely settled surrounding area — urban fringe — that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile…" (EPA Urbanized Areas, 2005). Based on all characteristics that describe individual entities within the watershed, the stakeholder group put together a matrix to determine an entity's impact on the Rio Grande and other tributaries relative to the permit. As described in chapter 4, the matrix was an alternative approach to the impact algorithm. These characteristics of infrastructure, administrative capacity and land-use, were lumped together in one matrix that did not delineate their relative importance.

There was no weighting associated with these aspects when the matrix was developed. The author of this report did not consider this method effective in determining an entity's impact. The author also considered some of the characteristics in the matrix too dissimilar to group together. Therefore the author felt the individuality of the entities was misrepresented and the matrix was not beneficial in determining impact, resource allocation, or administrative capacity.

In order to further identify the individuality and capacity to deal with mandates under the new permit, the existing matrix developed by a stakeholder working group was refined

for this study (see Appendix D for the author's matrix spreadsheet). The categories "infrastructure," "land-use" and "administrative capacity" were used to define three separate matrix components, to avoid the grouping of dissimilar characteristics that would lead to ambiguous 'impact' results. It was determined that not all aspects of a watershed would produce an impact, such as those found under the categories of administrative capacity and infrastructure. The only aspects that the author believed to have an impact on receiving waters were those under the land-use category.

After separating characteristics into one of the three relative categories, the author applied a 'paired comparison method' (Appendix C) for the aspects that the author separated into a 'land-use' category. The 'paired comparison method' judges elements separately in pairs based on their importance. 'Importance' was determined through data gathered during the interviews and during stakeholder meetings. The results are meant to represent the perspective of stakeholders to assist them under the watershed-based permit if funding and/or other resources are needed. The number of times an element was selected was divided by the number of comparison (which was 55) and the result gives that particular weighting. Figure 7 presents a chart that represents this weighting for land-use aspects under the MRG WBP.

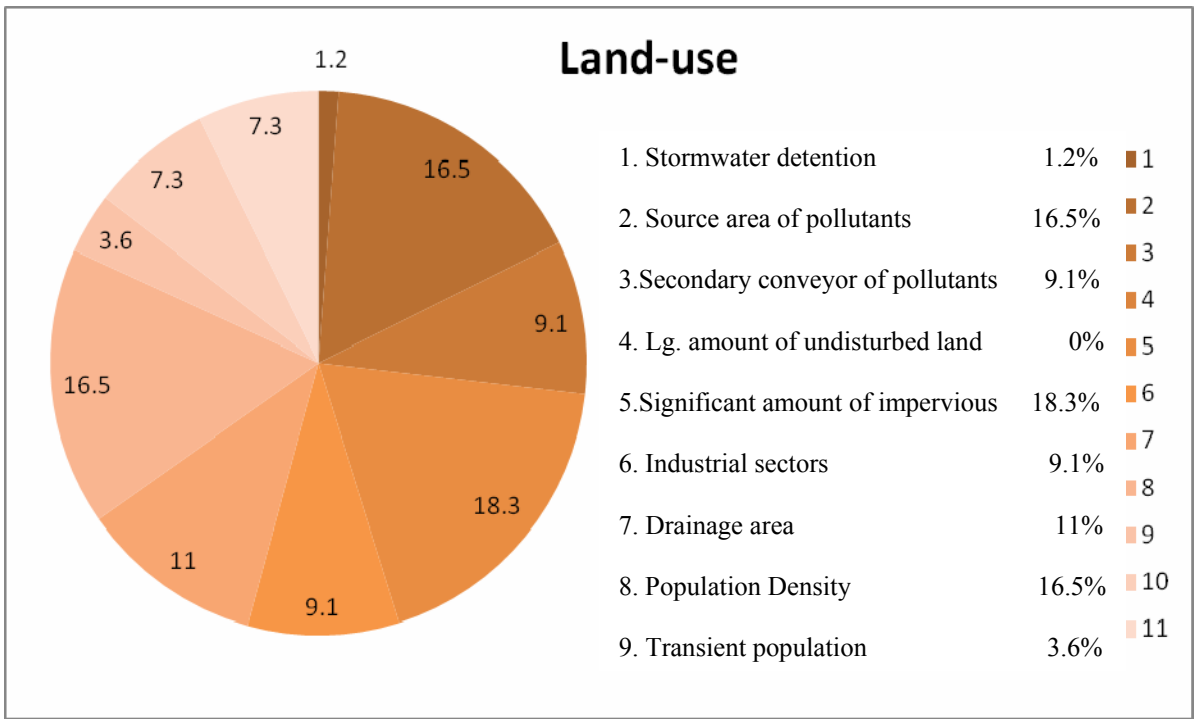

Figure 7 Weighting of land-use aspects

Ms. Bennet (graduate student working under Ciudad Soil and Water Conservation District) considered this weighting useful and applied those weights for population density, slope, drainage area and impervious surface coverage to her impact algorithm. This application slightly altered her results and placed the City of Albuquerque in its own individual sector. Regardless of the outcome of Ms. Bennet's impact algorithm, the matrix was also useful for showing administrative capacity and infrastructure for each entity and as they are relative to the entities in the whole watershed (figure 8).

Essentially, the matrix illustrates the individuality of each entity, outside of sector demarcation. It can be used as a tool in an application process under a WBP. For example, if an entity shows a high impact rating in 'land-use' or according to the

algorithm that Ms. Bennet puts forth, this entity would be placed in a sector that is mandated to execute ‘enhanced’ BMPs; however this entity may have no mechanism or experience to implement BMPs (little ‘administrative capacity’) and/or little in the area of stormwater infrastructure. With the matrix, the entity can juxtapose the scenarios (impact, administrative capacity and infrastructure) to show where they are unable to contend with WBP mandates. This is a method by which an entity can demonstrate individual needs and apply for funding.

Figure 8 Watershed matrix (Blumhoefer, 2012)

Impact weighting left blank intentionally, because the method by which to determine relative impact was yet to be determined by the stakeholder group.

6.6 Compliance schedules

Compliance schedules may also be determined by the relative administrative capacity an individual entity can demonstrate. During the writing of this report, the EPA region 6 permit writer discussed compliance schedules in terms of Notice of Intent (NOI) status. Furthermore, compliance schedules for BMP administration and monitoring regimes would be based on experience with the NPDES stormwater program (table 6).

- Small MS4 with approved NOI: revise and update its written stormwater management program (SWMP) document and submit it to EPA Region 6 within ___
- New small MS4 and MS4 that have not submitted a NOI: submit a NOI with proposed SWMP document for public comment and submit it to EPA Region 6 within_____
- Residual Designation Document (ROD)- Public Notice (Village of Tijeras, Sandia Labs??) within___
- Phase I (City of Albuquerque): revise and update its SWMP document and submit it to EPA Region 6 within _____
- Co-permittees of phase I permit: (UNM, TXDOT, AMAFCA) - Optional approach. Submit individual NOI or joint NOI with the City of ALB. within _____
- After two years of permit issuance: Opportunity to submit joint SWMP documents within ____ (OPTIONAL)

Table 6 Compliance schedule scenario (Smith, 2012)

It may be beneficial to couple the author's matrix category for 'administrative capacity' with a schedule based on NOI status. This would further individuate compliance schedules. The NOI based compliance schedule may not accurately represent MRG entities; this is primarily because the NPDES stormwater program is relatively new to the MRG area. Thus NOI status may not be a very significant factor in determining compliance schedules.

