USEPA-APPROVED

TOTAL MAXIMUM DAILY LOAD (TMDL)

FOR THE

MAIN STEM OF THE LOWER RIO GRANDE
(FROM THE INTERNATIONAL BOUNDARY WITH MEXICO TO ELEPHANT BUTTE DAM)

June 11, 2007

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LIST OF ABBREVIATIONS

4Q3	4-Day, 3-year low-flow frequency
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cms	Cubic meters per second
CWA	Clean Water Act
^oC	Degrees Celcius
^oF	Degrees Farenheit
DOD	Department of Defense
FR	Forest Road
GIS	Geographic Information Systems
GPS	Global Positioning System
HUC	Hydrologic unit code
IBWC	International Boundary and Water Commission
LA	Load allocation
lbs/day	Pounds per Day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
mm	Millimeters
MOS	Margin of safety
MOU	Memoranda of Understanding
MS4	Municipal Separate Storm Sewer System
MSGP	Multi Sector General Storm Water Permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SWPPP	Storm Water Pollution Prevention Plan
SWQB	Surface Water Quality Bureau
TMDL	Total maximum daily load
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through February 16, 2006)
WRAS	Watershed Restoration Action Strategy
WWTP	Waste water treatment plant

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL identifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 Code of Federal Regulations Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources and background conditions, and include a Margin of Safety (MOS).

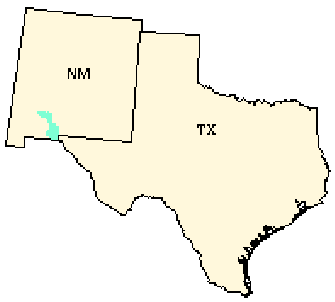
The Lower Rio Grande watershed is located in south-central New Mexico. The Surface Water Quality Bureau (SWQB) conducted an intensive surface water quality survey of the Lower Rio Grande basin in 2004. Water quality monitoring stations were located throughout the Lower Rio Grande watershed during the intensive watershed survey to evaluate the impact of tributary streams and ambient water quality conditions. As a result of assessing data generated during this monitoring effort, combined with data from outside sources that met SWQB quality assurance requirements, impairment determinations of New Mexico water quality standards for *E. coli* were documented for Rio Grande (International Mexico Boundary to Leasburg Dam) and Rio Grande (Leasburg Dam to Percha Dam). This TMDL document addresses the above noted impairments as summarized in the tables below.

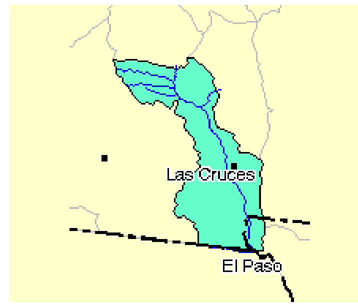
A number of assessment units could not be assessed in this document due to insufficient data. These impairments will remain on the Clean Water Act Integrated §303(d)/§305(b) List of Assessed Surface Waters until additional data are available. Furthermore, assessment units whose designated uses are not existing or attainable and those that will be de-listed are detailed in this document.

Additional water quality data will be collected by the SWQB during the standard rotational period for intensive stream surveys. As a result, targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate category on the Clean Water Act Integrated §303(d)/§305(b) List of Assessed Surface Waters.

The SWQB's Watershed Protection Section has and will continue to work with Lower Rio Grande watershed groups to finalize the Watershed Restoration Action Strategies (WRAS) in order to develop and implement strategies to attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the WRAS will be done with participation of all interested and affected parties.

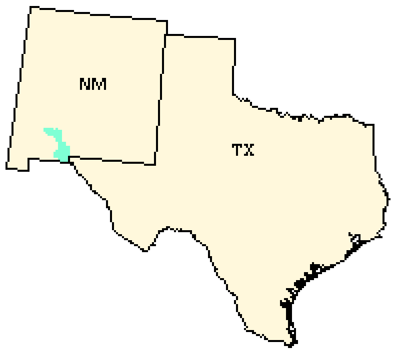
TOTAL MAXIMUM DAILY LOAD FOR BACTERIA
RIO GRANDE (INTERNATIONAL MEXICO BOUNDARY TO LEASBURG DAM)

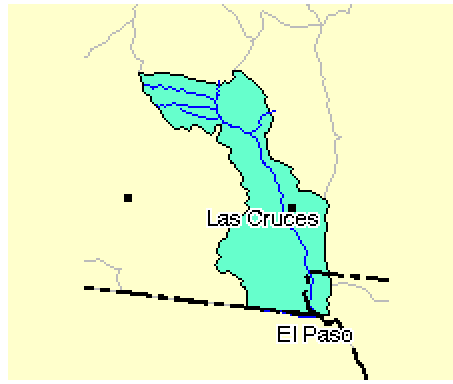




New Mexico Standards Segment	20.6.4.101
Waterbody Identifier	NM-2101_00
Segment Length	62.68 mi.
Parameters of Concern	Bacteria
Uses Affected	Secondary Contact
Geographic Location	El Paso – Las Cruces USGS Hydrologic Unit Code 13030102
Scope/size of Watershed	29,267 mi^2
Land Type	Chihuahuan Deserts Ecoregion (24)
Land Use/Cover	Rangeland (82%), Forest (12%), Agriculture (2%), Barren (2%), Riparian (1%), and Urban (<1%)
Probable Sources	Impervious Surface/Parking Lot Runoff; Municipal (urbanized high density areas); Municipal Point Source Discharges; On-site Treatment Systems (septic systems and similar decentralized systems); Permitted Runoff from Confined Animal Feeding Operations (CAFOs); Rangeland Grazing; Wastes from Pets; Waterfowl; Wildlife other than Waterfowl
Land Management	BLM (35%), Private (32%), USFS (18%), State (12%), Bureau of Reclamation (2%), and Department of Defense (<1%)
Priority Ranking	5/5C
TMDL for *E. coli:*	**TMDL = WLA + LA + MOS**
High Flow Conditions	**$4.11 \times 10^{12} = 1.28 \times 10^{11} + 3.32 \times 10^{12} + 6.64 \times 10^{11}$**
Moist Flow Conditions	**$2.55 \times 10^{12} = 9.79 \times 10^{10} + 1.83 \times 10^{12} + 6.20 \times 10^{11}$**
Mid-Range Flow Conditions	**$1.52 \times 10^{12} = 7.85 \times 10^{10} + 8.84 \times 10^{11} + 5.52 \times 10^{11}$**
Dry Flow Conditions	**$4.10 \times 10^{11} = 6.29 \times 10^{10} + 1.19 \times 10^{11} + 2.28 \times 10^{11}$**
Low Flow Conditions	**$8.64 \times 10^{10} = 6.05 \times 10^{10} + 2.03 \times 10^{10} + 4.25 \times 10^{9}$**

TOTAL MAXIMUM DAILY LOAD FOR BACTERIA RIO GRANDE (LEASBURG DAM TO PERCHA DAM)





New Mexico Standards Segment	20.6.4.101
Waterbody Identifier	NM-2101_10
Segment Length	44.35 mi.
Parameters of Concern	Bacteria
Uses Affected	Secondary Contact
Geographic Location	El Paso – Las Cruces USGS Hydrologic Unit Code 13030102
Scope/size of Watershed	29,267 mi^2
Land Type	Chihuahuan Deserts Ecoregion (24)
Land Use/Cover	Rangeland (82%), Forest (12%), Agriculture (2%), Barren (2%), Riparian (1%), and Urban (<1%)
Probable Sources	Impervious Surface/Parking Lot Runoff; Municipal Point Source Discharges; On-site Treatment Systems (Septic Systems and Similar Decentralized Systems);; Rangeland Grazing; Wastes from Pets; Waterfowl; Wildlife other than Waterfowl
Land Management	BLM (35%), Private (32%), USFS (18%), State (12%), Bureau of Reclamation (2%), and Department of Defense (<1%)
Priority Ranking	2
TMDL for *E. coli*: *Mid-Range Flow Conditions*	**TMDL = WLA + LA + MOS** **3.03×10^{12} = 2.39×10^{9} + 1.05×10^{12} + 1.98×10^{12}**

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1.0 INTRODUCTION

Under Section 303 of the Clean Water Act (CWA), states establish water quality standards, which are submitted and subject to the approval of the U.S. Environmental Protection Agency (USEPA). Under Section 303(d)(1) of the CWA, states are required to develop a list of waters within a state that are impaired and establish a total maximum daily load (TMDL) for each pollutant. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standard including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA 1999). A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources and natural background conditions, and include a margin of safety (MOS). This document provides TMDLs for assessment units within the Lower Rio Grande watershed that have been determined to be impaired based on a comparison of measured concentrations and conditions with water quality criteria and numeric translators for narrative standards.

This document is divided into several sections. Section 2.0 provides background information on the location and history of the Lower Rio Grande watershed, provides applicable water quality standards for the assessment units addressed in this document, and briefly discusses the intensive water quality survey that was conducted in the Lower Rio Grande watershed in 2004. Section 3.0 provides detailed descriptions of the individual watersheds for which TMDLs were developed. Section 4.0 presents the TMDLs developed for bacteria in the Lower Rio Grande watershed. Pursuant to Section 106(e)(1) of the Federal CWA. Section 5.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 6.0 discusses implementation of TMDLs (phase two) and the relationship between TMDLs and Watershed Restoration Action Strategies (WRAS). Section 7.0 discusses assurance, Section 8.0 public participation in the TMDL process, and Section 9.0 provides references.

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2.0 LOWER RIO GRANDE BACKGROUND

The Lower Rio Grande Basin was intensively sampled by the Surface Water Quality Bureau (SWQB) from February to November 2004 and is addressed in this document. The Lower Rio Grande Basin includes perennial reaches of the Lower Rio Grande from the International Boundary with Mexico to Elephant Butte Dam, as well as tributaries that enter the Lower Rio Grande along those perennial reaches. Surface water quality monitoring stations were selected to characterize water quality of the stream reaches. Assessment units that will have a TMDL prepared in this document are discussed in their respective individual watershed sections. A number of assessment units could not be assessed due to insufficient data. These impairments will remain on the CWA Integrated §303(d)/§305(b) list of waters until additional data are available.

2.1 Location Description

The Rio Grande originates in the San Juan Mountains of southern Colorado and follows a 1,885-mile course before it flows into the Gulf of Mexico. Along the way, the river and its tributaries drain a land area of 182,200 square miles. This drainage encompasses a widely varied landscape in the United States and Mexico, including mountains, forests, and deserts. The basin is home to diverse native plants and wildlife as well as some 10 million people. For approximately two-thirds of its course, the river also serves as the boundary between the United States and Mexico.

The Lower Rio Grande watershed (US Geological Survey [USGS] Hydrologic Unit Codes [HUCs] 13030102 and 13030101) is located in Doña Ana, Sierra, and Socorro Counties in south-central New Mexico (NM). This survey included the geographic area draining into the portion of the Rio Grande located from Elephant Butte Dam to the New Mexico-Texas Border and the International Boundary with Mexico. At this point, the Rio Grande drains approximately 29,267 square miles (mi^2). Twenty-two water quality sites were sampled during this survey (Figures 2.1 through 2.3). Table 2.1 details location descriptions of sampling stations in each assessment unit (AU), station numbers, STORET identification codes, the current listings on the Integrated CWA §303(d)/§305(b) Report, and the associated water quality segment number. The reader should bear in mind that these are the listings for the Lower Rio Grande Watershed prior to the survey. Landscapes range from forested mountains to desert grasslands to vegetated riparian zones. As presented in Figure 2.1, land use is approximately 82% rangeland, 12% forest, 2% agriculture, 2% barren, 1% riparian, and 1% urban. Figure 2.2 shows land ownership as 35% Bureau of Land Management (BLM), 32% private, 18% US Forest Service (USFS), 12% State, 2% Bureau of Reclamation, and 1% Department of Defense.

Several species within this watershed are listed as either threatened or endangered by both State and Federal agencies. Federally listed endangered species include the Rio Grande silvery minnow (*Hybognathus amarus*), northern aplomado falcon (*Falco femoralis septentrionalis*), and southwestern willow flycatcher (*Empidonax traillii extimus*). Federally listed threatened species include the Mexican spotted owl (*Strix occidentalis lucida*). Additional species listed by the State as endangered include the common ground dove (*Columbina passerine pallescens*), interior least tern (*Sterna antillarum athalassos*), and desert bighorn sheep (*Ovis Canadensis mexicana*). Additional species listed by the State as threatened include the neotropic cormorant (*Phalacrocorax brasilianus*), common black-hawk (*Buteogallus anthracinus anthracinus*), Lucifer hummingbird (*Calothorax lucifer*), Costa's hummingbird (*Calypte costae*), broad-billed hummingbird (*Cynanthus laitrostris*), Bell's vireo (*Vireo bellii*), gray vireo (*Vireo vicinior*), Baird's sparrow (*Ammodramus bairdii*), varied bunting (*Passerina versicolor*), spotted bat (*Euderma maculatum*), and the Doña Ana talussnail (*Sonorella todseni*).

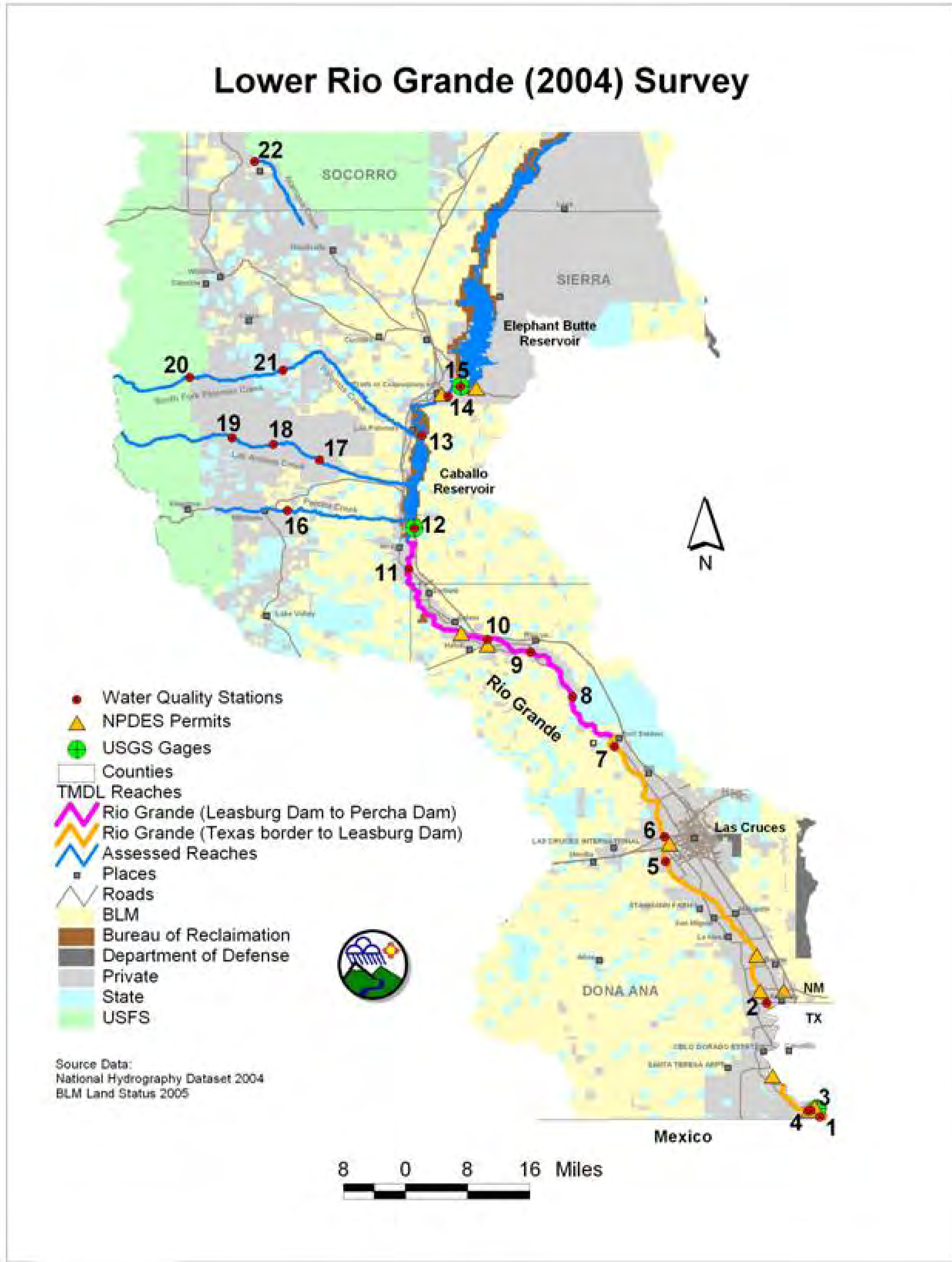
In this mostly arid to semiarid region, the absence of flow in the river as well as the presence of flow determines the basin's character. Two-thirds of the annual precipitation (7.8 inches) is packed into the late summer and early fall (La Mar 1984). Many of the river tributaries are intermittent streams and much of the flow is controlled by numerous reservoirs in the basin. Throughout the basin, an extensive system of water structures captures and controls the flow of water in the subbasins to meet regional needs for flood control, power generation, and storage for domestic, agricultural, and industrial purposes. Ranching and irrigated agriculture is a major component of the economy in the basin. The Lower Rio Grande offers a 247-day growing season where temperatures can soar to 111 degrees Fahrenheit (°F) and plummet to –16 °F. The various state parks and reservoirs located along the river support activities such as hiking, mountain biking, camping, and fishing as well as water skiing and other recreational sports.

Table 2.1 Summary of Assessment Units and Associated Sampling Stations

Assessment Unit	Station No.	STORET Code	Sampling Station	2004-2006 Integrated List	WQS (July 2005) reference
Rio Grande (International boundary with Mexico to Leasburg Dam)	1	42RGrand000.5	Rio Grande below Sunland Park	Fecal Coliform	20.6.4.101
	2	42RGrand001.1	Rio Grande at NM-225 Bridge near Anthony, NM		
	3	42RGrand004.1	Rio Grande at Bridge below Sunland Park		
	4	42RGrand004.7	Rio Grande above Sunland Park WWTF outfall		
	5	42RGrand038.7	Rio Grande at Bridge near La Mesilla		
	6	42RGrand044.2	Rio Grande at Picacho Ave. in Las Cruces		
	7	42RGrand084.8	Rio Grande below Leasburg Dam, NM		
Rio Grande (Leasburg Dam to Percha Dam)	8	42RGrand101.2	Rio Grande above Rincon Drain, near Rincon, NM	---	20.6.4.101
	9	42RGrand115.0	Rio Grande near Rincon at NM 140		
	10	42RGrand124.0	Rio Grande near Hatch at NM 26		
	11	42RGrand149.5	Rio Grande near Derry, NM		
Rio Grande (Percha Dam to Caballo Res.)	12	42RGrand160.3	Rio Grande below Caballo Dam, NM	---	20.6.4.102
Rio Grande (Caballo Res. to Elephant Butte Dam)	13	41RGrand184.1	Rio Grande above Caballo Reservoir	---	20.6.4.103
	14	41RGrand201.0	Rio Grande below Cuchillo Negro		
	15	41RGrand204.5	Rio Grande below E.Butte Dam at USGS Gage		
Percha Creek (Perennial reaches Caballo R to M Fork)	16	41Percha025.3	Percha Creek at Percha Box	Sedimentation/ Siltation	20.6.4.103
Las Animas Creek (perennial portion R Grande to headwaters)	17	41LAnima018.6	Las Animas Creek at Rd Crossing	---	20.6.4.103
	18	41LAnima029.3	Las Animas Creek above box		
	19	41LAnima038.3	Las Animas Creek near Dunn		
Palomas Creek (perennial portion R Grande to headwaters)	20	41SPalom019.1	South Fork Palomas Creek near Hermosa	---	20.6.4.103
	21	41Paloma036.7	South Fork Palomas Creek above North Fork		
Alamosa Creek (Perennial reaches abv Monticello diversion)	22	40Alamos058.5	Alamosa Creek below USGS Gage 8360000	Sedimentation/ Siltation	20.6.4.103

Figure 2.1 Lower Rio Grande Watershed Land Use and 2004 Sampling Stations

Figure 2.2 Lower Rio Grande Watershed Land Ownership



2.2 History and Geology

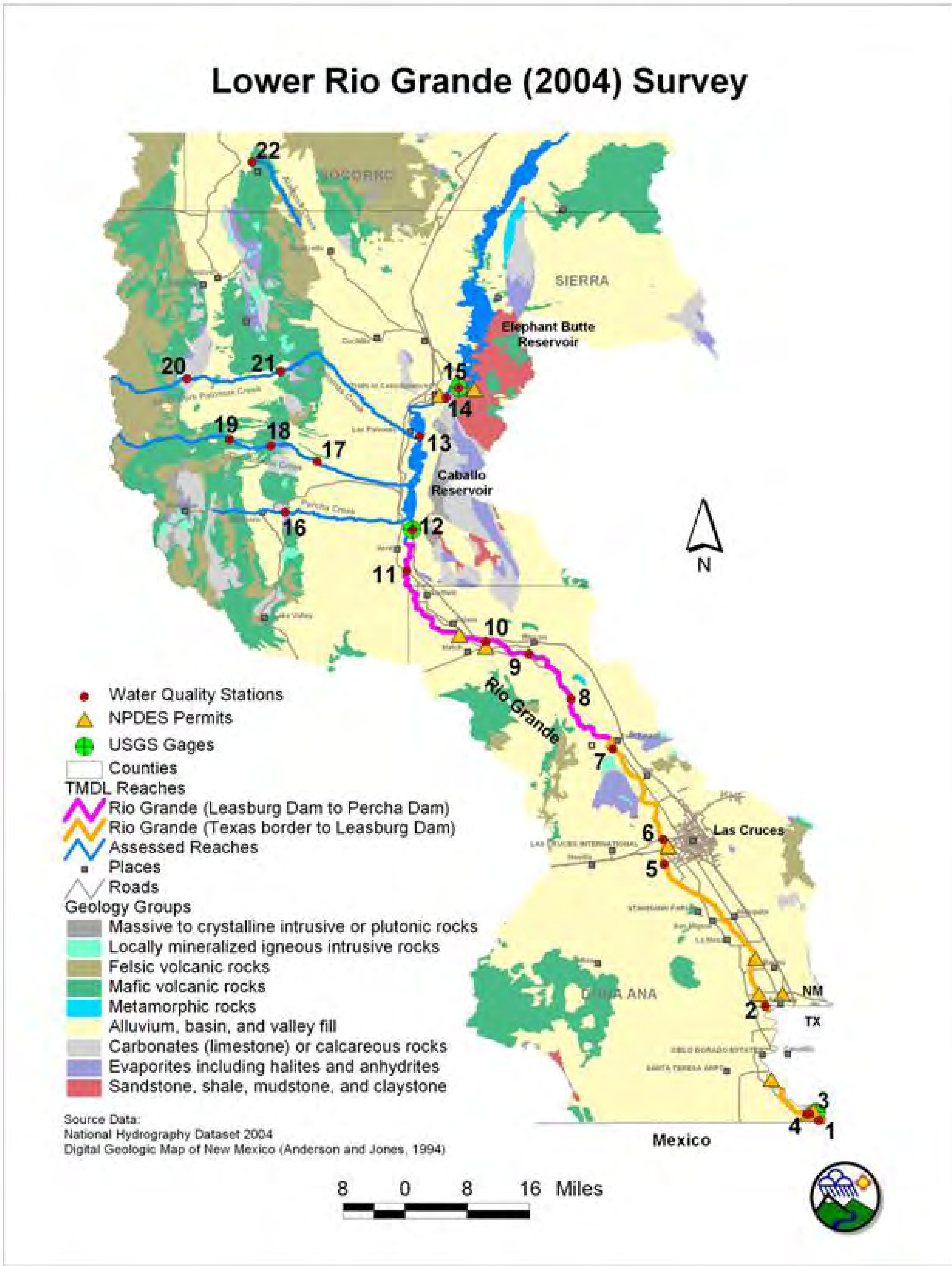
The Spanish Empire's *entradas* for colonization and conversion first made their way up the Rio Grande led by explorer Alvar Nuñez Cabeza de Vaca in 1536. Wandering inland in search of the mythic "Seven Cities of Cibola," Cabeza de Vaca and his band never found gold, but they did uncover an unexpected surprise. The conquistadors and priests found Pueblo Indians irrigating and cultivating almost 30,000 acres of maize, beans, and calabashes. The Spanish arrival instigated a hundred year test of wills between the Europeans and the Pueblos. At the beginning of the seventeenth century, a mission established by fathers at El Paso del Norte (modern Juarez, Mexico) began schooling the Indians in more advanced methods of growing crops, aided by water provided by the Acequia Madre (Main Canal). In 1680, an Indian revolt drove the Spanish and Christianized Indians south from New Mexico to present-day Juarez, Mexico and Yselta, Texas. Don Diego de Vargas began the reconquest of New Mexico twelve years later and the Spanish influence over the Rio Grande was cemented into place (Autobee 1994).

In the following 150 years, up to 40,000 acres of land were tilled along the river. Around 1890, extensive settlement and irrigation development in southern Colorado, in addition to that which had already taken place in central New Mexico, depleted the normal summer flow of the Rio Grande, causing the river to be dry at El Paso for more frequent and longer periods. To resolve this issue, Elephant Butte Dam and Reservoir and its companion structure, Caballo Dam and Reservoir, were constructed and started storing water for irrigation purposes as early as 1916.

Historic and current land uses in the watershed include agriculture, recreation, and municipal related activities (Las Cruces, El Paso). Much of the land ownership adjacent to the river is private with the exception of state parks near Elephant Butte Lake, Caballo Lake, Percha Dam, and Leasburg Dam. The Bureau of Land Management and the State of New Mexico also own and manage sizable tracts of public lands in the upland portions of the watershed. The Lower Rio Grande watershed is located in Omernick Level III Ecoregion 24 (the Chihuahuan Deserts) contained within Aggregate Ecoregion 3 (the Xeric West). The elevation range for the various sampling sites in the survey was 3720' to 4500'.

The surrounding geology was shaped by the Rio Grande Rift system. The Rio Grande Rift system is a series of grabens (fault-bounded basins) that extend from central Colorado southward through New Mexico and into western Texas and Mexico. Continental rifting was associated with crustal stretching and uplift of the southwestern United States. Grabens dropped down thousands of meters relative to adjacent uplifts, and alluvial sediment accumulated to great thickness in the basins. Intrusions and volcanic eruptions also took place within the rift valleys and throughout the surrounding region.

Figure 2.3 Lower Rio Grande Watershed Geology



2.3 Water Quality Standards

General standards and standards applicable to attainable or designated uses for portions of the Lower Rio Grande watershed that were surveyed in this study are set forth in sections 20.6.4.13, 20.6.4.97, 20.6.4.98, 20.6.4.99, and 20.6.4.900 of the Standards for Interstate and Intrastate Surface Waters (NMAC 2006). Segment specific standards for the Lower Rio Grande watershed are set forth in sections 20.6.4.101, 20.6.4.102, and 20.6.4.103 and read as follows:

20.6.4.101 RIO GRANDE BASIN - The main stem of the Rio Grande from the international boundary with Mexico upstream to one mile below Percha dam.

A. Designated Uses: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and secondary contact.
B. Criteria:
(1) In any single sample: pH: within the range of 6.6 to 9.0 and temperature 34°C (93.2°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL (see Subsection B of 20.6.4.14 NMAC).
(3) At mean monthly flows above 350 cfs, the monthly average concentration for: TDS 2,000 mg/L or less, sulfate 500 mg/L or less and chlorides 400 mg/L or less.
C. Remarks: Sustained flow in the Rio Grande below Caballo reservoir is dependent on release from Caballo reservoir during the irrigation season; at other times of the year, there may be little or no flow. [20.6.4.101 NMAC - Rp 20 NMAC 6.1.2101, 10-12-00; A, 12-15-01; A, 05-23-05]

20.6.4.102 RIO GRANDE BASIN - The main stem of the Rio Grande from one mile below Percha dam upstream to Caballo dam.

A. Designated Uses: irrigation, livestock watering, wildlife habitat, primary contact and warmwater aquatic life.
B. Criteria:
(1) At any sampling site: pH within the range of 6.6 to 9.0 and temperature 32.2°C (90°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 235 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).
C. Remarks: Sustained flow in the Rio Grande below Caballo reservoir is dependent on release from Caballo reservoir during the irrigation season; at other times of the year, there may be little or no flow. [20.6.4.102 NMAC - Rp 20 NMAC 6.1.2102, 10-12-00; A, 05-23-05]

20.6.4.103 RIO GRANDE BASIN - The main stem of the Rio Grande from the headwaters of Caballo reservoir upstream to Elephant Butte dam and perennial reaches of tributaries to the Rio Grande in Sierra and Socorro counties.

A. Designated Uses: fish culture, irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, secondary contact and warmwater aquatic life.
B. Criteria:
(1) In any single sample: pH within the range of 6.6 to 9.0 and temperature 25°C (77°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of E. coli bacteria 548 cfu/100 mL or less, single sample 2507 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).
C. Remarks: Flow in this reach of the Rio Grande main stem is dependent upon release from Elephant Butte dam. [20.6.4.103 NMAC - Rp 20 NMAC 6.1.2103, 10-12-00; A, 05-23-05]

The New Mexico Environment Department (NMED) proposed several modifications to the New Mexico WQS during the February 2004 triennial review hearing. Changes that will potentially affect the Lower Rio Grande watershed are:

- Changing the criteria related to contact uses from fecal coliform to *E. coli* (monthly geometric mean of 126 colony forming units (cfu)/100 mL or less in 20.6.4.101 and 20.6.4.102, monthly geometric mean of 548 cfu/100 mL in 20.6.4.103; single sample 410 cfu/100 mL in 20.6.4.101, single sample 235 cfu/100 mL in 20.6.4.102, and single sample 2507 cfu/100 mL in 20.6.4.103).

The State of New Mexico Water Quality Control Commission (WQCC) adopted the proposed WQS changes as of July 17, 2005.

2.4 Intensive Water Quality Sampling

The Lower Rio Grande watershed was intensively sampled by the SWQB in 2004. A brief summary of the survey and the hydrologic conditions during the intensive sample period is provided in the following subsections.

2.4.1 Survey Design

The Monitoring and Assessment Section of the SWQB conducted an intensive water quality survey of the Lower Rio Grande watershed between February 24, 2004 and November 18, 2004. Sample events were conducted to capture different portions of the hydrograph and were designed to coincide with the significant cyclical flow events of the river's historic flow regime (Fig. 2.4). The survey included the geographic area draining into a portion of the Rio Grande located from Elephant Butte Dam to the New Mexico-Texas Border and the International Boundary with Mexico. At this point, the Rio Grande drains approximately 29,267 mi^2. Water quality was studied to characterize the streams and determine impairment. Water samples were analyzed for nutrients, ions, total and dissolved metals, and on a more limited basis bacteria, radionuclides, and anthropogenic organic compounds. In addition, field parameters such as dissolved oxygen, pH, and temperature were measured using a YSI multi-parameter Sonde. Water and sediment samples were collected on a limited basis from select sites and were tested for ambient toxicity.

Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches and reservoirs) throughout the basin (Figures 2.1 through 2.3). The stations were generally sampled 8-10 times, with one site being sampled only once and two other sites associated with the SWQB Elephant Butte 104(b)(3) Study being sampled 24 times. Monitoring these stations enabled an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream of the stations (i.e. irrigation, storage, and diversion of Rio Grande waters). Data results from grab sampling are housed in the SWQB provisional water quality database and will be uploaded to USEPA's Storage and Retrieval (STORET) database. A draft version of the water quality survey report is available for this study (NMED/SWQB 2006a).

All temperature and chemical/physical sampling and assessment techniques are detailed in the *Quality Assurance Project Plan* (QAPP, NMED/SWQB 2004b) and the SWQB Assessment Protocols (NMED/SWQB 2006b). As a result of the 2004 monitoring effort and subsequent assessment of results, several surface water impairments were determined.