6.7 Sectors

It may be helpful to delineate sectors based on impact to designate the level of BMPs an entity must administer as was discussed during the planning process. BMPs fall under three categories of basic, advanced and enhanced strategies according to an entity's impact. However, beyond activity allocation under the MCMs, sectors may not be advantageous for entities. As previously mentioned, the sector demarcation seemed to group those with similar administrative capacity together. This would not necessarily assist in cost-sharing or credit trading.

If sectors are the chosen method by which to minimize the complexity of the WBP in the MRG region, alternative sector scenarios should be considered. An alternative for sectors would be a system based on *geography* rather than impact**.** This is a method that the EPA has already promoted. The EPA recommends basing SWMPs and other joint items according to geographic adjacency:

> "In the case of limited capabilities, the permittee can work with neighboring operators of regulated small MS4s, preferably on a watershed basis, to form a shared stormwater management program in which each permittee is responsible for activities that are within individual legal authorities and abilities" (EPA, 2000)

This recommendation would not void the impact algorithm. The impact algorithm is critical to determine the degree of BMP activity for each entity. If a sector system is

employed under the new permit, it would be more beneficial to base it on geographical relation for cost-sharing and credit trading scenarios.

A geographically-based sector system would prevent redundancy in administrative tasks such as monitoring and ordinance development. A geographically based sector demarcation would group entities together that are not as similar in administrative capacity and operational function within the watershed. Therefore, they would have a larger spectrum of resources and authority from which to work. In this case those sharing a joint-SWMP would be immediate neighbors, rather than a group of entities that may be at all ends of the watershed. Moreover, if entities are encouraged to cooperate with those other entities right beside them in the watershed, it may be easier to implement the watershed approach. This is mainly because political boundaries merge more readily on the landscape when they are on top of one another. This scenario would also assist in identifying where pollutants are originating in the watershed, because the physical adjacency would make it easier to trace the constituents between neighbors.

6.8 Construction and LID

Developing watershed-based ordinances for construction may be critical for implementing MCMs that focus on construction and post-construction runoff control. If a sector-system is applied, it may be easier to oversee and regulate multiple construction sites if sectors are based on geographic proximity. Again, this would allow for those entities with little to no administrative capacity to work alongside those that do.

In the MRG watershed there is a critical need to identify LID methods that are sensitive to the hydrologic and hydraulic conditions in the basin and the regulatory constraints associated with management of water resources in the arid environment of New Mexico.

6.9 Funding and community awareness

Involving the public is essential to a MS4 watershed-based permit. It is required under two of the six MCMS. Coordinating community awareness programs such as a "Run for the Watershed" event have been successful in other regions (Cherry Creek, 2008). This would address the needs for both funding and for applying BMP activities to the watershed. "Adopt a Watershed" programs have also been successful activities that promote both the awareness of watershed issues as well as the protection of watershed health. Depending on how the program is executed, a variety of benefits may ensue from adopting a watershed (Adopt a Watershed, 2012.).

These activities could be accomplished either through sub-watershed sectors or an overarching watershed group that develops programs for fundraising and volunteering events. As previously mentioned, an overarching watershed organization can act as treasurer and distributer of funds based on demonstrated needs of individual entities/sectors, as would be done under a credit-sharing system.

Available grants will also need to be accessed for the watershed-based permit. It is important to keep an active grant application process available for the entire watershed. This would include a database that lists all agencies that provide these grants, as well as

the process by which to apply for these grants. Some entities in the watershed have previous experience with applying for grants.

Conclusions

The EPA's strategy to transition from the general MS4 NPDES approach in the nation's urbanized areas, to a watershed-based approach was long overdue. This was evidenced by the NRC 2006 report, as well as statements made by EPA administrators that described the criticality of a watershed-based system to manage the nation's resources (EPA, 2002). It is difficult to speculate how a new approach to stormwater management will play out in the Middle Rio Grande Area. This is particularly because during the planning process for the watershed-based NPDES permit, this transition was not yet made public. The challenges, constraints and opportunities under the watershed-based stormwater permit may become much easier to comprehend once the permit is in place.

The EPA may not be familiar enough with the MRG area to effectively address all institutional, political, cultural, and environmental complexities that are inherent to the area. A watershed-based approach to stormwater management may further complicate governmental intersections and policy formulation. As discussed, there are state codes and federal laws that often conflict one another in the watershed. These conflicts have already created a 'water *quality* verses water *quantity*' paradox. The large geographic area of the watershed and the associated political landscape may be particularly challenging to a watershed-approach.

Furthermore, because the NPDES MS4 stormwater program was relatively new to the region, there were many unmet needs under established MS4 permits before the watershed pilot project was initiated. The permit may stretch resources even thinner. As discussed, LID technologies were not yet suitable for stormwater management in the arid southwest, which could result in even higher financial and environmental costs.

There were many strategies discussed during the planning process to combat this constraint along with other primary concerns such funding, compliance schedules and ordinance enforcement. Strategies brought forth at stakeholder meetings did not completely remedy voiced concerns. However, alternative approaches were discussed in this report that could potentially address foreseen challenges; some examples were delineating sub-watershed sectors based on geographic proximity rather than based on impact, employing a watershed-wide organization or utility to administer credit-trading and funding, and the formulation of overarching policies particularly for runoff control at construction sites. Public involvement was addressed as a major resource for the execution of a watershed-approach.

Since water quality is critical to human health, it is generally not difficult to emphasize in the public domain. This is an important aspect to consider, because the citizens of the Middle Rio Grande may be an important tool for implementing BMPs and for raising funds necessary to monitor the nation's waters. Public education and outreach may be the most straight-forward control measure to apply to the watershed in the beginning stages of permit execution. This was felt by most stakeholders as the easiest measure over which

to cooperate. This measure could also operate as a fundraising mechanism for the entire watershed, or sub-watershed sectors. If environmental issues are presented effectively, they are generally significant among the public. If the watershed stakeholders work together resourcefully, it is probable that citizens of the watershed will participate in activities that are directed under the permit.

Although interactions between the stakeholder group and citizens are a necessary aspect of the watershed-based stormwater permit, the need for political will is even more critical. The stakeholders that were involved in the planning process were not policy makers. Therefore they could not adequately defend their jurisdictions under a watershed-based NPDES stormwater permit. Moreover, during the writing of this report the political involvement in higher echelons was virtually non-existent. For the watershed-based approach to be employed successfully in the MRG, political will is necessary due to the regions complicated governmental framework.

Success of the MRG watershed-based pilot project can be measured through how well selected strategies are performed, such as the creation of joint-stormwater management plans; activity implementation and sharing of resources across the watershed; fundraising or shared funding mechanisms; legislative action; applied research for new LID technologies; and whether or not pollutants of concern have been reduced. A failure of the permit would be the lack of political will within governments; evidence of non-participation among specific entities; the lack of awareness about water quality among the citizen base; and negative environmental externalities that were not witnessed before

the establishment of the permit. An example of a negative externality would be environmental degradation downstream or within the watershed. These successes and failures may need to be measured through progress reports, data evaluation from monitoring sites and activity completion. In order to employ 'adaptive management' which is an aspect of the watershed-approach, consistent adjustments may need to be made to stormwater management plans.

If the Middle Rio Grande area stakeholder group and local policy makers aim to establish a leadership role in the implementation of a watershed-based stormwater permit in an arid climate, they must encourage a new environmental paradigm that stresses cooperation. If this fails to ensue, negative environmental externalities are expected to increase spending. That is, costs will rise if responsibility under the new permit is not distributed equitably, because both state and local agencies are responsible for water quality under the NPDES stormwater program.