2.4.2 Hydrologic Conditions

Streamflow in the Lower Rio Grande is controlled largely by releases from Elephant Butte Reservoir. As Figure 2.4 demonstrates, flows in Lower Rio Grande (USGS Gage 08361000) during the 2004 survey year were below average based on the period of record, except for March (spring snowmelt), July (summer monsoons), and a brief peak in August (also summer monsoons). As stated in the Assessment Protocol (NMED/SWQB 2006b), data collected during all flow conditions, including low flow conditions (i.e. flows below the 4-day, 3-year low-flow frequency [4Q3]), will be used to determine designated use attainment status during the assessment process. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

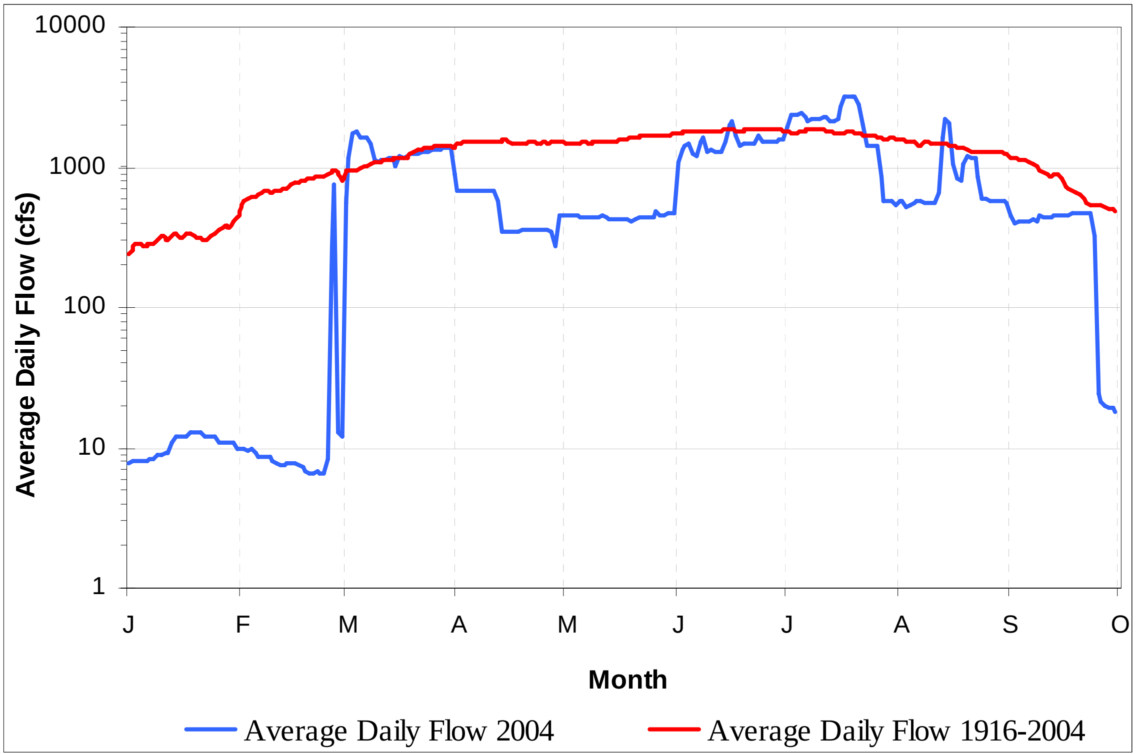


Figure 2.4 Streamflow at Rio Grande below Elephant Butte Dam (USGS Gage 08361000)

Two stream gaging stations were used to calculate the TMDLs presented in this document. The gage locations are presented in Figures 2.1 through 2.3. Flows from IBWC Gage 08364000 (Rio Grande at El Paso) were used to calculate the critical flows for the Rio Grande (International Mexico Boundary to Leasburg Dam). Average daily flows for the Rio Grande at El Paso are presented graphically in Figure 2.5. The moving average is shown as the bright pink line. As the graph depicts, there is a considerable decrease in the moving average between October 2003 and October 2004 indicating below average flow during the SWQB intensive survey.

Flows from USGS Gage 08362500 (Rio Grande below Caballo Dam) were used to calculate the critical flow for the Rio Grande (Leasburg Dam to Percha Dam). Average daily flows for the Rio Grande below Caballo Dam are presented graphically in Figure 2.6. The moving average is shown as the bright pink line. Similar to the Rio Grande at El Paso, there is a considerable decrease in the moving average between October 2003 and October 2004.

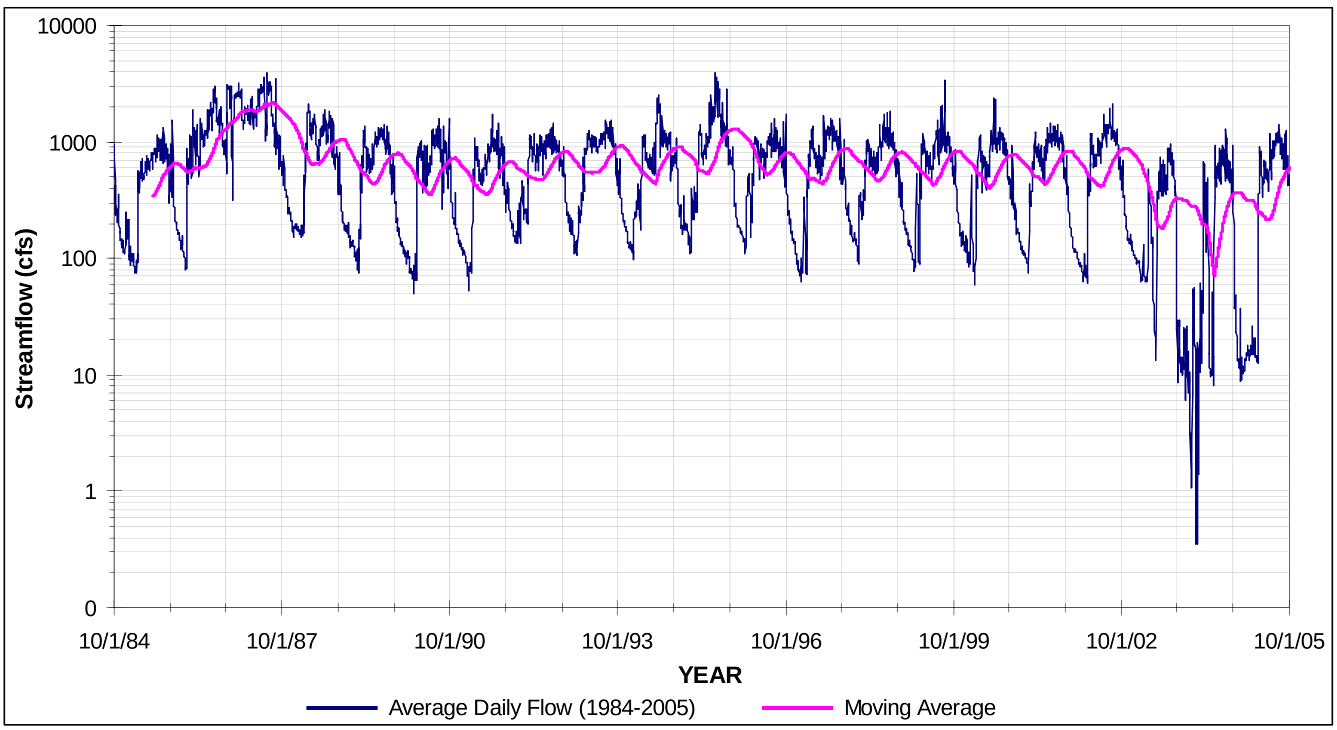


Figure 2.5 Streamflow at Rio Grande at El Paso (IBWC Gage 08364000)

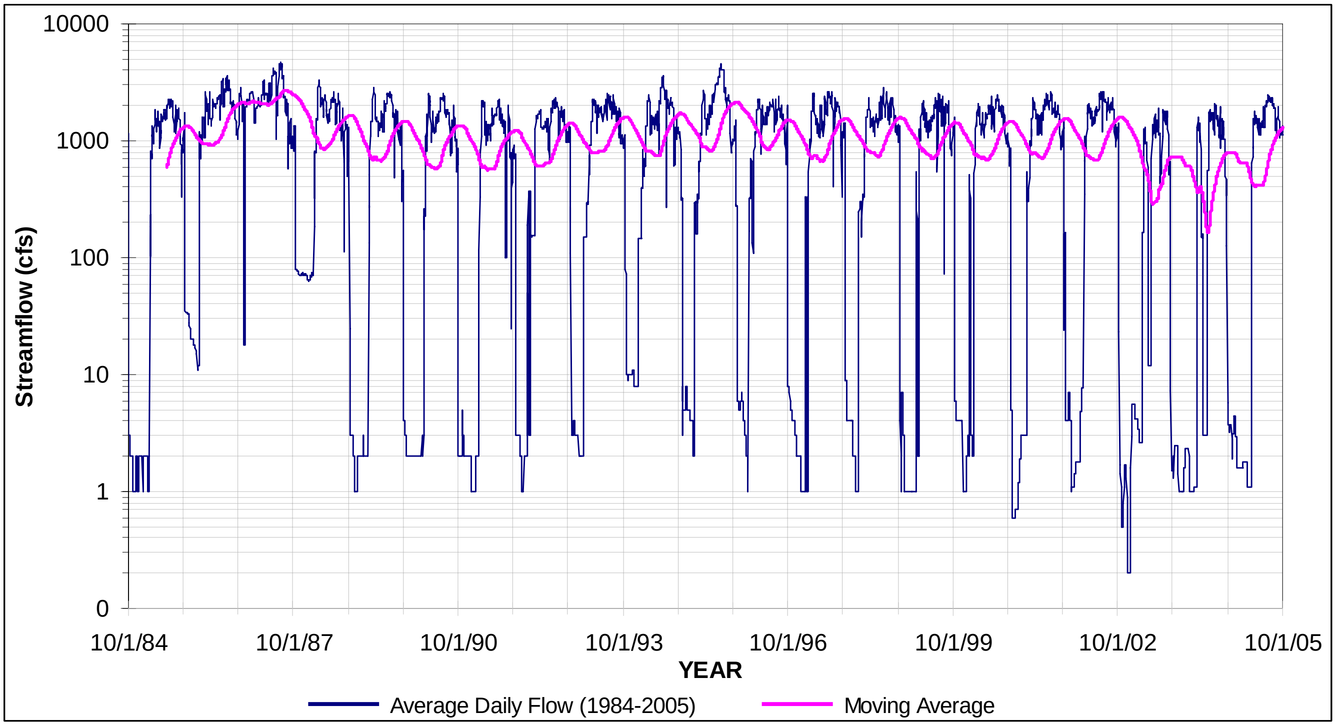


Figure 2.6 Streamflow at Rio Grande below Caballo Dam (USGS Gage 08362500)

3.0 INDIVIDUAL WATERSHED DESCRIPTIONS

TMDLs were developed for assessment units (AUs) for which constituent (or pollutant) concentrations measured during the 2004 water quality survey, as combined with quality outside data, indicated impairment. Because characteristics of each watershed, such as geology, land use, and land ownership provide insight into probable sources of impairment, they are presented in this section for the individual watersheds within the Lower Rio Grande basin. In addition, the 2004-2006 Integrated §303(d)/§305(b) listings within the Lower Rio Grande basin are discussed (NMED/SWQB 2004a).

3.1 El Paso – Las Cruces Watershed (HUC 13030102)

According to available Geographic Information System (GIS) coverages, this portion of the Lower Rio Grande basin has an average elevation of 3900 feet above sea level and receives approximately 11.7 inches of precipitation a year. As presented in Figure 2.1, land uses include 82% rangeland, 12% forest, 2% agriculture, 2% barren, 1% riparian, and 1% urban. Land ownership is 35% Bureau of Land Management (BLM), 32% private, 18% US Forest Service (USFS), 12% State, 2% Bureau of Reclamation, and 1% Department of Defense (Figure 2.2). The geology of the El Paso-Las Cruces watershed is predominantly comprised of alluvium, basin, and valley fill with limited areas of mafic and felsic volcanic rocks as well as evaporites such as halites and anhydrites (Figure 2.3).

The Rio Grande (International Mexico Boundary to Leasburg Dam) is approximately 63 miles in length. SWQB established seven stations along this assessment unit and deployed one thermograph during the 2004 intensive survey. The Rio Grande (International Mexico Boundary to Leasburg Dam) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for bacteria. No TMDLs have previously been established for this assessment unit. Therefore, TMDLs were developed for inclusion in this document for the following assessment unit in the Lower Rio Grande basin:

- ***Bacteria***: Lower Rio Grande (International Mexico Boundary to Leasburg Dam)

Photo 3.1 Rio Grande at the Texas/New Mexico Border (June 10, 2003)

The Rio Grande (Leasburg Dam to Percha Dam) is approximately 44 miles in length. SWQB established four stations along this assessment unit and deployed one thermograph during the 2004 intensive survey. No TMDLs have previously been established for this assessment unit. Therefore, TMDLs were developed for inclusion in this document for the following assessment unit in the Lower Rio Grande basin:

- ***Bacteria*:** Lower Rio Grande (Leasburg Dam to Percha Dam)

Photo 3.2 Rio Grande at Leasburg Dam (June 10, 2003)

4.0 BACTERIA

During the 2004 SWQB sampling monitoring effort in the Lower Rio Grande watershed, *E. coli* data showed several exceedences of the New Mexico water quality secondary contact use standard for several assessment units. This data was combined with other sources of data to determine overall impairment for these assessment units. As a result, two assessment units in the Lower Rio Grande watershed were determined to be impaired with *E. coli* as a pollutant of concern (see summary in Table 4.1 and data in Appendix A). Presence of *E. coli* bacteria is an indicator of the possible presence of other bacteria that may limit beneficial uses and present human health concerns. There are probable nonpoint and point sources of *E. coli* bacteria throughout the basin that could be contributing to the *E. coli* levels.

According to the New Mexico Water Quality Standards (WQS), the *E. coli* standard reads:

> *20.6.4.101 NMAC: The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.*
>
> *20.6.4.102 NMAC: The monthly geometric mean of E. coli bacteria 126/100mL or less; single sample 235/100mL or less.*
>
> *20.6.4.103 NMAC: The monthly geometric mean of E. coli bacteria 548/100mL or less; single sample 2507/100mL or less.*

When water quality standards have been achieved, the reach will be moved to the appropriate category on the Clean Water Act Integrated §303(d)/§305(b) list of assessed waters.

Table 4.1. Summary of Bacteria Data in the Lower Rio Grande

Assessment Unit	New Mexico Standards Segment	*E. coli*: # Exceedences/ Total Samples	*E. coli*[(a)] %Exceedence
Rio Grande (International Mexico bnd. to Leasburg Dam)	20.6.4.101	16/53	30%
Rio Grande (Leasburg Dam to Percha Dam)	20.6.4.101	4/23	17%
Rio Grande (Percha Dam to Caballo Res.)	20.6.4.102	0/7	0%[(b)]
Rio Grande (Caballo Res. to Elephant Butte Dam)	20.6.4.103	0/7	0%[(b)]

Notes:
[(a)] Exceedence rates ≥ 15% result in a determination of Non Support based on the assessment protocol (NMED/SWQB 2006b)
[(b)] There are no TMDL calculations for *E. coli* in the Rio Grande (Percha Dam to Elephant Butte Dam) in this document because the exceedence rate was <15%. Thus, the determination would be Full Support.

4.1 Target Loading Capacity

Overall, the target values for bacteria TMDLs will be determined based on (1) the presence of numeric criteria, (2) the degree of experience in applying the indicator and (3) the ability to easily monitor and produce quantifiable and reproducible results. For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to achieve numeric criteria. This TMDL is also consistent with New Mexico's antidegradation policy.

The segment-specific criteria leading to an assessment of use impairment for the Rio Grande (International Mexico Boundary to Leasburg Dam) and the Rio Grande (Leasburg Dam to Percha Dam) is the numeric criteria stating that "The monthly geometric mean of *E. coli* bacteria 126cfu /100 mL or less; single sample 410cfu /100 mL or less" for the designated contact use (20.6.4.101 NMAC).

4.2 Flow

Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified period. A flow duration curve relates flow values to the percent of time those values have been met or exceeded. The use of *"percent of time"* provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently.

A basic flow duration curve runs from high to low along the x-axis. The x-axis represents the duration amount, or *"percent of time"*, as in a cumulative frequency distribution. The y-axis represents the flow value (e.g., cubic feet per second) associated with that *"percent of time"* (or duration). Flow duration curve development typically uses daily average discharge rates, which are sorted from the highest value to the lowest (Figures 4.1 and 4.2). Using this convention, flow duration intervals are expressed as a percentage, with zero corresponding to the highest stream discharge in the record (i.e., flood conditions) and 100 to the lowest (i.e., drought conditions). Thus, a flow duration interval of sixty associated with a stream discharge of 312 cubic feet per second (cfs) implies that sixty percent of all observed daily average stream discharge values equal or exceed 312 cfs (Figure 4.1).

Duration curve analysis identifies intervals, which can be used as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree). Flow duration curve intervals can be grouped into several broad categories or zones. These zones provide additional insight about conditions and patterns associated with the impairment. A common way to look at the duration curve is by dividing it into five zones, as illustrated in Figures 4.1 and 4.2: one representing *high flows (0-10%)*, another for *moist conditions (10-40%)*, one covering *mid-range flows (40-60%)*, another for *dry conditions (60-90%)*, and one representing *low flows (90-100%)* (Cleland 2003). This particular approach places the midpoints of the moist, mid-range, and dry zones at the 25^{th}, 50^{th}, and 75^{th} percentiles respectively (i.e., the quartiles). The high zone is centered at the 5^{th} percentile, while the low zone is centered at the 95^{th} percentile.

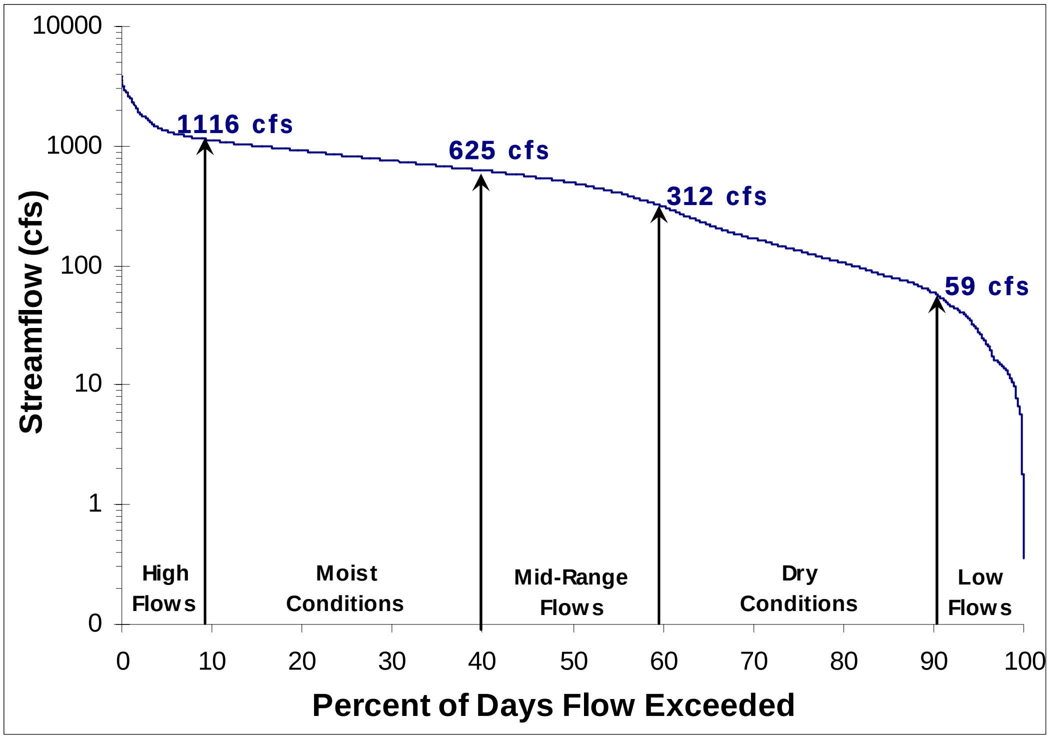


Figure 4.1 Flow Duration Curve: IBWC 08364000 Rio Grande at El Paso, TX (1966-2006)

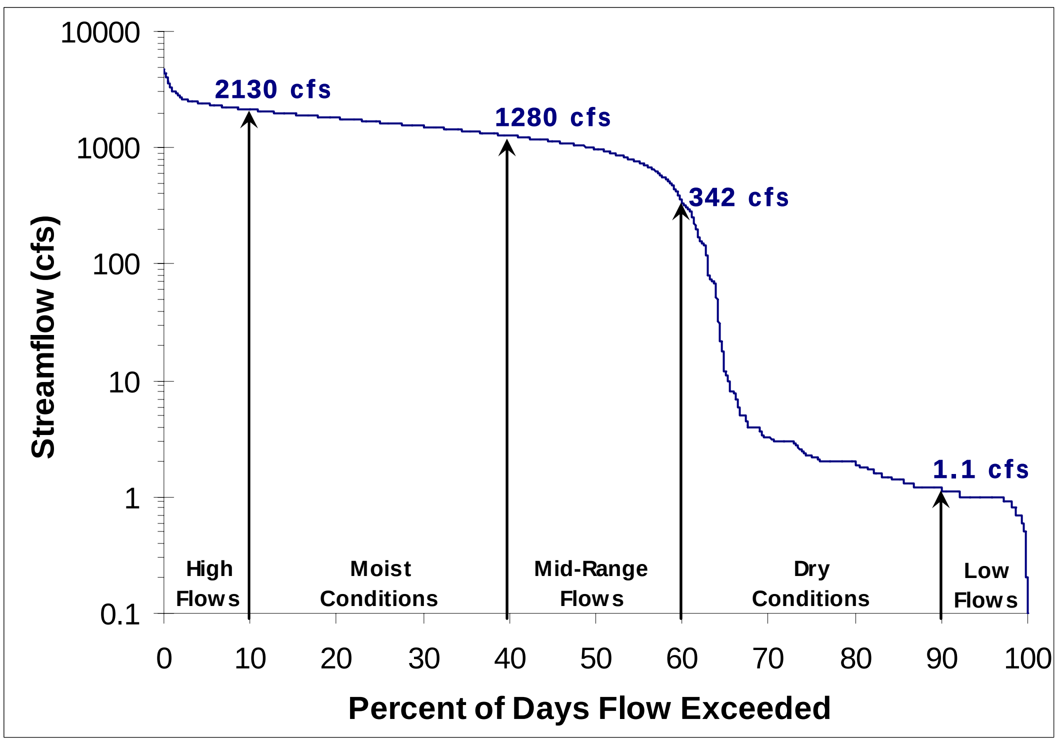


Figure 4.2 Flow Duration Curve: USGS 08362500 Rio Grande blw Caballo Dam (1965-2005)

The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates. Specifically, a maximum daily concentration limit can be used with basic hydrology and a duration curve to identify a TMDL that covers the full range of flow conditions. With this approach, ambient water quality data, taken with some measure or estimate of flow at the time of sampling, can be used to compute an instantaneous load. Using the relative percent exceedence from the flow duration curve that corresponds to the stream discharge at the time the water quality sample was taken, the computed load can be plotted in a duration curve format (Figures 4.3 and 4.4).

By displaying instantaneous loads calculated from ambient water quality data and the daily average flow on the date of the sample (expressed as a flow duration curve interval), a pattern develops, which describes the characteristics of the water quality impairment. Loads that plot above the curve indicate an exceedence of the water quality criterion, while those below the load duration curve show compliance. The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left generally reflect probable nonpoint source contributions. This concept is illustrated in Figures 4.3 and 4.4.

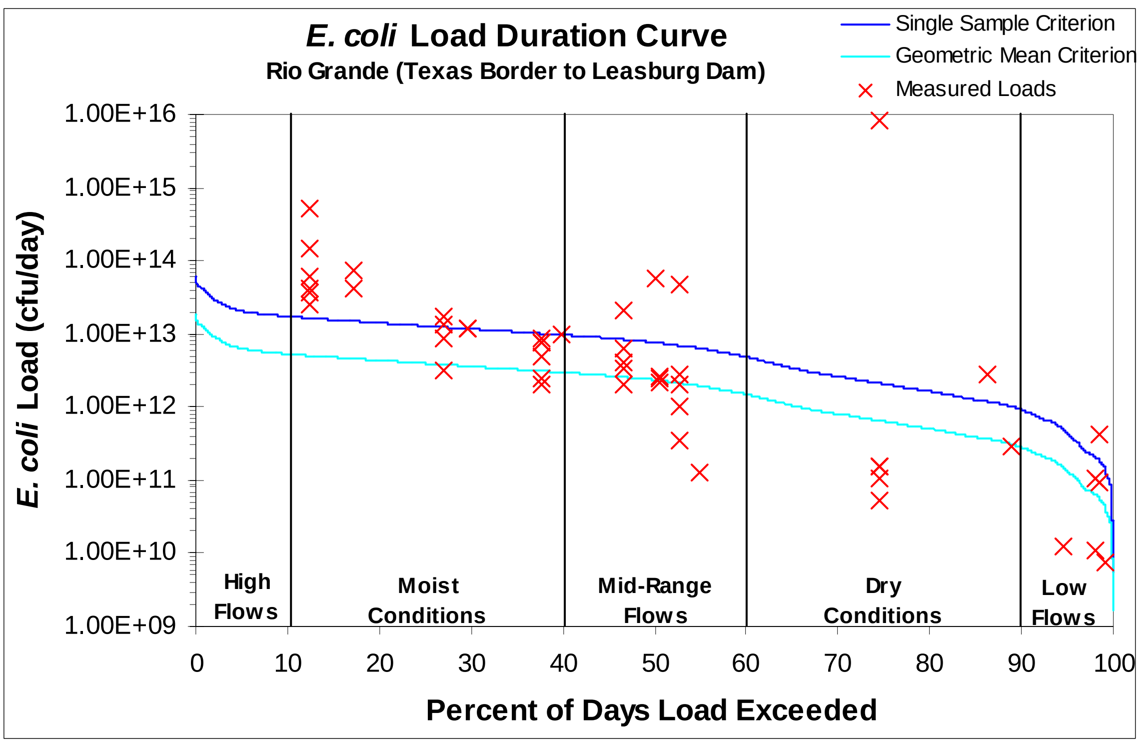


Figure 4.3 ***E. coli*** **Load Duration Curve – Rio Grande (International Mexico Boundary to Leasburg Dam)**

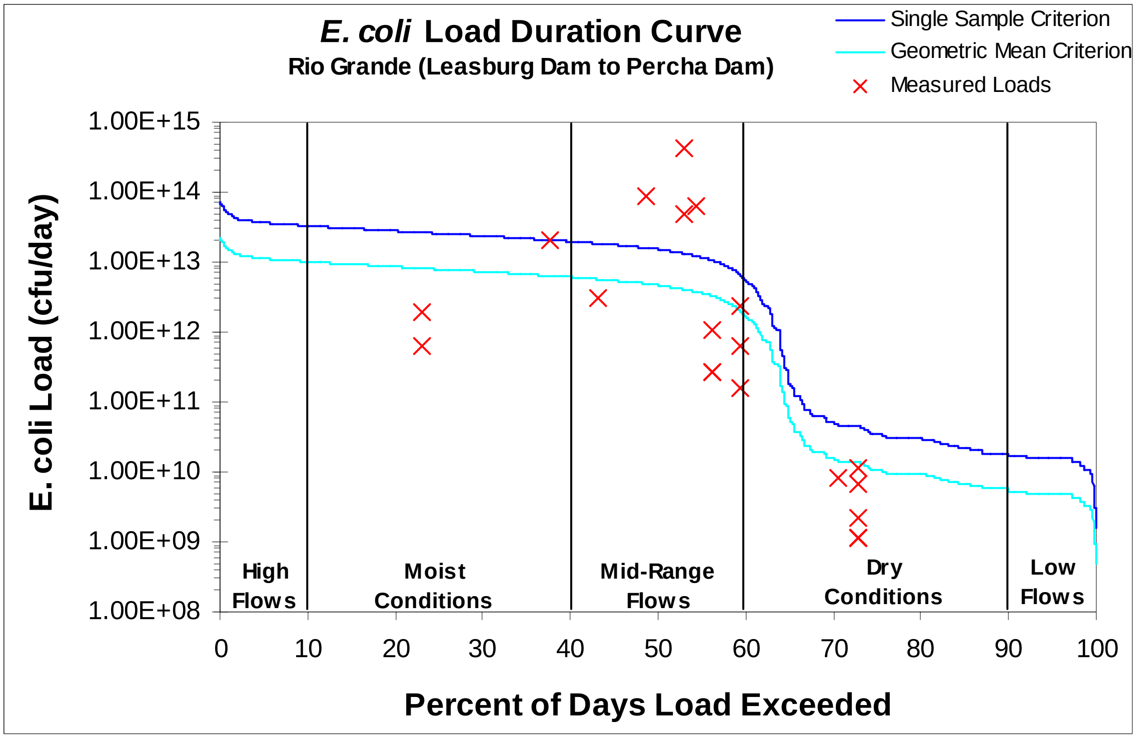


Figure 4.4 *E. coli* Load Duration Curve – Rio Grande (Leasburg Dam to Percha Dam)

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning processes designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained.

4.3 Calculations

Bacteria standards are expressed as colony forming units (cfu) per unit volume. The *E. coli* criteria are listed in Tables 4.2 and 4.3. Target loads for bacteria are calculated based on flow values, current and proposed WQS, and conversion factors (**Equation 1**). The more conservative monthly geometric mean criteria are utilized in TMDL calculations to provide an implicit MOS. In addition, if the single sample criteria were used as targets, the geometric mean criteria may not be reached.

C as cfu/100 mL * 1,000 mL/1 L * 1 L/ 0.264 gallons * Q * 1,000,000 gallons = cfu/day (**Eq. 1**)

Where C = NM state water quality standard criterion for bacteria,
Q = stream flow in million gallons per day (mgd)

Under the duration curve framework, the loading capacity is essentially the curve itself. The loading capacity, which sets the target load on any given day, is determined by the flow on the particular day of interest. However, a continuous curve that represents the loading capacity has some logistical drawbacks. It is often easier to communicate information with a set of fixed targets. Critical points along the curve can be used as an alternative method to quantify the loading capacity, such as the mid-point of each hydrologic zone (e.g., the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles). A unique loading capacity for each hydrologic zone allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes. The target loads (TMDLs) predicted to attain current standards were calculated using **Equation 1** and are shown in Tables 4.2 and 4.3.

Table 4.2. Calculation of Target Loads: Rio Grande (Int'l Mexico bnd. to Leasburg Dam)

Rio Grande (International Mexico boundary to Leasburg Dam)	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
E. coli **geometric mean criterion (cfu/100mL)**	126	126	126	126	126
Mid-point Flow (mgd)	860	534	317	86	18
Conversion Factor[(a)]	3.79×10^7	3.79×10^7	3.79×10^7	3.79×10^7	3.79×10^7
TMDL	**4.11×10^{12}**	**2.55×10^{12}**	**1.52×10^{12}**	**4.10×10^{11}**	**8.64×10^{10}**

[(a)] Conversion factor is based on Equation 1.

Table 4.3. Calculation of Target Loads: Rio Grande (Leasburg Dam to Percha Dam)

Rio Grande (Leasburg Dam to Percha Dam)	FLOW CONDITIONS				
	High[(b)]	**Moist**[(b)]	**Mid-Range**	**Dry**[(b)]	**Low**[(b)]
E. coli **geometric mean criterion (cfu/100mL)**	-	-	126	-	-
Mid-point Flow (mgd)	-	-	635	-	-
Conversion Factor[(a)]	-	-	3.79×10^7	-	-
TMDL	**-**	**-**	**3.03×10^{12}**	**-**	**-**

[(a)] Conversion factor is based on Equation 1.
[(b)] There are no TMDL calculations for High, Moist, Dry, or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 4.4).

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

Excess bacteria levels may be a component of some storm water discharges so these discharges should be addressed. On September 29, 2006, EPA Region 6 issued general permits for discharges from regulated small municipal separate storm sewer system (sMS4s) in New Mexico and on Indian Country lands in New Mexico and Oklahoma. Notice of availability of the general permits will be published in the Federal Register in the near future. The general permits offer coverage for discharges of storm water from sMS4s that are regulated under Phase II of the National Pollutant Discharge Elimination System (NPDES) Storm Water Program to various waters of the United States in New Mexico and Oklahoma. The permits will be effective January 1, 2007, and Notices of Intent to be covered will generally be due by April 1, 2007. In New Mexico, some of the major impacts to small MS4s are as follows: operators of MS4s located in urbanized areas (UAs) must develop, implement, and enforce a storm water management program to reduce the discharge of pollutants from its MS4 to the "maximum extent practicable" and protect water quality; operators of "regulated" MS4s must obtain NPDES permit coverage; the permit application (Notice of Intent [NOI]) must include six "minimum control measures" (using Best Management Practices, or BMPs) and measurable goals; the BMPs must be fully implemented within 5 years of permit issuance; and, operators must submit yearly progress reports to EPA.

There are seven municipalities along the Rio Grande (International Mexico Boundary to Leasburg Dam) that are eligible for coverage under the statewide, general sMS4 permit (#NMR040000). The municipalities include Anthony, Doña Ana, Las Cruces, Mesilla, Santa Teresa, Sunland Park, and University Park. In addition to the general sMS4 permit, there are eight NPDES permitted municipal wastewater treatment facilities (WWTF) in the region.