If cooperation is not initiated, financial responsibility may fall into only a few hands. There is no single entity that is equipped to deal with that burden. This is a dilemma because funding was the largest concern among stakeholders during the planning process. The Middle Rio Grande region stakeholders and policy makers cannot afford to take a back seat to the federal agenda for watershed-based stormwater management.

Appendix A: Interview Questions

1.)Describe your existing storm water management programs. What is the approximate annual budget allocated to these programs? Do you have a SWMP? What is your opinion of the feasibility of implementing GI/LID concepts into your SWMP?

2.) How does your jurisdiction Rio Grande impact the Rio Grande? Are there any other major storm water quality issues that your jurisdiction faces?

3.) Are you familiar with the proposed watershed based permit? And have you participated in the planning meetings leading to development of a watershed based permit?

4.) What are some of the activities determined by the six control measures for a general MS4 are you currently practicing? and which (given a menu based approach and degree of your jurisdiction's impact) are you thinking about for the Watershed Based MS4? Who is the targeted audience for these new items? (e.g.. homeowners, industry operators, governments, school children?) Future funding and thoughts on cost sharing for new activities? And how would your jurisdiction feel about moving toward a region-wide stormwater utility? How would this function?

5.)Which permit requirements do you think could be done cooperatively and which could be done individually?

6.) What should be considered unique about your jurisdiction for the planning process and what is similar about your area to others that may help in adopting an MOU?

7.) As representatives from NMED and Ciudad Soil and Water Conservation District try to determine resource commitment from permittees, they are looking at the following factors (below). Which of these do you think are most important in developing a fair and equitable method of sharing the costs of a stormwater quality management program?

- Drainage area
- Slope
- Percentage of impervious cover
- Population density

8.) Are there any components we have not discussed that must be included in a watershed based stormwater permit to ensure its success in the Middle Rio Grande?

Appendix B: Interview summaries

Present stormwater management efforts

TOWN OF BERNALILLO
MS4 Phase II

- SWMP as verified by MS4 permit
- Employees delegated to stormwater management efforts: Water Department/division of Public Works. Only one building inspector to oversee runoff from commercial/construction sites.
- BMPs under six minimum control measures currently practicing:

– Public education and outreach:
There is public access to water quality reports and additional information about stormwater issues can be found on the Water Department website.
– Public participation/involvement:
There is a citizens' concerned hotline in place for illicit discharge and/or other stormwater concerns.
– Pollution prevention/good housekeeping:
Street sweeping

LOS RANCHOS DE ALBUQUERQUE
MS4 Phase II

- SWMP as verified by MS4 permit
- Employees delegated to stormwater management efforts: four trustees and mayor, code enforcement officer and the water quality board.
- There is a strong political will to make all residents comply with the ordinance that mandates connecting to sewer system.
- The town already practices LID.
- As an agricultural community, water is treated as a resource and maintains little to no runoff.
- BMPs under six minimum control measures currently practicing:

– Public education and outreach:
Village magazine 'Village Vision' is a medium by which Los Ranchos can educate the public.
– Public participation/ involvement:
The 'Village Vision' and website are in place to bring awareness and thereby prompt involvement among citizens.
– Construction and post-construction site runoff control:
There is an existing ordinance for commercial developments to practice GI/LID. They are required to discharge at pre-developed rates; generally there are retention ponds on-site. These sites are also required to submit a grading and drainage plan. One engineer

generates the plan and a second engineer validates it. There is no tolerance to non-compliance with these plans. TAFT FIELD: underground retention system.

– Pollution Prevention/good housekeeping:

The Alameda drain has only 5cfs of outfall during the largest storm event. This outfall is cleaned by an interceptor before it reaches the river. Existing funding is allocated out of maintenance budget for cleaning.

VILLAGE OF TIJERAS
No MS4 permit

- No current SWMP in place
- There is no budget allocated for stormwater management efforts.
- 2 out of the 12 village employees are designated for water system/maintenance.
- The village just started work on a Waste Water or Sanitary Sewer System and will have nine (possibly 10) residences connected within the next few months (1/19/2012).
- There is political will to record existing BMPs and to participate in what is required to create a SWMP for the watershed-based stormwater permit.

SOUTHERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY (SSCAFCA)
MS4 Phase II

- SWMP as verified by MS4 permit
- SSCAFCA and Rio Rancho public works employees are dedicated to storm water efforts.
- SCAFCA receives funding in the form of general obligation bonds that come from a tax levy through the state on a 13 year cycle.
- All new development for arroyos has to be designed so that historic flow is met.
- GI/LID is incorporated into all new developments.
- Large water quality facilities/elements such as the Sportsplex: a dam with retention pond and trash racks.
- SSCAFCA is a member of the Middle Rio Grande stormwater Quality team.
- There is a water harvesting guide is distributed to promote harvesting on individual lots.
- SSCAFCA is actively looking for options/solutions so that they can continue to work efficiently and effectively with neighbors under the new watershed permit.

BERNALILLO COUNTY
MS4 Phase II

- SWMP as verified by MS4 permit
- Planning and municipal development is managed through an active water resources program.
- Under the newest Notice of Intent (NOI) submission a new position was created to administer stormwater quality.

- Four staff members in public works dedicated to maintenance that clean and fix drains, also puts markers "drains to river" on inlets.
- Street sweeping and street maintenance is done by the roads department.
- Solid waste department is responsible for Managing complaints on illicit dumping.
- Parks and recreation monitor fertilizer and pesticide application on their grounds.
- There is one administrative employee for Bernalillo County to administer stormwater quality efforts.
- Bernalillo County is a member of the Middle Rio Grande Stormwater Quality Team.
- BMPs under six minimum control measures Bernalillo county is currently practicing (for all BMPs please see Bernalillo County's current NPDES SWMP):

– Public Education and outreach:

Bernalillo county works in conjunction with the city of ABQ, SSCAFCA, AMAFCA, UNM and DOT on the Stormwater Quality Team efforts for Public Education and outreach (see city of ABQ's BMPs for examples).

– Public participation/involvement:

The county has held training sessions for BMPs that are aimed at the construction industry and also has hosted a booth at the local xeriscape conference on stormwater quality issues.

– Pollution prevention/housekeeping:

The county seeks to reduce the number of households using septic tanks, thus decreasing the possibility for pollutants from defective systems to impact storm water. There have been utilities projects through the Public Works Division (PWD) and the Technical Services Department (TSD) that involved the construction of infrastructure so that the Valley residents have access to sewer and public drinking water supply. The Parks and Recreation Department (PRD) are responsible for sections of mixed use land and open space- PRD implements BMPs to control what enters the stormwater system by reducing runoff and controlling pollution.

– Illicit discharge detection and elimination:

The water resources program developed a systems-wide map to assist in the detection of illicit discharges from unregulated sources into the storm drain system.

– Construction and post-site construction runoff control:

GI/LID ordinance has created certain requirements and incentives for water harvesting- in collaboration with *Sites Southwest.* Zoning, Building and Planning Department BMPs promote cluster developments and encourage developers to reduce the amount of impervious cover that is used during and after construction.

UNIVERSITY OF NEW MEXICO (UNM)

MS4 Phase I

- SWMP as verified by MS4 permit
- Two employees are dedicated to stormwater management.
- GI/LID already incorporated into construction on campus:

-underground cisterns for collecting stormwater

-above and below ground retention sites

- Water quality inlets are in compliance with MS4 guidelines.
- UNM is a member of the Middle Rio Grande Stormwater Quality Team.

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT) DISTRICT 3
MS4 phase I

- SWMP as verified by MS4 permit (Albuquerque co-permittee).
- There is a small budget for stormwater management efforts.
- There are two dedicated positions for stormwater management, only one is fulfilled at this point.
- The NPDES manual is utilized as a stormwater management plan mostly for construction purposes.
- DOT is a member of the Middle Rio Grande Stormwater Quality Team
- BMPs under six minimum control measures currently practicing (for a complete list look at Albuquerque's Phase I MS4 permit):

– Public education and outreach:

There are pamphlets distributed by the Stormwater Quality Team located in NMDOT district 3 office. They include "Scoop the poop", "Help reduce stormwaters pollution," and "Your yard can mess up the river".

– Pollution Prevention/housekeeping:

There is street cleaning and maintenance.

– Illicit discharge detection and elimination:

There is regular monitoring of DOT property for.

– Construction and post- construction site runoff control:

DOT is in the process of revamping the NPDES manual for GI/LID concepts.

DEPARTMENT OF ENERGY (DOE)/ SANDIA NATIONAL LABS
No MS4 permit

- Stormwater management program is verified through the Industrial Multi-sector General Permit (MSGP).
- ISO 1401* industrial use international standards are in place by federal mandate.
- There are numerous construction Stormwater pollution prevention plans. (SWPPPs).
- There are three employees dedicated to the administration of stormwater management.
- The infrastructure program maintains stormwater sewer system and field workers monitor the program.
- There is a federal budget in place for the stormwater system and construction projects.
- There are many sub-contractors, so it is difficult to identify figures for a budget.
- DOE has a lot of incentives for contractors. They have several LEED silver buildings; there is an executive order in place for GI for anything above 5,000ft^2.
- Required to monitor two main discharges under the MSGP into the Tijeras Arroyo.
- BMPs under six minimum control measures have never been required, however the following are currently being practiced:

– Public education and outreach:

There is a workforce in place that administers this criterion.

– Illicit Discharge and Elimination:

The MSGP are the overarching control mechanism for detecting and eliminating illicit discharge

– Construction and post construction-site runoff control:

Industrial stormwater inspections are made every quarter. There is a visual inspection report required.

KIRTLAND AIRFORCE BASE (KAFB)
MS4 Phase II/MSGP

- SWMP/SWPPP verified by MS4 and MSGP permits.
- MSGP covers maintenance, sampling and reports.
- KAFB samples at 5 locations. All locations require visual monitoring. 2/5 outfalls require analytical monitoring.
- KAFB is heavily regulated by federal government; everything the MSGP does not cover the MS4 covers.
- KAFB is regulated by several different agencies that eliminate pollutants from their source to the maximum extent possible. There are many analytical procedures that KAFB uses to monitor things outside of the MS4 mandate.
- In 2011 KAFB won an excellence award for wastewater management program from the Albuquerque Bernalillo County Water Utility Authority.
- All building projects must meet silver standard LEED criteria.
- BMPs under six minimum control measures currently practiced:

– Public education and outreach:

There are two kiosk centers that have educational posters related to stormwater. At the Kirtland family housing area this information is distributed to housing residents and to children at Earth Day events. There is a newspaper that distributes articles on good housekeeping and pollution prevention. Developers receive EPA furnished documents to guide activities to prevent stormwater runoff. There are also grounds- keeping documents that educate about the use of herbicide and pesticides.

– Public participation/involvement:

Earth Day events.

– Pollution prevention/good housekeeping:

There is a 'Newcomers' Package that is distributed to mainly military personnel which contains a document that guides the maintenance of vehicles so that they do not pollute the grounds. There is also a guidance manual distributed to those who wish to hold charity carwashes.

– Illicit discharge detection and elimination:

The MSGP is the overarching control mechanism for detecting and eliminating illicit discharge.

– Construction and post- construction site runoff control:

KAFB has active Construction General Permit (CGP) oversight. Any Land-use proposal has to go through the National Environmental Policy Act (NEPA). KAFB provides meetings to give guidance on how to go through SWPPP before NOI is filed. There is supervision of construction sites from the stage of groundbreaking activities until

stabilization. If a project is under an acre it Is not subject to MS4 criteria, but KAFB still requires them to have good housekeeping measures. If a project that has <5,000 ft^2 of impervious surface it is required to have 95% if retention of stormwater to mimic predevelopment release/discharge. If there is any project that is >than 5,000 ft^2 they need to hold water at 95% of predevelopment rates. KAFB is effectively doing this by implementing Energy Independence and Security Act of 2007 (EISA 438.)

THE CITY OF ALBUQUERQUE
MS4 Phase I

- SWPM as verified by MS4 Phase I (renewed in 2012).
- There are two main Department of Municipal Development (DMD) employees dedicated to stormwater management efforts: a civil engineer for infrastructure design and a district manager for stormwater quality.
- Funding is from tax revenue on a two year General Obligation bond cycle.
- There is unofficial encouragement for developers to implement GI/LID.
- BMPs under six minimum control measures currently practiced:

– Public education/outreach:

Grade school educational programs through the Middle Rio Grande Storm Water Quality Team (MRGSWQT); the city of ABQ is partners with SSCAFCA, AMAFCA, UNM, DOT and Bernalillo County in this effort. The City uses funding through MRGSWQT for the "River Exchange". The River Exchange is a program of 15 classes where people go out and teach all aspects of hydrology. BEMP: There is a budget in place for UNM biology students to take grade school children to the Rio Grande to participate in water quality monitoring. The city distributes brochures to animal shelters educating about pet waste. The city runs a media campaign during monsoon season that educates about stormwater quality. AMAFCA participates in the state fair parade and distributes information about the arroyo system and stormwater pollution.

– Public participation/involvement:

The city works with organizations like New Mexico Wilderness Alliance, Amigos Bravos, the Sierra Club, and Food and Water Watch on public events such as film festivals like ""It's All About Water — Films and Conversation". These film festivals are held to spark action among ABQ citizens over water issues. Information distributed at these types of events can then be distributed at neighborhood association meetings.

– Pollution prevention/good housekeeping:

Measures that are attained in conjunction with AMAFCA, UNM and NMDOT that focus on the proper disposal of waste in the MS4, such as sediments, floatables, and dredge spoil. New flood management projects are assessed for impacts on water quality.

– Illicit discharge detection and elimination:

ordinances or regulatory mechanism in place to prohibit non-stormwater discharges into the stormwater system. Inspections are required of suspected severe illicit discharges within 48 hours. A large portion of their budget goes to the several monitoring sites that are currently utilized for the detection of TMDLs.

– Construction and post-construction site runoff control:

The city inspectors look at city sites and check for SWPPPs. The "NPDES Stormwater Management Guidelines for Construction and Industrial Activities Handbook" is consistent with effluent limitation guidelines. There is unofficial encouragement of GI/LID features such as permeable paving in new developments.

ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY (AMAF CA)
MS4 Phase I

- SWMP as verified by MS4 Phase I.
- AMAFCA is a member of the MRGSWQT
- They are incorporating GI/LID into new and old arroyo infrastructure/retrofit projects such as the Hahn Arroyo project.
- BMPs under six minimum control measures currently practiced (for complete list please refer to AMAFCA's SWMP)

– Public education/outreach:
In conjunction with the MRGSWQT AMAFCA participates in 'scoop the poop' partnerships and 'Keep the Rio Grande' partnerships (brochure distribution, etc).

– Public participation/involvement:
AMAFCA has finished projects such as the North Diversion Channel Embayment Project, the Hahn Arroyo project and others that have included interagency partnerships. The Hahn Arroyo project has indirectly involved the public through signage along the arroyo that is heavily utilized by bikers and passer bys. AMAFCA, in conjunction with the MRGSWQT has also participated in media campaigns that have reached thousands of people.