The waste load allocation (WLA) for sMS4s was based on the percent jurisdictional area approach. For each zone, the amount available for nonpoint source load allocations (LAs) and the sMS4 WLA was the TMDL for that zone minus the margin of safety (MOS) and the WLAs for WWTFs. In the case of the Lower Rio Grande, two percent of the watershed falls within the jurisdiction of sMS4 communities. Thus, the sMS4 WLA is two percent of the available allocation for each zone. The remaining ninety-eight percent was designated for nonpoint sources and natural background as the LA for each zone. Individual waste load allocations for all NPDES permits in the impaired assessment units are shown in Table 4.4.

In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges are transient because they occur during storm events. Coverage under Phase II of the NPDES Storm Water Program requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with urban activities to minimize impacts to water quality. In the case of the Lower Rio Grande, compliance by those municipalities within the terms of their individual MS4 permits will fulfill any obligations they have toward implementing this TMDL.

Table 4.4. Waste Load Allocations for *E. coli*

Assessment Unit	Facility	Design Capacity Flow (mgd)	Proposed *E. coli* Effluent limits[a] (cfu/100mL)	Conversion Factor[b]	Waste Load Allocations (cfu/day)
Rio Grande (International Mexico boundary to Leasburg Dam)	**NM0029629** Anthony Water and Sanitation District WWTP	0.9	126	3.79×10^7	4.30×10^9
	NM0028487 Gadsden Independent School District	0.088	126	3.79×10^7	4.20×10^8
	NM0023311 City of Las Cruces WWTP	8.9	126	3.79×10^7	4.25×10^{10}
	NM0030201 City of Sunland Park (Santa Teresa)	0.53	126	3.79×10^7	2.53×10^9
	NM0030490 South Central Regional WWTP, Dona Ana Co.	1.05	126	3.79×10^7	5.01×10^9
	NM0029483 City of Sunland Park WWTP	1.2	126	3.79×10^7	5.73×10^9
	NMR040000 Municipal Separate Storm Sewer System (MS4) storm water permit	--	--	--	Variable[c]
Rio Grande (Leasburg Dam to Percha Dam)	**NM0020010** Village of Hatch WWTP	0.3	126	3.79×10^7	1.43×10^9
	NM0030457 Village of Salem WWTP	0.2	126	3.79×10^7	9.55×10^8

Notes:
[a] Based on current in-stream New Mexico WQS for segment 20.6.4.101 NMAC (as amended February 16, 2006).
[b] Based on equation 1.
[c] The waste load allocation for the storm water MS4 permit was based on the percent jurisdictional area approach. Two percent of the watershed fell within the jurisdiction of MS4 communities. Thus, the MS4 waste load allocation is 2% of the available allocation for each hydrologic zone, where the available allocation = TMDL – WLA – MOS.

4.4.2 Load Allocation

In order to calculate the LA, the WLAs listed in table 4.4 and the MOS were subtracted from the target capacity (TMDL), as shown below in **Equation 2**.

$$WLA + LA + MOS = TMDL \qquad \textbf{(Eq. 2)}$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors (see Section 4.7 for details). Results are presented in Tables 4.5 and 4.6.

Table 4.5. TMDLs for *E. coli*: Rio Grande (International Mexico bnd. to Leasburg Dam)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**4.11×10^{12}**	**2.55×10^{12}**	**1.52×10^{12}**	**4.10×10^{11}**	**8.50×10^{10}**
Load Allocation	**3.32×10^{12}**	**1.83×10^{12}**	**8.84×10^{11}**	**1.19×10^{11}**	**2.03×10^{10}**
NM0029629	4.30×10^{9}	4.30×10^{9}	4.30×10^{9}	4.30×10^{9}	4.30×10^{9}
NM0000108	0	0	0	0	0
NM0028487	4.20×10^{8}	4.20×10^{8}	4.20×10^{8}	4.20×10^{8}	4.20×10^{8}
NM0023311	4.25×10^{10}	4.25×10^{10}	4.25×10^{10}	4.25×10^{10}	4.25×10^{10}
NM0030201	2.53×10^{9}	2.53×10^{9}	2.53×10^{9}	2.53×10^{9}	2.53×10^{9}
NM0030490	5.01×10^{9}	5.01×10^{9}	5.01×10^{9}	5.01×10^{9}	5.01×10^{9}
NM0029483	5.73×10^{9}	5.73×10^{9}	5.73×10^{9}	5.73×10^{9}	5.73×10^{9}
NMR040000	6.77×10^{10}	3.74×10^{10}	1.80×10^{10}	2.43×10^{9}	0
Total Waste Load Allocation	**1.28×10^{11}**	**9.79×10^{10}**	**7.85×10^{10}**	**6.29×10^{10}**	**6.05×10^{10}**
Margin of Safety	**6.64×10^{11}**	**6.20×10^{11}**	**5.52×10^{11}**	**2.28×10^{11}**	**4.25×10^{9}**

Table 4.6. TMDLs for *E. coli*: Rio Grande (Leasburg Dam to Percha Dam)

	FLOW CONDITIONS				
	High[(a)]	**Moist**[(a)]	**Mid-Range**	**Dry**[(a)]	**Low**[(a)]
TMDL	-	-	**3.03×10^{12}**	-	-
Load Allocation	-	-	**1.05×10^{12}**	-	-
NM0020010	-	-	1.43×10^{9}	-	-
NM0030457	-	-	9.55×10^{8}	-	-
Total Waste Load Allocation	-	-	**2.39×10^{9}**	-	-
Margin of Safety	-	-	**1.98×10^{12}**	-	-

[(a)] There are no TMDL calculations for High, Moist, Dry, or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 4.4).

The extensive data collection and analyses necessary to determine background *E. coli* loads for the Lower Rio Grande watershed were beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

Measured loads were also calculated using **Equation 1**. In order to achieve comparability between the target capacity (i.e., TMDL values) and measured loads, the same flow rates were used for both calculations. The load reductions necessary to meet the target loads were calculated to be the difference between the target load and the measured load. Results are presented in Tables 4.7 and 4.8.

Table 4.7. Load Reduction: Rio Grande (International Mexico Boundary to Leasburg Dam)

Rio Grande (Int'l Mexico bnd. to Leasburg Dam)	FLOW CONDITIONS				
	High[a]	**Moist**	**Mid-Range**	**Dry**	**Low**
Measured *E. coli* concentration (cfu/100mL) [b]	--	1308	523	228,732	150
Mid-point Flow (mgd)	--	534	317	86	18
Conversion Factor[c]	--	3.79×10^7	3.79×10^7	3.79×10^7	3.79×10^7
Measured Loads	**--**	$\mathbf{2.65 \times 10^{13}}$	$\mathbf{6.29 \times 10^{12}}$	$\mathbf{7.45 \times 10^{14}}$	$\mathbf{1.01 \times 10^{11}}$
Target Loads[d]	**--**	$\mathbf{1.93 \times 10^{12}}$	$\mathbf{9.63 \times 10^{11}}$	$\mathbf{1.82 \times 10^{11}}$	$\mathbf{8.08 \times 10^{10}}$
Percent Reduction [e]	**--**	**92.7%**	**84.7%**	**100%**	**20.2%**

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.
[a] There were no measured concentrations at high flows, thus measured load and reduction estimate could not be calculated.
[b] The measured concentration is the arithmetic mean of the measured values (see Appendix A)
[c] Based on equation 1.
[d] Target Load = LA + WLA
[e] Percent reduction is the percent the existing measured load must be reduced to achieve the target load, and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100

Table 4.8. Load Reduction: Rio Grande (Leasburg Dam to Percha Dam)

Rio Grande (Leasburg Dam to Percha Dam)	FLOW CONDITIONS				
	High [a]	**Moist** [a]	**Mid-Range**	**Dry** [a]	**Low** [a]
Measured *E. coli* concentration (cfu/100mL) [b]	--	--	1662	--	--
Mid-point Flow (mgd)	--	--	635	--	--
Conversion Factor[c]	--	--	3.79×10^7	--	--
Measured Load	**--**	**--**	$\mathbf{4.00 \times 10^{13}}$	**--**	**--**
Target Load[d]	**--**	**--**	$\mathbf{1.05 \times 10^{12}}$	**--**	**--**
Percent Reduction[e]	**--**	**--**	**97.4%**	**--**	**--**

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.
[a] There are no calculations for High, Moist, Dry, or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 4.4).
[b] The measured concentration is the arithmetic mean of the measured values (see Appendix A)
[c] Based on equation 1.
[d] Target Load = LA + WLA
[e] Percent reduction is the percent the existing measured load must be reduced to achieve the target load, and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100

4.5 Identification and Description of Pollutant Sources

Based on measured loads and potential contributions from existing point sources, probable point and nonpoint pollutant sources that may be contributing to observed *E. coli* loads are displayed in Table 4.9.

Table 4.9. Pollutant Source Summary for *E. coli*

Pollutant Sources	Magnitude (cfu/day)	Assessment Unit	Probable Sources[(a)]
Point: [(b)]			
E. coli	1.28×10^{11} (High Flow) – 6.05×10^{10} (Low Flow)	Rio Grande (International Mexico bnd. to Leasburg Dam)	**0.3%** (Moist Conditions) **– 59.8%** (Low Flow) Municipal Point Source Discharges
E. coli	2.39×10^{9}	Rio Grande (Leasburg Dam to Percha Dam)	**0.1%** Municipal Point Source Discharges
Nonpoint: [(c)]			
E. coli *High Flow* *Moist Conditions* *Mid-Range* *Dry Conditions* *Low Flow*	-- 2.64×10^{13} 6.21×10^{12} 7.45×10^{14} 4.07×10^{10}	Rio Grande (International Mexico bnd. to Leasburg Dam)	**99.7%** (Moist Conditions) **– 40.2%** (Low Flow) Impervious Surface/Parking Lot Runoff; Municipal (Urbanized High Density Areas); On-site Treatment Systems (Septic Systems and Similar Decentralized Systems); Permitted Runoff from Confined Animal Feeding Operations (CAFOs); Rangeland Grazing; Wastes from Pets; Waterfowl; Wildlife other than Waterfowl
E. coli *High Flow* *Moist Conditions* *Mid-Range* *Dry Conditions* *Low Flow*	-- -- 4.00×10^{13} -- --	Rio Grande (Leasburg Dam to Percha Dam)	**99.9%** Impervious Surface/Parking Lot Runoff; On-site Treatment Systems (Septic Systems and Similar Decentralized Systems); Rangeland Grazing; Wastes from Pets; Waterfowl; Wildlife other than Waterfowl

[(a)] From the 2004-2006 Integrated CWA 303(d)/305(b) Report (NMED/SWQB 2004a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time. Point source percentage calculated as WLA magnitude divided by measured load. Nonpoint source percentage is the remainder when this value is subtracted from 100%.
[(b)] Current probable point source contributions (based on WLA calculations)
[(c)] Measured load minus current probable point source contributions

4.6 Linkage Between Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment (NMED/SWQB 1999). The Source Documentation Sheet and Sources Summary Table in Appendix B provide an approach for a visual analysis of a pollutant source along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of probable sources of impairment in this watershed. Table 4.9 (Pollutant Source Summary) identifies and quantifies probable sources of nonpoint source impairments along the reach as determined by field reconnaissance and assessment.

Among the probable sources of bacteria are municipal point sources discharges such as wastewater treatment facilities, poorly maintained or improperly installed (or missing) septic tanks, runoff from the numerous confined animal feeding operations (CAFOs), impervious surface/parking lot runoff, livestock grazing of valley pastures and riparian areas, upland livestock grazing, in addition to wastes from pets, waterfowl, and other wildlife. Very high *E. coli* concentrations have been measured in water sampled from SWQB monitoring stations along the Lower Rio Grande. Howell et. al. (1996) found that bacteria concentrations in underlying sediment increase when cattle (*Bos taurus*) have direct access to streams, such as the Lower Rio Grande. Natural sources of bacteria are also present in the form of other wildlife such as waterfowl, elk, deer, and any other warm-blooded mammals. In addition to direct input from dairy farm operations and wildlife, *E. coli* concentrations may be subject to elevated levels as a result of re-suspension of bacteria laden sediment during storm events. Temperature can also play a role in *E. coli* concentrations. Howell et. al. (1996) observed that bacteria re-growth increases as water temperature increases, which definitely is a concern along the Lower Rio Grande.

E. coli Data

E. coli data collected during the 2004 water quality survey are shown in Tables 4.10 and 4.11. Rainfall measurements collected at the NOAA stations in Anthony, NM and Leasburg, NM were used to identify trends between elevated *E. coli* levels and rainfall. The Pearson correlation coefficient was used to assess whether a statistical association existed between *E. coli* and rainfall. The Pearson correlation coefficient, denoted by *r*, measures the strength and direction of a *linear* relationship between *X* and *Y* variables.

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

Rio Grande (International Mexico Boundary to Leasburg Dam)

The available data for the Rio Grande (International Mexico Boundary to Leasburg Dam), shows no relationship between *E. coli* and rainfall events (r = -0.07). Data in Table 4.10 and Figure 4.5 show that elevated *E. coli* levels tend to occur during non-rainfall events. This potentially shows that along this segment of the Rio Grande sources of bacteria are delivered to the river during non-rainfall events. Moreover, the Discharge Monitoring Reports revealed that the City of Sunland Park WWTP (NPDES permit #NM0030201) was in violation for fecal coliforms during the weeks of April 8-14, April 15-21, April 22-28, and August 12-18, 2004. The South Central Regional WWTP (NPDES permit #NM0030490) was also in violation for fecal coliforms during the weeks of November 7-13 and November 21-27, 2004.

Table 4.10. *E. coli* concentration in the Rio Grande (International Mexico Boundary to Leasburg Dam)

Date Collected	Average *E. coli* Concentration (cfu/100mL)	Rainfall (inches)
4/6/04	642	0.41
4/20/04*	320,018*	0*
5/5/04	20	0
6/7/04	128	0
6/24/04	222	0.06
8/2/04	397	0.22
8/3/04	345	0.01
8/16/04	1550	0
8/17/04	3413	0.12
8/27/04	400	0
9/20/04	1500	1.06
9/21/04	352	0
10/18/04	10	0
11/8/04	0	0
11/9/04	275	0
11/17/04	110	0

***Note:** The sample from March 20, 2004 was not included on the graph because the *E. coli* concentration was so much higher than the other samples, thus skewing the graph.

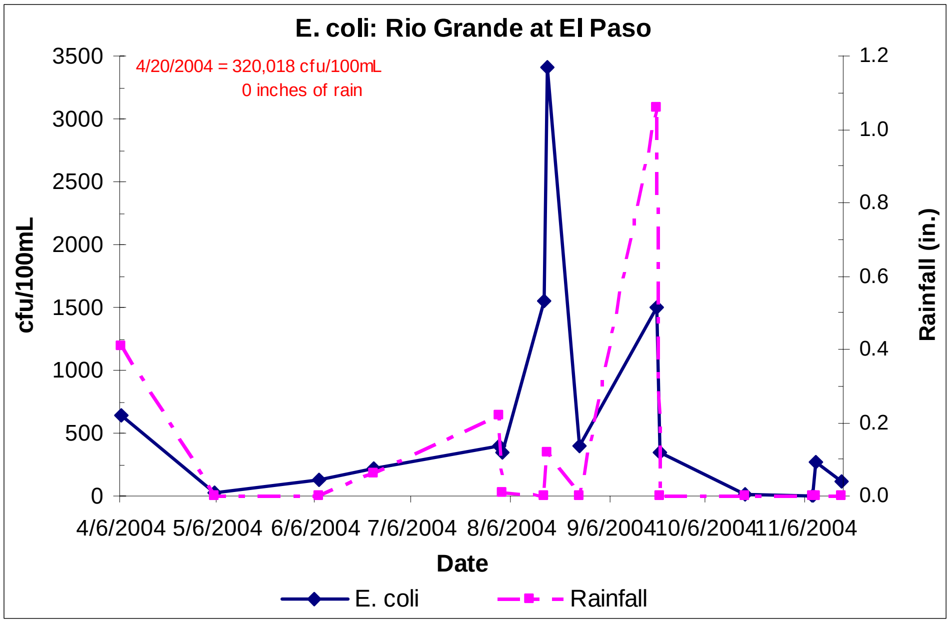


Figure 4.5 ***E. coli*** **Measurements in the Rio Grande (International Mexico Boundary to Leasburg Dam)**

Rio Grande (Leasburg Dam to Percha Dam)

The available data for the Rio Grande (Leasburg Dam to Percha Dam) shows a strong positive association between *E. coli* and rainfall events (Table 4.11 and Figure 4.6; r = 0.75). This potentially shows that along this segment of the Rio Grande sources of bacteria are delivered to the river mostly during rainfall events.