– Pollution prevention/good housekeeping:
Through coordination with the MRGSWQT and the MCMs, pollution prevention is attained through public education. Projects such as those mentioned above were specific to pollution prevention. The AMAFCA owned arroyos are maintained and retrofitted as necessary.

– Illicit discharge detection and elimination:
AMAFCA is in partnership with the City of Albuquerque, NMDOT and UNM to detect and illuminate illicit discharge including dry weather screening and monitoring.

– Construction and post-construction site runoff control:
Arroyos owned by AMAFCA are primarily established, however where retrofitting projects are needed for runoff control, such as the Hahn Arroyo Project, measures are taken to accomplish those needs. Runoff control measures are regularly in progress, such as retrofitting by adding dams, debris catchments and baffle systems.

Unique aspects of individual entities:

TOWN OF BERNALILLO

- Flat landscape-little slope
- Drains west into SSCAFCA
- Only one sewer that goes to river-side drain

- No curbside drains/no pipes

LOS RANCHOS DE ALBUQUERQUE

- Primarily agricultural land
- Landscape is bowl shape, so that it naturally holds and infiltrates water into the ground
- No stormwater conveyance/drainage system
- No curbside drains
- Only one sewer drain near 4th street that is the outfall of a 6,000' sewer system: the only outflow in 100 year storm event is 5cfs
- Most landscaping is gravel not concrete

VILLAGE OF TIJERAS

- Village is 1.13 square miles or 723 acres
- Probably the steepest slope of participating entities in the watershed-based stormwater permit, BUT farthest from the Rio Grande
- No existing stormwater infrastructure what-so-ever that drains into any water body of the U.S.
- Tijeras Arroyo is of consequence for the watershed–based permit
- No commercial or building space available for development

SSCAFCA

- A conveyance system, not a municipality
- Dual handling before and after AMAFCA and ESCAFCA
- Two major outfalls into the Rio Grande
- Geography is cross-jurisdictional
- Straight with impervious and permeable surfaces
- No population per se

BERNALILLLO COUNTY

- 5 outfalls to the Rio Grande
- Small impact because land-use is a blend between urban and rural
- In some ways it functions a lot like a city with infrastructure, but also holds a lot of vacant land that does not have storm drains
- Those who own land where there are no storm drains often dig ponds to prevent flooding and runoff
- One of the few jurisdictions that has a water resources program

UNM

- Smallest of all entities (a little over 600 acres)
- UNM has both transient and residential populations
- No industrial exposures

NMDOT

- The highway/road system acts like a through way for stormwaters.
- NMDOT has only transient populations.
- NMDOT is primarily impervious.

DOE /SANDIA NATIONAL LABS

- Their land is leased from the federal government so they are essential stewards of land that is not their own.
- There is no population outside of urbanized area.
- It is difficult to get samples from the area because some areas do not receive enough volume of rainwater.
- They lease a lot of land from the Forest Service and KAFB. The land however is used as if it is owned by DOE-they build on it-this is coordinated through NEPA.
- There are both remote/pristine and industrial/impervious areas.
- The largest slopes are on pristine land that is being used by no industry or any other disturbing force.
- There is one large industrial user.

KAFB

- 7,000 acres of developed urbanized area (including industry).
- 43,000 acres of desert and mountains that is undeveloped.
- 2 outfalls for the MS4 that dump into Albuquerque's phase I MS4.
- A part of their impervious surface coverage is a runway that they share with the city of Albuquerque.
- Some of their land is leased to DOE/Sandia National Labs.
- Tijeras Arroyo runs through KAFB and discharges via MS4 through way.
- There is an abandoned Albuquerque landfill upstream of this arroyo that may contribute to pollutants in the Arroyo.

CITY OF ALBUQUERQUE

- The CABQ is the largest entity in geographic area.
- They have the largest population and population density.
- Under the new watershed-based permit they are the "the elephant in the room," because they are under the most scrutiny by the EPA and have the largest array of stormwater management responsibilities.
- The city is already working with AMAFCA on stormwater quality issues.
- They work in conjunction with the USGS on stormwater quality monitoring.
- There are many pathways for pollution to come into the city. This pollution sometimes originates outside the city.

AMAFCA

- AMAFCA owns the largest channels and largest dams in the Albuquerque area.
- The arroyo system acts as a conveyor of stormwaters.

- Their primary obligation is to life and property by controlling flood waters. Stormwater quality has always been second to this.

Current challenges and uncertainties for existing stormwater management efforts

TOWN OF BERNALILLO

- No effective system/team to oversee active construction sites.
- Measures 5 and 6 of the minimum control measures need more attention.
- No additional funding in place to comply with potential mandates under new watershed-based permit.

LOS RANCHOS DE ALBUQUERQUE

- There has always been a division between technical staff and elected officials.
- There is a need to amend the LID/GI ordinance to further adhere to any likely regulations under a watershed-based permit.

VILLAGE OF TIJERAS

- Funding is major concern now for the village.
- Not enough man power for stormwater management efforts.

SSCAFCA

- SSCAFCA has limited authority unless discharging into a city.
- SSCAFCA has cross-jurisdictional relationships and physical boundaries.

BERNALILLO COUNTY

- Jurisdictional overlap- the roads act as a conveyance system through the county and NMDOT is responsible for some of them (313 and 528) - this may cause conflict when administering rules and regulations.
- Impact fees have been waived for new developments- due to economy- this is inconsequential to developers because costs get passed onto buyers.
- Incentive for property owners to incorporate GI/LID into their plans is low.
- Building codes in place have more to do with energy than anything else which may contribute to the neglect of stormwater management.
- Conveyance systems built for flood control carry shallow waters quickly through the county. These waters are penetrated by the unrelenting sun contributing to thermal pollution that in turn can be a factor of bacteria growth (such as *e-coli*). These are some examples of factors not taken into account when national standards were set for TMDLs in the east where the climate and stormwater management and/or conveyance systems are significantly different.

UNM

- UNM is under the Phase I MS4, unlike most Universities that are designated as "non-traditional" small MS4s: 40 CFR §122.26(b)(16)(iii) . This may hold the University to stricter guidelines than are appropriate.
- Costs continue to go up for phase I MS4s. This is particularly true for monitoring PCBs which is $1,000 per each analysis.
- Although there is no industrial exposure there is no exemption for this.
- UNM is constrained by available space, so GI/LID for stormwater becomes more expensive (many GI/LID designs require extra space).

NMDOT

- NMDOT currently has only two dedicated positions to stormwater management and one of these positions is vacant.
- Current NPDES manual is not heavy on LI/GID concepts.

DOE/ SANDIA NATIONAL LABS

- Lack of staff for outreach and education, however they do not have a population so who would they educate aside from the employees?
- Difficult to get data/compare data across jurisdictions, often it is incongruent with another entity's sample.
- The Forest Service is not currently involved, yet they lease land from them.
- LEED codes are primarily focused on energy, not stormwater.

CITY OF ALBUQUERQUE

- Currently, it is sometimes difficult to cooperate with only 4 intersecting entities under MS4 phase I.
- Monitoring is extremely costly.
- There is only one staff person that deals with the entire MS4 phase I permit for the city.
- Lack of documentation and annual reports-no cohesive SWMP.
- No efficient funding mechanism for stormwater efforts.
- There are not enough regulations in place for GI/LID stormwater features.
- It is difficult to get developers to comply with existing regulations, often construction begins before SWPPP is completed and reviewed.