Table 4.11. ***E. coli*** **concentration in the Rio Grande (Leasburg Dam to Percha Dam)**

Date Collected	Average *E. coli* concentration (cfu/100mL)	Rainfall (inches)
4/20/04	13	0
5/5/04	57	0
11/8/04	23	0
9/20/04	65	0.2
4/6/04	20	0.01
8/17/04	7275	1.09
8/2/04	1160	0.34
7/28/04	400	0.15
6/24/04	20	0.14

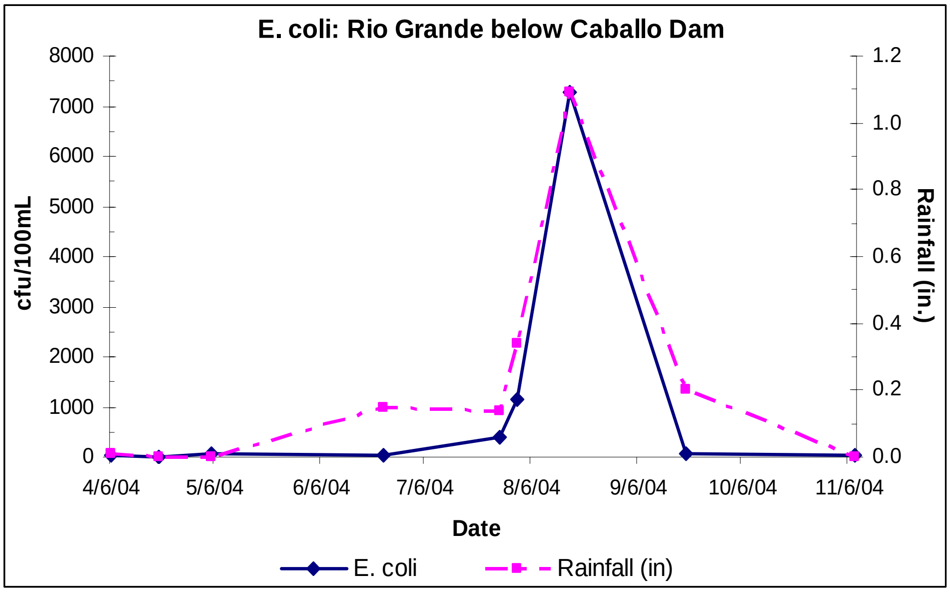


Figure 4.6 ***E. coli*** **Measurements in the Rio Grande (Leasburg Dam to Percha Dam)**

Conclusions

The bacteria loading probably originates from a combination of drought-related impacts, increasing municipal demands on surface and ground water, septic systems and similar decentralized systems, and livestock and wildlife wastes that are transported downstream during runoff events.

The duration curve method, by itself, is limited in the ability to track individual source loadings or relative source contributions within a watershed. Additional analysis is needed to identify pollutant contributions from different types of probable sources and activities (i.e., construction zone versus agricultural area) or individual sources of a similar source category (i.e., WWTF #1 versus WWTF #2). Practitioners interested in more precise source characterization should consider supplementing the duration curve framework with a separate analysis. An added analytical tool might aid in evaluating allocation scenarios and tracking individual sources or source categories. This could allow for improved targeting of restoration activities.

One method of characterizing sources of bacteria is a Bacterial, or Microbial, Source Tracking (BST) study. The extensive data collection and analyses necessary to determine bacterial sources were beyond the resources available for this study. However, sufficient data exist to support development of *E. coli* TMDLs to address the stream standards violations.

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and explicit allocations. Therefore, this MOS is the sum of the following two elements:

- *Implicit Margin of Safety*

  Treating *E. coli* as a conservative pollutant, that is a pollutant that does not readily degrade in the environment, was used as a conservative assumption in developing these loading limits.

  A more conservative limit of the geometric mean value, rather than the current single sample criterion which allows for higher concentrations in individual grab samples, was used to calculate loading values.

- *Explicit Margin of Safety*

  Using a duration curve framework, an explicit MOS can be identified for each listed reach and corresponding set of flow zones. In this TMDL, the MOS was based on the difference between the loading capacity as calculated at the mid-point of each of the four higher flow zones (high, moist, mid-range, and dry), and the loading capacity calculated at the minimum flow in each zone. Given that the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point, a substantial MOS is provided. This explicit MOS ensures that allocations will not exceed the load associated with the minimum flow in each zone (USEPA 2006).

  The MOS for the low flow zone was determined using a different method because the lowest flow recorded was only 0.35 cfs. If the MOS was calculated as described above, the MOS would constitute the majority of the target load. In other words, there would not be enough load to allocate to point and nonpoint sources under this flow regime. Similar to previous SWQB bacteria TMDLs which were based on 4Q3 low-flows, there is inherent error in all flow measurements. A conservative MOS of **5 percent** was therefore explicitly allocated to the low flow hydrologic zone.

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc). As new information becomes available, this unallocated capacity may be attributed to nonpoint sources including tributary streams (which could then be added to the load allocation); or it may be attributed to point sources (and become part of the waste load allocations).

4.8 Consideration of Seasonal Variability

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Seasonal variation was accounted for in these TMDLs by using 40 years of USGS flow records when estimating flows to develop flow exceedence percentiles.

During the 2004 water quality survey, bacteria exceedences occurred during spring, summer, and fall months. Higher flows may flush more nonpoint source runoff containing *E. coli*. It is also possible the criterion may be exceeded under a low flow condition when there is insufficient dilution of a point source. The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates during different seasons. Allocations within the TMDL are set in a way that reflects dominant concerns associated with appropriate hydrologic conditions.

4.9 Future Growth

According to the calculations, the overwhelming source of bacteria loading is from nonpoint sources in the upper AU (Leasburg Dam to Percha Dam). However, the lower AU (International Mexico Boundary to Leasburg Dam) experienced impacts from both point and nonpoint sources depending on the flow conditions. Estimates of future growth are not anticipated to lead to a significant increase in bacteria concentrations that cannot be controlled with BMP implementation and appropriate NPDES permit limits in this watershed.

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5.0 MONITORING PLAN

Pursuant to Section 106(e)(1) of the Federal CWA, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State.

The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls, and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every seven years. The next scheduled monitoring date for the Rio Grande watershed is 2011. The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6 (NMED/SWQB 2004b). In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program. Current priorities for monitoring in the SWQB are driven by the CWA Section 303(d) list of streams requiring TMDLs. Short-term efforts will be directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997).

Once assessment monitoring is completed, those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority assessment units (including biological assessments), and compliance monitoring of industrial, federal, and municipal dischargers, as specified in the SWQB Assessment Protocols (NMED/SWQB 2006b).

Long-term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited approximately every seven years. This information will provide time relevant information for use in CWA Section 303(d) listing and 305(b) report assessments and to support the need for developing TMDLs. The approach provides:

- a systematic, detailed review of water quality data which allows for a more efficient use of valuable monitoring resources;
- information at a scale where implementation of corrective activities is feasible;
- an established order of rotation and predictable sampling in each basin which allows for enhanced coordinated efforts with other programs; and
- program efficiency and improvements in the basis for management decisions.

SWQB recently developed a 10-year monitoring strategy submitted to USEPA on September 30, 2004. Once the 10-year monitoring plan is approved by the USEPA, it will be available at the SWQB website: http://www.nmenv.state.nm.us/swqb/. The strategy will detail both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. According to the draft proposed 8-year rotational cycle, which assumes the existing level of resources, the next time SWQB will intensively sample the Lower Rio Grande watershed during 2012.

It should be noted that a watershed would not be ignored during the years in between intensive sampling. The rotating basin program will be supplemented with other data collection efforts such as the funding of long-term USGS water quality gaging stations for long-term trend data. Data will be analyzed and field studies will be conducted to further characterize acknowledged problems and TMDLs will be developed and implemented accordingly. Both long-term and intensive field studies can contribute to the State's Integrated §303(d)/§305(b) listing process for waters requiring TMDLs.

6.0 IMPLEMENTATION OF TMDLS

6.1 Coordination

In this watershed public awareness and involvement will be crucial to the successful implementation of these plans and improved water quality. Staff from SWQB will work with stakeholders to provide guidance in developing the Watershed Restoration Action Strategy (WRAS). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It includes opportunities for private landowners and public agencies in reducing and preventing impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving constituent levels consistent with New Mexico's WQS, and will be used to prevent water quality impacts in the watershed. The WRAS is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WRAS leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

SWQB staff will assist with any technical assistance such as selection and application of BMPs needed to meet WRAS goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholders in this process will include SWQB, and other members of the WRAS.

Implementation of BMPs within the watershed to reduce pollutant loading from nonpoint sources will be encouraged. Reductions from point sources will be addressed in revisions to discharge permits.

6.2 Time Line

Table 6.1 details the proposed implementation timeline.

6.3 Clean Water Act §319(h) Funding Opportunities

The Watershed Protection Section of the SWQB provides USEPA §319(h) funding to assist in implementation of BMPs to address water quality problems on reaches listed as category 4 or 5 waters on the Integrated §303(d)/ §305(b) list. These monies are available to all private, for profit and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, Federal agencies, or agencies of the State. Proposals are submitted by applicants two times a year through a Request for Proposal (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is available for both watershed group formation (which includes WRAS development) and on-the-ground projects to improve surface water quality and associated habitat. Further information on funding from the CWA §319 (h) can be found at the SWQB website: http://www.nmenv.state.nm.us/swqb/.

Table 6.1 Proposed Implementation Timeline

Implementation Actions	Year 1	Year 2	Year 3	Year 4	Year 5
Public Outreach and Involvement	X	X	X	X	X
Form watershed groups	X	X			
TMDL Development	X				
WRAS Development		X	X	X	
Revise any NPDES permits as necessary (currently EPA Region 6)	X	X	X	X	X
Establish Performance Targets		X	X		
Secure Funding for WRAS		X	X		
Implement Management Measures (BMPs)		X	X	X	
Monitor BMPs		X	X	X	
Determine BMP Effectiveness				X	X
Re-evaluate Performance Targets				X	X

6.4 Other Funding Opportunities and Restoration Efforts in the Rio Grande Basin

Several other sources of funding existing to address impairments discussed in this TMDL document. NMED’s Construction Programs Bureau assists communities in need of funding for WWTP upgrades and improvements to septic tank configurations (such as the design of cluster systems). They can also provide matching funds for appropriate CWA §319(h) projects using state revolving fund monies. The USDA Environmental Quality Incentive Program (EQIP) program can provide assistance to private land owners in the basin. The USDA Forest Service aligns their mission to protect lands they manage with the TMDL process, and are another source of assistance. The BLM has several programs in place to provide assistance to improve unpaved roads and grazing allotments.

7.0 ASSURANCES

New Mexico's Water Quality Act (Act) does authorize the WQCC to "promulgate and publish regulation to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Water Quality Act also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (see NMAC 20.6.4.6.C) (NMAC 2006) states:

> *…[These water quality standards] do not grant the water quality control commission or any other entity the power to create, take away or modify property rights in water*.

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State.*
>
> *Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's 319 Program has been developed in a coordinated manner with the State's 303(d) process. All 319 watersheds that are targeted in the annual RFP process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a NPS. The NMED NPS water quality management program has historically strived for and will continue to promote voluntary compliance to NPS water pollution concerns by utilizing a voluntary, cooperative approach. The State provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through §319 of the Clean Water Act. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including Federal, State and private land, NMED has established Memoranda of Understanding (MOUs) with various Federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other State agencies, such as the New Mexico State Highway and Transportation Department. These MOUs provide for coordination and consistency in dealing with NPS issues.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. Stakeholders in this process will include SWQB, and other members of the WRAS. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

8.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL (see Appendix C). The draft TMDL was made available for a 45-day comment period starting on February 23, 2007. Response to comments will be attached as Appendix D of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers.

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APPENDIX A

E. coli DATA

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AU	Sample site	Collection date/time	Result	Units
Texas Border to Leasburg Dam	Rio Grande above East Drain	10/16/2001 0:00	8	/100 ml
Texas Border to Leasburg Dam	Rio Grande above East Drain	2/13/2002 0:00	920.8	/100 ml
Texas Border to Leasburg Dam	Rio Grande above East Drain	2/18/2003 0:00	111	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	4/6/2004 10:00	20	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	4/6/2004 13:00	2850	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	4/6/2004 14:45	120	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	4/6/2004 15:30	160	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	4/6/2004 16:00	60	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	4/20/2004 11:15	30	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	4/20/2004 12:30	10	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	4/20/2004 12:45	30	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	4/20/2004 13:30	20	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	4/20/2004 14:00	1600000	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	5/5/2004 10:05	20	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	6/7/2004 11:50	140	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	6/7/2004 12:15	115	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	6/7/2004 12:25	130	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	6/24/2004 8:00	350	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	6/24/2004 8:20	300	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	6/24/2004 9:10	100	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	6/24/2004 9:50	300	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	6/24/2004 10:20	80	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	6/24/2004 10:45	200	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	8/2/2004 15:05	393	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	8/2/2004 15:30	400	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	8/3/2004 14:05	280	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	8/3/2004 14:10	440	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	8/3/2004 14:35	100	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	8/3/2004 15:20	560	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	8/16/2004 15:30	2000	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	8/16/2004 15:50	1100	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	8/17/2004 8:40	1450	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	8/17/2004 9:05	3500	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	8/17/2004 9:50	600	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	8/17/2004 10:45	875	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	8/17/2004 12:00	13000	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	8/17/2004 12:35	1050	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	8/27/2004 8:20	400	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	9/20/2004 14:20	3000	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	9/20/2004 14:50	0	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	9/21/2004 12:30	160	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	9/21/2004 12:40	100	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	9/21/2004 13:15	300	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	9/21/2004 14:00	1000	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT PICACHO AVE IN LAS CRUCES	9/21/2004 14:30	200	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	10/18/2004 14:35	10	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW LEASBURG DAM, NM	11/8/2004 13:10	0	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE BELOW SUNLAND PARK	11/9/2004 7:40	900	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	11/9/2004 8:00	0	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	11/9/2004 9:10	200	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE AT BRIDGE NEAR LA MESILLA	11/9/2004 10:15	0	/100 ml
Texas Border to Leasburg Dam	Rio Grande Near Anthony	11/17/2004 9:40	200	/100 ml
Texas Border to Leasburg Dam	RIO GRANDE Above SUNLAND PARK WWTF OUTFALL	11/17/2004 10:30	20	/100 ml

AU	Sample site	Collection date/time	Result	Units
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	4/6/2004 8:45	40	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	4/6/2004 9:15	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	4/6/2004 9:30	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	4/20/2004 10:00	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	4/20/2004 10:15	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	4/20/2004 10:30	20	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	5/5/2004 9:15	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	5/5/2004 9:30	100	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	5/5/2004 9:40	60	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	6/24/2004 11:10	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	6/24/2004 11:25	30	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	7/28/2004 8:00	400	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	8/2/2004 14:10	70	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	8/2/2004 14:15	1980	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	8/2/2004 14:40	1430	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	8/17/2004 7:55	13000	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	8/17/2004 8:10	1550	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	9/20/2004 13:40	10	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	9/20/2004 13:55	40	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	9/20/2004 14:00	145	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE Near DERRY, NM	11/8/2004 12:10	70	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR HATCH AT NM 26	11/8/2004 12:35	0	/100 ml
Leasburg Dam to Percha Dam	RIO GRANDE NEAR RINCON AT NM 140	11/8/2004 12:50	0	/100 ml

APPENDIX B
SOURCE DOCUMENTATION SHEET AND SOURCES SUMMARY TABLE

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Source Documentation Sheet

DES FOR USES NOT FULLY SUPPORTED

HQCWF =	HIGH QUALITY COLDWATER FISHERY	☐	DWS	=	DOMESTIC WATER SUPPLY
CWF =	COLDWATER FISHERY	☐	PC	=	PRIMARY CONTACT
MCWF =	MARGINAL COLDWATER FISHERY	☐	IRR	=	IRRIGATION
WWF =	WARMWATER FISHERY	☐	LW	=	LIVESTOCK WATERING
LWWF =	LIMITED WARMWATER FISHERY	☐	WH	=	WILDLIFE HABITAT

ı culture, secondary contact and municipal and industrial water supply and storage are also designated in particular stream reaches where these : are actually being realized. However, no numeric standards apply uniquely to these uses.