AMAFCA

- No concerns over current operations and/or administration were stressed during the interview.

Concerns about administrative inefficiencies under the watershed-based permit

TOWN OF BERNALILLO

- How to enforce BMPs

- No current requirement for septic tanks to go into sewer system. If new ordinances mandate this connection there will be controversy because many residences are too far from utilities to make this a financially practical.
- Funding: property taxes may not be best mechanism, than what mechanism will there be available?
- Location of testing sites for pollutants is very important to determine where pollutants are entering the watershed.
- Placitas is upstream and may contribute to pollutants found in Bernalillo, but are not involved in watershed-based MS4.
- There may be potential conflicts with the Office of the State Engineer (OSE): water rights (holding water for more than 96 hours in case of stormwater retention pond).
- How will responsibility be delegated for TMDLs?
- Currently DOT maintains highways 550 and 528, but contends that it is not responsible for any runoff from I-25.
- Public school acreage contributes to a large portion of runoff but has no legally mandated responsibility for stormwater runoff.
- Runoff from reservation and forest lands meets roads and flows onto private property. Therefore pollutants from this runoff are difficult to monitor and they may contribute to TMDLs.
- Overflow from retention ponds may go into MRGCD ditches. The MRGCD is not currently involved in the watershed-based stormwater permit.

LOS RANCHOS DE ALBUQUERQUE

- What funding mechanism will be in place for meeting any potential criteria under the new watershed-based stormwater permit? Of special concern are costly mandates such as additional TMDL testing.
- Gross receipts tax is very small: most general fund revenue goes to Albuquerque; therefore these monies are not as available for smaller communities. These communities may be in greater need of funding because they do not currently have stormwater infrastructure in place.
- Cost sharing: if enacted who will oversee this process, so that one entity is not utilizing the majority of available funding?
- Equitable sharing of available resources to meet all minimum control measures is a concern.
- The role of the MRGCD is important because their acequias encase the village and are direct conduits to the Rio Grande.
- Testing sites that adequately show water quality as it enters and as it leaves the village is critical to determine pollutants that the village is responsible for.
- What funding will be in place for training new/current employees on inspecting construction sites?
- The bird population is very large in the village since the Rio Grande is a natural flyway. This may be a cause of *e-coli* which is on the list of TMDL pollutants. An administration cannot control this aspect of the habitat.

VILLAGE OF TIJERAS

- There is no budget for testing and monitoring, infrastructure or employment.
- They feel that they need to play with others when it comes to funding or at least held to a more flexible compliance schedule for BMPs.

SSCAFCA

- There may be a struggle to fit into a relevant ranking without identifying the dual representation of a flood control authority that deals with quantity, but also with quality of storm water.
- Geography is an issue for funding and determining impact because it is cross-jurisdictional.
- All factors that determine an entity's impact on the Rio Grande -slope, population density, impervious surface coverage, and drainage area- could be considered ambiguous for SSCAFCA.
- SSCAFCA has no enforcement capabilities- so they cannot issue violations through ordinances. This may be burdensome under the new permit that has stricter mandates.

BERNALILLO COUNTY

- Aspects of slope, population density, impervious surface coverage, and area will be hard to measure in a meaningful way for the county. Slope is particularly difficult to quantify; maybe slope should be a multiplier for the other aspects.
- GI/LID are possible but will not be easy because there is little data on BMPs for arid regions. How will these systems work here and how will they be incorporated alongside concerns with flood control? Often the measures of quantity and quality control are fundamentally conflicting in nature.

-Velocity of stormwaters once they enter the system may not allow for the same type of GI/LID BMPs found in the east.

- In many cases there is no solution to TMDL constituents, because temperature, flow, and other naturally/man -made phenomena has much to do with their growth.
- There may be a conflict with the State Engineer if they decide to interfere with holding water in retention ponds (water rights and the 96 hr rule.)

NMDOT

- If requirements are forced they may be unfunded, whereas many roadway projects are currently funded.
- Funding for new employees may be an issue.
- Population density and drainage area are hard to quantify for NMDOT. I-25 collects all of the drainage area. What would area be measured? Would drainage area be all of right of ways or all of the intersections?
- A lot of agencies have different power of government, so it may be a challenge to adopt an MOU.

DOE/SANDIA NATIONAL LABS

- Sediment is the main TMDL issue, but it is difficult to manage.
- If there are new mandates, the funding they already have in place may be burdened by cost sharing and in effect lessen their stormwater management efforts.
- How does a federal agency cooperate with other groups? What mechanisms will enable this?
- There are systems in place already that need to be maintained as they are stewards of federal land.
- Cross-jurisdictional data has already been difficult to cross-analyze.
- How will the pristine Forest Service lands be taken into account when determining impact?
- Who is monitoring the Rio Grande?
- Cost sharing may be an administrative nightmare-if you already do your own monitoring, why would you be required to pay into a pool?
- There is no residential impact.
- There is a need for a data pool, to clarify where pollutants are and where they go.
- Will there be an overarching entity that manages the new permit?
- What is practical for compliance with BMPs?
- How will an annual report be put together?
- Whose responsibility is a database and executive summary for the entire watershed?
- Presentations need to be given to upper management about the new watershed-based permit.

CITY OF ALBUQUERQUE

- Public Involvement as a BMP requirement has been difficult in the past.
- There are only two existing staff members that deal with the current MS4.
- There is a need for funding to hire more staff, implementation of BMPs, and for the potential increase in monitoring requirements.
- Sediment and other 303(d) pollutants that contribute to TMDLs in the Rio Grande are, to some extent, naturally occurring. Standards are often set in the east; the MRG is a different type of water body in a different climate.
- Potential conflicts with the Office of the State Engineer and LID/GI aspects, especially in drought years.
- Potential conflicts with the NM Ground Water Quality Bureau.
- The permit process needs to be easier for GI/LID.
- More ordinances/regulations need to be implemented across the board for stormwater quality,
- Cooperation may be difficult among the entities.
- Determining population density will be difficult, however it is very important to determine the allocation of cost responsibility under the new permit.
- How will a watershed-partner that is not complying with MCMs be addressed?
- The uniqueness of NM in general (cultural, politics, physiographical) may make administering a watershed-based stormwater permit especially difficult, compared to that of other regions.

Cross-analysis of interviews

Shared physical aspects among entities

- Town of Bernalillo, Village of Corrales, and Los Ranchos De Albuquerque are all designed to hold water either by way of natural landscapes or through land-use agricultural practices.
- Albuquerque, NMDOT and the flood control agencies (AMAFCA, ESCAFCA, SSCAFCA) were all designed to shed water as quickly as possible.
- Bernalillo County and Sandoval County are both blends of urban and rural land-uses.
- Bernalillo County and DOE/Sandia both have mixtures of pristine and impervious land.
- Flood control authorities, UNM, Sandia/DOE, and DOT, all have transient populations.
- Corrales, Tijeras, the town of Bernalillo, and the flood control authorities do not have pipes.
- Rio Rancho, the City of Albuquerque, Bernalillo County, and the flood control authorities all have outfalls that go directly into the waters of the US.

Shared administrative capacity among entities

- All entities (aside from tribes) were created by state statute.
- Public limitations and benefits are similar among most entities.
- There is an overarching will to cooperate and develop MOU/MOA.
- Stormwater management efforts are sometimes ambiguous and hard to define for those who have had no experience with NPDES MS4 permits.
- Some entities are bound together through organizations such as the MRG Stormwater Quality Team and Ciudad Soil and Water Conservation District.

Shared concerns among entities

- **Funding** is the single largest concern among stakeholders.
- There is both political and geographic overlap among entities.
- Cooperation among federal and non-federal entities is a concern (tribal vs. municipality, what if pollution is coming from tribal lands?).
- Runoff of pollutants contributing to TMDLs may come from outside the watershed boundaries.
- How will testing be administered to find the origin of pollutants?
- If an entity is already monitoring, why should they pay into a pool for monitoring elsewhere as may occur in a cost-sharing situation?
- Public schools contribute to a large portion of impervious surface coverage. These institutions are not currently regulated.
- Birds are international commerce and contribute to a large portion of *e-coli* bacteria. How is an administration expected to control this?
- Stormwater runs off of Pueblo lands within and outside of regulated areas. How will this be managed?

- Stormwater runs off of lands owned by the National Forest Service that will not be regulated by the new watershed –based permit. This is especially a concern for the Department of Energy (and Sandia Lab counterpart) because they lease forest lands. These lands are considered pristine and will not be directly regulated through the Forest Service by the new watershed-based permit.
- Runoff from these lands (forest and Pueblos) is a concern for any entity receiving this water via roadways, especially those without curbside drains. In this case water goes directly onto private property and cannot be regulated.
- Stormwater runs off of DOT roads onto adjacent lands. How will this situation be monitored or managed?
- Where will testing sites be located that adequately represent each entities contribution to TMDL pollutants?
- Potential conflicts with the Office of the State Engineer and LID/GI aspects, especially in drought years.
- How will LID/GI aspects be enforced if they are mandated by the EPA rulemaking? Especially since LEED is mainly focused on energy points, not water quality.
- Potential conflicts with the NM Ground Water Quality Bureau.
- Cost sharing program: will one exist? Will there be a regional entity/utility that oversees the process so that monetary resources are distributed fairly.
- TMDLs: Some pollutants are impossible to control.
- What funding will be in place for training new/current employees on inspecting construction sites?
- Enforcement capabilities are a concern for those entities that do not now have the authority to create ordinances.
- There is a connection between air quality and stormwater management, which is more important to the EPA? How are these connections defined? One of the pollutants the Rio Grande is impaired for are PCBs, these are often air contaminants before they are rained onto land surfaces. This may be important if both are EPA mandated issues-monitoring may be very costly.
- How does the EPA define a watershed?
- How does the EPA justify the proper management of a watershed in the Watershed Restoration and Action Strategy (WRAS) for the Middle Rio Grande? How does the management of stormwater under a new watershed-based stormwater permit fit into this strategy?
- Does the expansion of the urbanized area also include an expansion of the definition of "Waters of the US" according to the EPA? Moreover does this definition extend beyond the Rio Grande to a much broader definition including arroyos, creeks and streams within the watershed area?
- What entity will monitor the River in general?

Shared perceptions about the watershed-based MS4 permit among entities

- Incentive for GI/LID building is energy central. Specific building incentives are generally not focused on stormwater and runoff control.
- Construction and post construction site runoff control may be difficult to implement and manage if not all entities are following suit.

- Compliance schedules need to be established for those entities who have no experience with MS4 permits or stormwater management, or those who are lacking funding or infrastructure necessary to comply with permit guidelines.
- Historical data collection is important so that a more cohesive understanding of how the condition (impaired) of the watershed was realized. The contribution to TMDL pollutants each entity has discharged and how these discharges have changed over time is important to address this issue more effectively.
- Pinpointing the origins of these pollutants is critical for the new watershed-based permit to be effective.
- Ordinances are an important tool to get the public to comply with permit obligations.
- BMPs that should be done cooperatively include those that effect construction, such as related ordinances and SWPPPs for construction sites. This is to ensure that development spreads evenly throughout watershed and that all sites are following GI/LID guidelines set forth by EPA rulemaking measures under the new permit.
- Public Education and Public Participation/Involvement are considered to be the easiest BMPs to cooperate on. 91% of participating entities agree that regional educational programs that are relative to each entity, and to the watershed as a whole, should be done cooperatively. The remaining 9% feel that cooperative educational programs will only be beneficial if they are done extremely well and this is a hard task considering the uniqueness of all entities.
- Among all entities, media is considered a successful tool to educate the public these avenues include, but not limited to: radio, television and internet.
- The MRG Stormwater quality team has been a tool for participating entities in accomplishing BMPs.
- There needs to be an overarching utility that deals with administration of the watershed-based permit.
- Monitoring is costly and should be done cooperatively.

Unique perceptions about the watershed-based MS4 permit

- Power of persuasion over developers (I-Hop in Bernalillo has impervious surfaces in parking lot due to a simple suggestion from building inspector).
- Philosophy-paradigm that relates to improving the environment needs to be established.
- There are existing relationships between entities that should be utilized for a watershed based stormwater permit. These relationships have generally been formed around geographic adjacency. These relationships may be especially important when determining cost-sharing and responsibility allocated to the BMPs under the new permit. These relationships are an alternative rendition of 'sectors' that have been based on MS4 permit phases or experience with stormwater management thus far.
- Investigation into 'economies of scale' or 'learning by doing' on a watershed basis is an appropriate concept for this pilot project to aid in cost-sharing.
- Trade-credit methods (tit-for-tat) have been discussed as an appropriate cost sharing technique to help in the functionality and cost of BMPs over a larger geographic area with a multitude of separate jurisdictions.

Appendix C: Paired comparison method

In table 3, numbers are only associated with the first four categories to give an example of how the 'paired comparison method' evaluates the given characteristics. The number of times some characteristic is selected (circled) is then divided by the number of boxes (55 boxes total). This gives the weighting for each characteristic.