REACH NAME:

SEGMENT NUMBER:
BASIN:
PARAMETER:

STAFF MAKING ASSESSMENT:
DATE:

ƆES FOR SOURCES OF NONSUPPORT (CHECK ALL THAT APPLY)

☐ 0100 INDUSTRIAL POINT SOURCES

☐ 0200 MUNICIPAL POINT SOURCES
☐ 0201 DOMESTIC POINT SOURCES

☐ 0400 COMBINED SEWER OVERFLOWS

☐ 1000 AGRICULTURE
☐ 1100 NONIRRIGATED CROP PRODUCTION
☐ 1200 IRRIGATED CROP PRODUCTION
☐ 1201 IRRIGATED RETURN FLOWS
☐ 1300 SPECIALTY CROP PRODUCTION (e.g., truck farming and orchards)
☐ 1400 PASTURELAND
☐ 1500 RANGELAND
☐ 1600 FEEDLOTS - ALL TYPES
☐ 1700 AQUACULTURE
☐ 1800 ANIMAL HOLDING/MANAGEMENT AREAS
☐ 1900 MANURE LAGOONS

☐ 2000 SILVICULTURE
☐ 2100 HARVESTING, RESTORATION, RESIDUE MANAGEMENT
☐ 2200 FOREST MANAGEMENT
☐ 2300 ROAD CONSTRUCTION or MAINTENANCE

☐ 3000 CONSTRUCTION
☐ 3100 HIGHWAY/ROAD/BRIDGE
☐ 3200 LAND DEVELOPMENT
☐ 3201 RESORT DEVELOPMENT
☐ 3300 HYDROELECTRIC

☐ 4000 URBAN RUNOFF/STORM SEWERS

☐ 5000 RESOURCES EXTRACTION
☐ 5100 SURFACE MINING
☐ 5200 SUBSURFACE MINING
☐ 5300 PLACER MINING
☐ 5400 DREDGE MINING
☐ 5500 PETROLEUM ACTIVITIES
☐ 5501 PIPELINES
☐ 5600 MILL TAILINGS
☐ 5700 MINE TAILINGS
☐ 5800 ROAD CONSTRUCTION/MAINTENANCE 8400
☐ 5900 SPILLS

☐ 6000 LAND DISPOSAL
☐ 6100 SLUDGE
☐ 6200 WASTEWATER
☐ 6300 LANDFILLS
☐ 6400 INDUSTRIAL LAND TREATMENT
☐ 6500 ONSITE WASTEWATER SYSTEMS (septic tanks, etc.)
☐ 6600 HAZARDOUS WASTE
☐ 6700 SEPTAGE DISPOSAL
☐ 6800 UST LEAKS

☐ 7000 HYDROMODIFICATION
☐ 7100 CHANNELIZATION
☐ 7200 DREDGING
☐ 7300 DAM CONSTRUCTION/REPAIR
☐ 7400 FLOW REGULATION/MODIFICATIO
☐ 7500 BRIDGE CONSTRUCTION
☐ 7600 REMOVAL OF RIPARIAN VEGETATI
☐ 7700 STREAMBANK MODIFICATION DESTABILIZATION
☐ 7800 DRAINING/FILLING OF WETLANDS

☐ 8000 OTHER
☐ 8010 VECTOR CONTROL ACTIVITIES
☐ 8100 ATMOSPHERIC DEPOSITION
☐ 8200 WASTE STORAGE/STORAGE TANK I
☐ 8300 ROAD MAINTENANCE or RUNOFF
☐ 8400 SPILLS
☐ 8500 IN-PLACE CONTAMINANTS
☐ 8600 NATURAL
☐ 8700 RECREATIONAL ACTIVITIES
☐ 8701 ROAD/PARKING LOT RUNOFF
☐ 8702 OFF-ROAD VEHICLES
☐ 8703 REFUSE DISPOSAL
☐ 8704 WILDLIFE IMPACTS
☐ 8705 SKI SLOPE RUNOFF
☐ 8800 UPSTREAM IMPOUNDMENT
☐ 8900 SALT STORAGE SITES

☐ 9000 SOURCE UNKNOWN

Lower Rio Grande TMDL Probable Sources Summary

Reach	Parameter	Probable Sources (ADB v.2 terminology)
RIO GRANDE (TEXAS BORDER TO LEASBURG DAM)	*E. coli* (Bacteria)	Impervious Surface/Parking Lot Runoff Municipal (Urbanized High Density Area) Municipal Point Source Discharges On-site Treatment Systems (Septic Systems and Similar Decentralized Systems) Permitted Runoff from Confined Animal Feeding Operations (CAFOs) Rangeland Grazing Wastes from Pets Waterfowl Wildlife Other than Waterfowl
RIO GRANDE (LEASBURG DAM TO PERCHA DAM)	*E. coli* (Bacteria)	Impervious Surface/Parking Lot Runoff Municipal Point Source Discharges On-site Treatment Systems (Septic Systems and Similar Decentralized Systems) Rangeland Grazing Wastes from Pets Waterfowl Wildlife other than Waterfowl

APPENDIX C
PUBLIC PARTICIPATION PROCESS FLOWCHART

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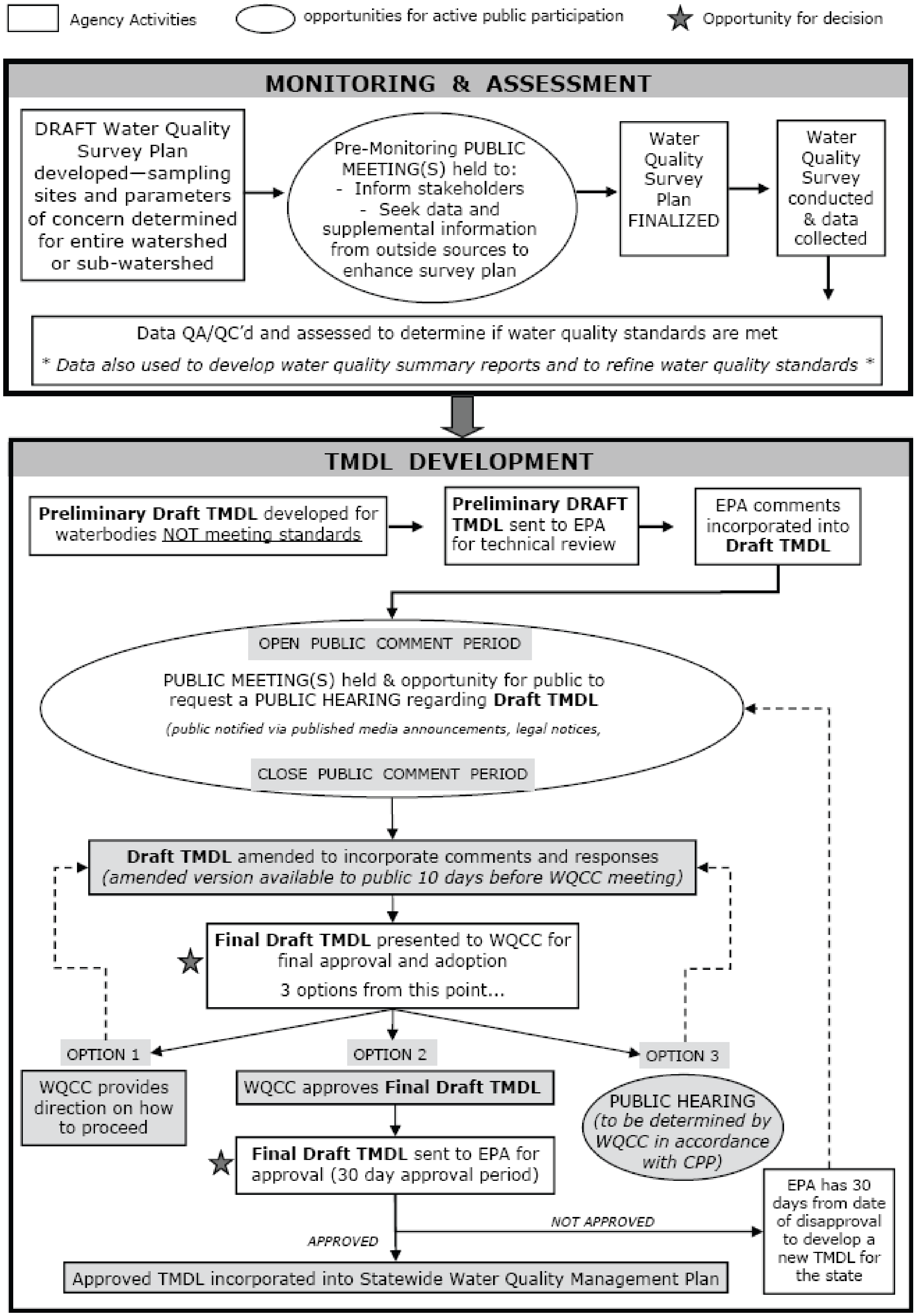
Monitoring, Assessment, & TMDL Development Process



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APPENDIX D
RESPONSE TO COMMENTS

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Comment Set A:
Dan Santantonio, PhD
Las Cruces Utilities Department

(Sent via electronic mail)

Comments to draft TMDL Document for the Lower Rio Grande (from the Texas Border to Elephant Butte Dam), 13 March 2007.

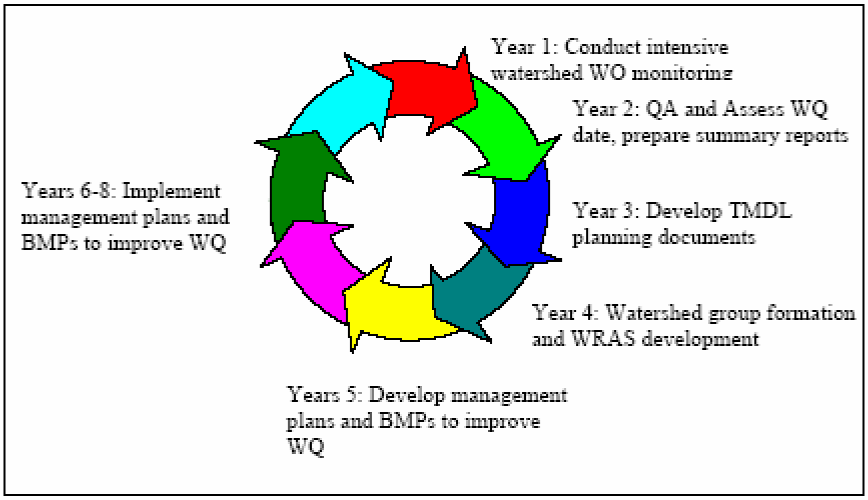
Thank you for coming to Las Cruces on 13 March 2007 for the public meeting regarding the draft TMDL Document. The Las Cruces Utilities Department appreciates the opportunity to comment on the document.

We recognize that extremely high spikes in bacteria occur episodically in the two lower segments of the Rio Grande, and that, until recently, there were serious problems with overloaded municipal wastewater treatments facilities (WWTF) (point dischargers) located between Anthony, NM, and the Texas border.

We have concerns regarding the appropriateness of 2004 as an assessment year, given that is was a year that reflected serious conditions of drought, and because the next assessment is not scheduled until 2011 or 2012. What does the assessment period represent?

RESPONSE:
Similar to most other states, SWQB utilizes a rotating basin, targeted approach to water quality monitoring. Using this approach, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every eight years. Revisions to the schedule may be occasionally necessary based on staff and monetary resources that fluctuate on an annual basis.

This is an adaptive, on-going management approach, meaning a watershed will not be ignored between intensive survey years (refer to figure below).



What criteria were used to determine how much data, and what kind of data, were sufficient and necessary to determine the TMDL, and the timing of its issuance? What are the data quality objectives? According to EPA-approved criteria, were sufficient and appropriate data used?

RESPONSE:

A sampling frequency is determined based on the application of attainment criteria and human and budget resource constraints. SWQB does not require a specific minimum data set to make use attainment determinations. Intensive surveys are used because of the demonstrated advantage of this form of monitoring in relating water quality data to specific water quality problems. Intensive water quality surveys involve monthly sampling and on-site measurements of water quality variables at representative points in a waterbody. Beginning in 2002, a new sampling regime was begun. The new sampling regime was extended over an eight-month, three-season time period to better characterize the waterbody throughout most of the hydrograph and the associated variability. Each sampling station is generally visited monthly between March and October to achieve the "n" determined with the method described in Section 1.5 *Quality Objectives and Criteria for Measurement Data* of the quality assurance project plan (QAPP) (NMED/SWQB 2004a). Since the QAPP is approved by EPA, the SWQB had sufficient and appropriate data to make attainment determinations.

SWQB coordinates with several other entities during development and implementation of water quality monitoring activities. During survey development, SWQB holds a pre-survey monitoring meeting in the watershed to solicit comment and concerns from stakeholders as well as local, state, or federal agency personnel working in the watershed. This information is used to finalize draft sampling plans that are developed in accordance with the QAPP (NMED/SWQB 2004a). Standard operating procedures are followed during the survey to ensure consistent, quality collection and handling of samples (NMED/SWQB 2004b).

The sampling process design for any given project will vary depending on the objectives of the specific project; however, the majority of the data collected by the SWQB are based on some form of a judgmental sampling design, primarily due to resource limitations. Judgmental sampling design is the selection of sampling locations, dates, parameters, and frequencies based on knowledge of the features and conditions under investigation and on professional judgment, with no type of randomization. While a judgmental sample design can be implemented at a relatively low cost, it does not allow the level of confidence (uncertainty) to be accurately quantified and limits the statistical inferences that can be made (USEPA 2002).

References:

NMED/SWQB. 2004a. Quality Assurance Project Plan (QAPP) for Water Quality Management Programs, 2004. NMED/SWQB EPA QAPP QTRCK Number 04-088.

NMED/SWQB. 2004b. Standard Operating Procedures for Sample Collection and Handling, June 22, 2004. (http://www.nmenv.state.nm.us/swqb/MAS/index.html)

USEPA. 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection. EPA 240-R-02-005. USEPA Office of Environmental Information, Washington, D.C. December 2002.

There has been no source identification. There are fundamental and large differences in the large swath of possible sources identified by NMED in a generic manner, some not regulated under the Clean Water Act. Possible sources include septic tanks, agricultural sources, storm water, and point sources that were chronically in violation of NPDES permit requirements. These would represent very different pathways, and require different approaches to control and remediation. The cost to address them all would be very great, and possible wasteful if only certain sources are causing impairment. Can another assessment period be scheduled significantly sooner than 20011/12 in order to better identify sources before a TMDL, if appropriate, is put in place?

Did NMED use an analysis of reasonable potential to evaluate point sources? How was it conducted? Once point sources near the border (WWTFs), which were in violation, are in compliance, is there sufficient justification for a TMDL when impairment may be exclusively the result of non-point sources? Minor point source contributions (de minimis) to a water of the US that is already impaired by excessive non-point loadings would be better dealt with under Sec. 319 than under a TMDL under Sec. 303 (d) (1) (A). What Sec. 319 measures have been put into place? Have they been evaluated, and given a chance to become effective?

RESPONSE:
Under Section 303(d)(1) of the Clean Water Act (CWA), states are required to develop a list of waters within a state that are not in compliance with water quality standards and establish a total maximum daily load (TMDL) for each pollutant. By definition, TMDLs are the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources (NPSs) and background conditions, and includes a margin of safety (MOS). TMDLs are not regulatory documents, but they can be used to issue or modify permits for point sources and/or apply for funding to minimize the deleterious effects of nonpoint sources.

Current estimates indicate that nonpoint sources are the cause of approximately 95% of the state's water quality problem. The US Environmental Protection Agency (EPA) has developed guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States and Territories. The guidelines continue to emphasize a concentrated focus on the implementation of projects that are designed to improve waters that have been listed as impaired under Section 303(d) of the CWA. Therefore, the 303(d)/TMDL process actually provides opportunities for funding under Section 319.

TMDLs are the guiding document for development of Watershed Restoration Action Strategies (WRAS) by local stakeholders with assistance from the SWQB Watershed Protection Section (WPS). The WRAS is in essence the TMDL Implementation Plan, or phase 2 of the TMDL process. A WRAS is designed to focus on the prevention and remediation of nonpoint sources of pollution and provides details on the type and location of BMPs that will best address the impairments detailed in the TMDL. The local watershed group in the Las Cruces area is Paso del Norte Watershed Council (PdNWC). PdNWC is currently in the process of engaging local stakeholders to discuss WRAS development and prioritize remediation efforts.

As stated previously, development of the TMDL and WRAS opens up funding opportunities through the Clean Water Act §319(h) program to implement BMPs in the watershed. Work plans developed and funded under CWA §319(h) comprise a variety of efforts; including watershed association development, pollutant source tracking, riparian area restoration, spill response, and treatment of abandoned mines. SWQB has and will continue to encourage BMP implementation through technical assistance during the development of the WRAS and during the development, implementation, and monitoring of CWA §319(h) projects.