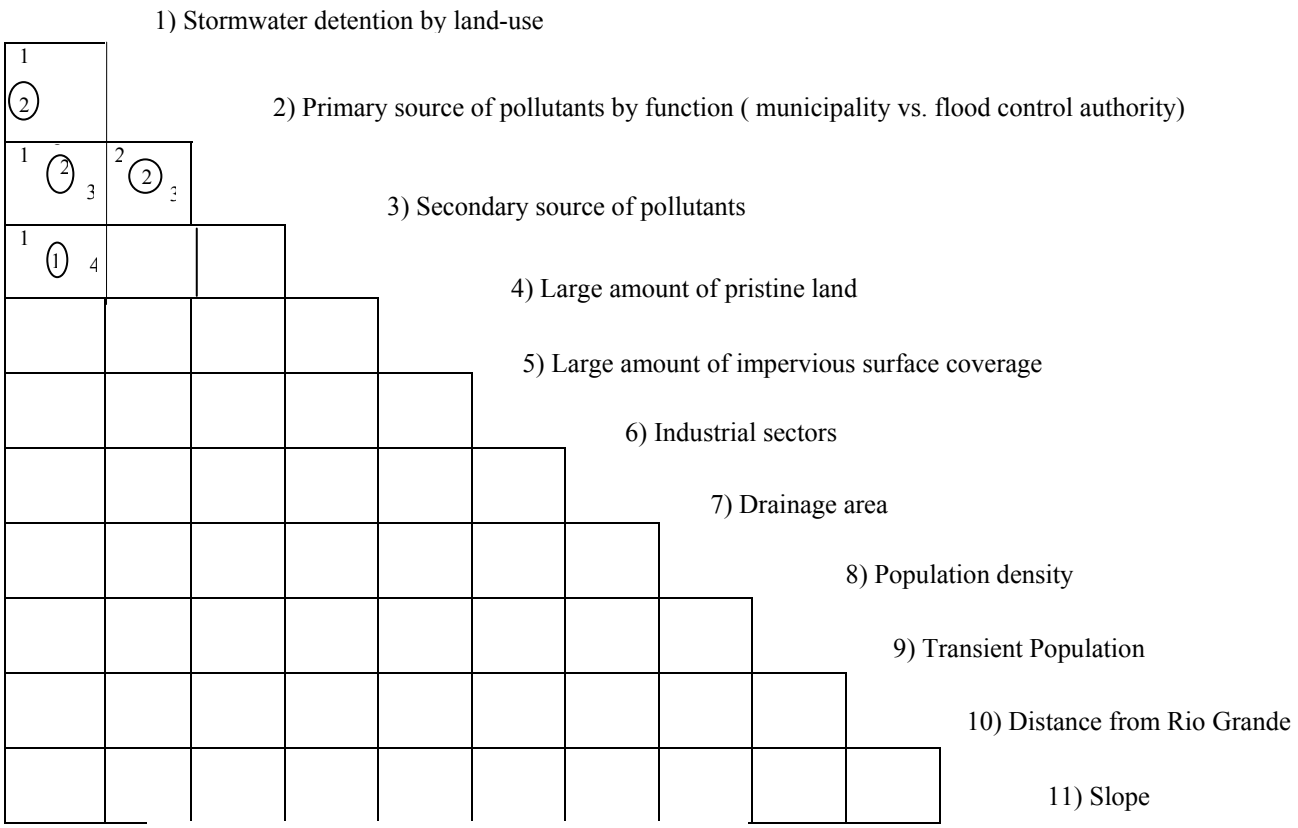

Table 3: Paired comparison method

Appendix D: Definitions

Definitions

applied to the watershed-based stormwater permit

Agricultural exemption: 40 CFR 122.26 states that agricultural stormwater runoff is exempted from the definition of point -source pollutant described at sections 122.2 and 122.3 of 40 CFR, which require permits for discharges of stormwater.

First flush: Initial runoff from a storm that is usually highly contaminated with pollutants that have accumulated on the land surface since the last storm event.

TMDL: Total Maximum Daily Load A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet WQ standards. Specifically, the TMDL consists of wasteload allocations (WLAs) for point sources; load allocations (LAs) for nonpoint sources; and a margin-of-safety; the TMDL also addresses seasonality. EPA outlined its requirements for how TMDLs should address municipal Phase I and Phase II stormwater discharges in a policy memorandum (Nemura and Powers, 2006).

Urbanization: the concentration of human populations into distinct areas, owing to transformation of land-use. Land-use is Specified by the EPA (2012) for residential, commercial, industrial & transportation purposes and these areas can include densely populated centers, as well as their "adjacent periurban or suburban fringes". Urbanized areas can be quantified in many different ways. The EPA's (2012) example definitions used to classify areas as "urban" or "developed" include:

1.) Core areas with population density ≥ 1,000 people per square mile**,** plus surrounding areas with population density ≥ 500 people per square miles according to the 2000 U.S. Census Bureau.

2.) Areas characterized by ≥ 30% constructed materials, such as asphalt, concrete, and buildings using the USGS National Land Cover Dataset.

Watershed: the area that drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer, or even the ocean.

Waters of the U.S.(40 CFR 122.2):

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands;"

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purposes;(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Note: the **MRGCD's** tributaries are adjacent to the Rio Grande and so are considered "tributaries of waters" (e) of the U.S. under the EPA's definition. Thus the EPA also considers the MRGCD tributaries "Waters of the U.S" for the Middle Rio Grande watershed-based pilot project.

303 (d) list: This is a list of impaired waters in each state that is reported to the EPA every 2 years under section 303(d) of the Clean Water Act. Where pollution controls are not adequate to maintain water quality standards, the development of TMDLs is made for the impaired body of water based on the pollution and use of the waters. A plan is then created by the state to ensure TMDLs are met no longer than 13 years of the listing.

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In table 3,numbers are only associated with the first four categories to give an example of how the ‘paired comparison method’ evaluates the given characteristics.

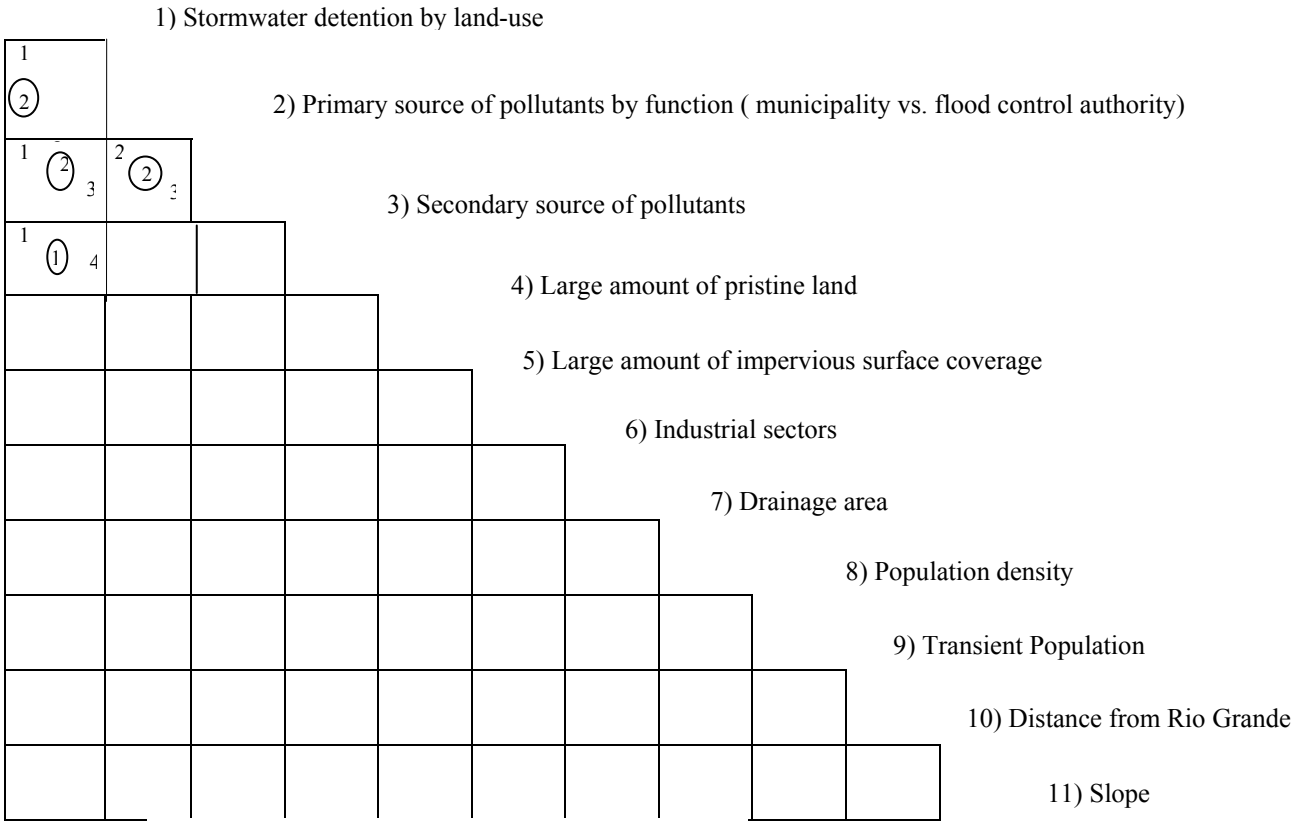

Table 3: Paired comparison method