NMED has used Fecals data from other sources, e.g. Howell et al. 1966. Did NMED, in their evaluation of point sources as a factor contributing to impairment, use Fecals data presented by the City of Las Cruces in technical testimony before the WQCC in Las Cruces during 9-10 October 2001? These data (attached) indicate that a WWTF in compliance with its NPDES permit is not a significant source of bacteria which would cause impairment. Samples were taken five of seven days of the week above and below the WWTF outfall which was also sampled during a total four months. We did not attempt to correlate rainfall events to the spikes in Fecals.

RESPONSE:
SWQB did not use the fecal coliform data presented by the City of Las Cruces for assessment purposes because the current water quality standard is for *E. coli*, not fecal coliform.

In reference to the TMDL Document, the evaluation of rainfall for the lowest segment of the Rio Grande should be done after data representing WWTFs in violation have been taken out of the data set. When this is done, the data in Figures 4.5 and 4.6 both show the same direct correlation of E. coli to rainfall events.

Margin of Safety (MOS, Sec 4.7) does not include an allowance for population/community growth, and in Sec. 4.9 "future growth [is] not anticipated to lead to a significant increase in bacteria that cannot be controlled with BMP implementation and appropriate NPDES permit limits in this watershed." Does this mean that NMED regards municipal WWTFs which are in compliance with their NPDES permits as not being a significant source of impairment, and this includes future growth? How would the TMDL affect municipal WWTF planned increases in design capacity to accommodate present and future growth?

The City of Las Cruces has begun construction to expand the design flow of the Jacob Hands WWTF from 8.9 to 13.5 MGD by equalizing flow through the addition of equalization basins to the present treatment trains. This would increase the WLA needed for the facility from 4.25×10^{10} cfu to ~~7.06×10^{10}~~ 6.25×10^{10} cfu throughout all flow conditions. This $ 12 million project is scheduled for completion in September 2008. Will the TMDL negatively impact this expansion to meet present and future growth of Las Cruces and the adjoining areas? Is an increase in the WLA to accommodate the greater design flow threatened?

RESPONSE:
New or expanding facilities will not see a change in their NPDES permits since the permits are written with a concentration limit only. All facilities in the Lower Rio Grande region will contain the same concentration limit of 126 cfu/100 mL. Writing permits in this manner does not allow competition between wastewater treatment plants, since all permits have the same concentration limit, but still allows room for future growth in this segment of the river.

The wasteload allocation (WLA) provided in the TMDL would be adjusted if and when a particular facility has an approved expansion. In the case of the City of Las Cruces WWTP, the extra load created from a 4.6 million gallon per day expansion, or 2.20×10^{10} cfu/day, would be added to the facility's WLA. Consequently, the load allocation would be reduced by 2.20×10^{10} cfu/day throughout all flow conditions.

We are concerned that the restrictions imposed on impaired segments with a TMDL may be an unfair burden to municipal point sources which are already in compliance with their NPDES permits. Municipal point sources have been too broadly and generically included as possible sources. Sufficient and appropriate enforcement measures could address those point sources that are not in compliance, if any at present. Excessive non-point loadings which are causing impairment could be more effectively dealt with by additional assessment to identify the most egregious sources and to implement BMP practices. A rifle shot or two and re-sighting is a more effective use of limited resources than a shotgun blast.

RESPONSE:
The probable source list provided in the TMDL is intended to include any and all activities that could be contributing to the identified impairment. It is not intended to single out any particular land owner or single land management activity, and has therefore been labeled "Probable" and generally includes several items. As stated in the TMDL, under Table 4.9, this list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time. It is up to the watershed group comprised of local stakeholders to determine the WRAS objectives and focus remediation efforts that will best address the impairments detailed in the TMDL. WRAS work plans comprise a variety of efforts; including watershed association development, pollutant source tracking, riparian area restoration, spill response, and treatment of abandoned mines.

Thank you. I hope these comments will encourage the development of the most cost-effective and environmentally sensible solutions to the problem of high levels of bacteria in the Rio Grande.

Comment Set B:
Mark Dubbin, P.E.
Las Cruces Public Works Department

(Sent via electronic mail)

Ms. Drinkard,

Thank you and the New Mexico Environment Department for conducting the study of the Rio Grande River in an effort to improve the water quality of our only river. In Regards to the study the City of Las Cruces has several concerns regarding the proposed TMDL for the Lower Rio Grande watershed.

- The number of samples taken along the river do not appear to be sufficient to make a conclusion regarding the "normal" levels of Escherichia coli bacteria (E.Coli.) present in the river. Standard Scientific methodology requires years of data taken at multiple intervals and then an evaluation of the data to determine its viability. Generally 8-10 samples are taken, high readings and low readings are discarded and mean is established, this does not appear to be consistent with the study.

RESPONSE:
A sampling frequency is determined based on the application of attainment criteria and human and budget resource constraints. SWQB does not require a specific minimum data set to make use attainment determinations. Beginning in 2002, a new sampling regime was begun. The new sampling regime was extended over an eight-month, three-season time period to better characterize the waterbody throughout most of the hydrograph and the associated variability. Each sampling station is generally visited monthly between March and October to achieve the "n" determined with the method described in Section 1.5 *Quality Objectives and Criteria for Measurement Data* of the quality assurance project plan (QAPP) (NMED/SWQB 2004). Since the QAPP is approved by EPA, the SWQB had sufficient and appropriate data to make attainment determinations, which is not the same as determining the "normal" levels of bacteria present in the river. SWQB agrees that it would be nice to collect water quality data as "standard scientific methodology" dictates (i.e. over multiple years and intervals), but the reality is that the resources are not available for SWQB to conduct such a study. Therefore, SWQB must do what it can with the resources it has according to what is deemed acceptable by EPA.

Reference:

NMED/SWQB. 2004. Quality Assurance Project Plan (QAPP) for Water Quality Management Programs, 2004. NMED/SWQB EPA QAPP QTRCK Number 04-088.

- The City of Las Cruces has only one direct storm water discharge to the Rio Grande, the Las Cruces Dam outfall channel. No samples were taken in this area to determine if contributions would impact the water quality, in fact, no discharge from the dam is believed to have occurred during the sampling period.
- As a Small MS4 (Phase II) the City of Las Cruces is not required to test storm water for quality. Visual inspection of storm water is the generally accepted method of evaluation. I would suggest to NMED that storm water discharges be sampled prior to assuming that there is some impact to the river.

- During a year with "normal" rainfall the City's storm water system will only discharge to agricultural drains that eventually lead to the river. The study specifically exempts pollution from agricultural sources while it seeks to assign urban runoff as a pollutant source. Hypothetically, if the City were to be required to spend millions of dollars in an effort to clean the storm water it would still discharge into a channel potentially loaded with agricultural pollution making no difference in the rivers' actual water quality.

RESPONSE:
The general permit for small municipal separate storm sewer systems (sMS4s) in New Mexico was issued on September 29, 2006. Seven municipalities in the Lower Rio Grande region fall under this general permit. According to 40 CFR § 130.2(h), NPDES-permitted stormwater must have a wasteload allocation (WLA), therefore the sMS4s in the Lower Rio Grande region will receive a categorical WLA under NPDES permit #NMR040000. EPA issued a joint NPDES/ TMDL memo which specifically addresses how NPDES regulated stormwater should be addressed in TMDLs. NPDES permits must be consistent with the assumptions and requirements of the WLA in a TMDL (40 C.F.R. § 122.44(d)(1)(vii)(B)). Accordingly, if an MS4 urbanized area did not receive a WLA in the TMDL, then the MS4 urbanized area would receive a "zero" WLA and would not be allowed to discharge.

Your comment above, "[as] a Small MS4 (Phase II) the City of Las Cruces is not required to test storm water for quality," is incorrect. Analytical monitoring is required for discharges into impaired waters (refer to parts 5.6.1.2 and 5.6.2 of the small MS4 permit issued on September 29, 2006). According to EPA's TMDL Stormwater Policy, the NPDES permit must specify the monitoring necessary to determine compliance with the given effluent limitation (40 CFR §122.144(i)). In instances in which the effluent limitation is expressed as BMPs, the permit must specify the monitoring necessary to determine if load reductions are achieved. Return flows by themselves should not contribute bacteria. It is most likely a combination of sources that are contributing to the bacterial loading in agricultural drains. The bacterial loading from these diverse sources are (or should be) controlled via the NPDES program, the Nonpoint Source Program, or others.

- There is no biological source study to support assumptions for the supposed urban influence to the E.Coli. levels. Although cattle are grazed along the entire length of the river the study assumes that this is insignificant and that spending millions to control undetermined sources is the solution.
- No hydrology was used to attribute a source to the few samples taken in proximity of rain events. Well utilized engineering methodology takes into account the time taken for a rain event to reach a particular point downstream however this was not considered at all.

RESPONSE:
One of the program elements incorporated into the MS4 operator's storm water management program (SWMP), which was developed to comply with the sMS4 permit, may be conducting a biological source study. The sMS4 permit requires that an MS4 operator document compliance with a TMDL and incorporate measures or controls necessary to comply with assumptions and requirements of the wasteload allocation defined in the TMDL. NMED has been suggesting that this may entail developing a program similar to that included in the NPDES permit for the large MS4 permit issued to Albuquerque (http://www.nmenv.state.nm.us/swqb/PSRS/NPDES_Permits/NMS000101-AlbuquerqueMS4.pdf).

The probable source list provided in the TMDL is intended to include any and all activities that may be contributing to the identified impairment. It is not intended to single out any particular land owner or single land management activity, and has therefore been labeled “Probable” and generally includes several items. As stated in the TMDL, under Table 4.9, this list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time. It is up to the watershed group comprised of local stakeholders to determine the WRAS objectives and focus remediation efforts that will best address the impairments detailed in the TMDL. The local watershed group in the El Paso/Las Cruces area is Paso del Norte Watershed Council (PdNWC).

This summary mentions but a few points and only then to raise the awareness of some of the flaws contained in the study. Answers to these questions will require years of solid results and impartial evaluation of the data. The City of Las Cruces is willing to assist NMED’s efforts to improve the water quality, but realizes that the preliminary evidence must support the spending of significant tax revenues to maximize the public benefit that such an endeavor would entail.

Regards,

Mark H. Dubbin, P.E.
Public Works Department
575 S. Alameda
Las Cruces, NM 88005
Office: (505) 528-3171 Fax: (505) 528-3036

Comment Set C:
Rebecca G. Perry- Piper
(PDF of letter received inserted)

March 9, 2007
135 Rincon Valverde
Ponderosa, NM 87044

Ms Shelly Drinkard
New Mexico Environment Department
Surface Water Quality Bureau
Harold Runnels Building Room N2109
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502-6110

Dear Ms Drinkard,

I hope that you are well.

As I intend to appear and present on April 10, 2007 when New Mexico Water Quality Control Commission will hold a public hearing to consider proposed amendments to 20.6.4 NMAC at the State Capitol, at 9:00 A.M., I feel that it is extremely important to also appear and present, additionally, during WQCC's considering approval of the Final Draft TMDL for the Lower Rio Grande (Texas Border to Elephant Butte Dam). To promote transparency, I am submitting the written form of my non-technical oral public comment to you.

Mailed 3-10-07
USPS 7006 0100 0003 0064 1240
CMR

March 9, 2007

What I intend to say, either on April 10 or 11, 2007, before NMWQCC, in the Roundhouse, concerning Agenda Item #4, as of a March 6, 2007 copy of same sent to me by Administrator Medina, is as follows:
-beginning-

"New Mexico Environment Department is continuing to allow its Commission/Board to place undue hardship upon the public-at-large wishing to participate in information gathering, substantively commenting and perhaps initiating due-process procedure during the crafting of TMDL documents for New Mexico waterbody identifiors' watersheds. Ironically, the basic qualifier for funding this crafting is public participation. ~~From March 11, 2007 to April 1, 2007 (Albuquerque Journal February 14, 2007, 'Your PC Might Not Spring Forward') computers, running on programs older than 2005 or lacking original vendor support might present erroneous information~~

[illegible] Perry-Ryan, USPS 7006 0100 0003 0064 1240 CMR
Mailed 3-10-07

March 9, 2007

~~about physical-world appointments due to daylight savings time starting three weeks earlier. There is a copy of this article enclosed herein.~~

Enclosed Albuquerque Journal legal, February 26, 2007, "The New Mexico Environment Department Surface Water Quality Bureau Propose Total Maximum Daily Loads (TMDLs) For The Lower Rio Grande Watershed", omitted ~~omits~~ a specific date and time for the public meeting to be held to summarize relevant information and provide comments. Additionally, nowhere in aforementioned February 26, 2007 Albuquerque Journal legal was ~~is~~ it specifically stated that interested parties could ~~can~~ be surface-mailed hardcopy draft (not the final draft) versions of Total Maximum Daily Load (TMDL) for the Lower Rio Grande Watershed (defined as from the Texas Border to Elephant Butte Dam) which includes E coli: Rio Grande (Texas Border to ~~Leasburg~~ Leasburg Dam) and E coli: Rio Grande (Leasburg Dam to Percha Dam) prior to the

Rebecca J. "Jeff" Peng-Piper
mailed 3-10-07
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technically, undisclosed "mid-March" public meeting; about same TMDL document; in Las Cruces, by writing to NMEDSWQB Shelly Drinkard. Further, interested parties may have felt ~~feel~~ communicatively intimidated upon . . . their having read ~~when reading~~ the phrase, '(if possible, please submit an electronic copy in addition to paper)', contained in said legal, Albuquerque Journal, February 26, 2007.

~~New Mexico Environment Department needs to rectify this grave communicative situation by publishing another legal, with all due respect, immediately in the Albuquerque Journal, stating the date and time of the Las Cruces public meeting on draft TMDL document Lower Rio Grande, making it more clear to the public that a draft TMDL document now exists and the contact name and physical address they can write to in order to obtain one prior to the Las Cruces public meeting.~~

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Ms Drinkard dutifully attempted to rectify said situation, on March 5, 2007, by responding (enclosed) to the receiving of my comment of March 2, 2007. In doing so, she reinforced my belief that the existence of the draft TMDL document (cover enclosed titled "*** Draft ***", not "Final Draft", but with unprecedented asterisks around the word "Draft" as evidenced in, also enclosed, title of Draft Total Maximum Daily Load (TMDL) For The San Juan River Watershed (Part Two) Navajo Nation Boundary At The Hogback To Navajo Dam September 23, 2005) for the Lower Rio Grande was not appropriately made accessible to all of the interested public-at-large in the February 26, 2007 legal, aforementioned. In Ms Drinkard's March 5, 2007 correspondence, a flyer (enclosed), announcing the public meeting, evidenced that the information on the date and time of the public meeting on the draft TMDL document for the Lower Rio Grande was known as early as February 23, 2007 and said information should have been

USPS 7006 0100 0003 0064 1240 CMK Peter D. "Ind" Perry-Ryan
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disclosed in the aforementioned February 26, 2007 legal. This communicative situation, in its entirely, was yet another example of how SWQB had not, and has not, ensured that members of the public-at-large who choose to obtain vital announcements through their state newspaper, hardcopy surface-delivered version, rather than electronically generated in their own homes or schools/libraries/offices, are being discriminated against. Additionally, the information in the legal, February 26, 2007, can be assumed to have been accessible three days later than a posting by some other manner, either in a contrived, regionally exclusive or communicatively exclusive manner.

As remarked upon earlier, ~~T~~the leaving of the time and date for the public's chance to gain substantiveness prior to comment is omitted in the legal. It is only to be gained in a narrow and unpredictable manner between March 11, 2007, and April 1, 2007, especially if a member of the public-at-large can only access computers operating on programs developed before 2005

Repeatedly "split" Perry-Ryan
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or that are no longer under contract to an original vendor. The contact person name, fax number, telephone number, email address, and zip code, ~~have~~ had been omitted from information concerning Las Cruces City Hall, preventing the public from conveniently enquiring about the scheduling of the "mid-March" public meeting. Additionally, the legal of February 26, 2007 does not document that the public servants in Las Cruces have been coordinated through SWQB to readily provide information on this mid-March public meeting should they be contacted by an enquiring citizen.

The participation of the public in this aforedescribed process can be interpreted ~~is~~ to only be expected to be timely, not substantive, ~~the participation of SWQB in this process, again, is only expected to be timely, not substantive.~~ in the manner that ~~t~~The texting of this February 26, 2007 Albuquerque Journal legal ~~lays this out in the manner it announces~~ announced the public participation process involved in the finalization

Rebecca J. "Kat" Kemp - [illegible]
Mailed 3-10-07

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of this TMDL document. Substantiveness of public comment ~~is~~ was never mentioned, never clearly provided for. Neither ~~is~~ was it made clear that the lack of substantiveness in submitted comments on said TMDL document will be grounds for dismissal of same submitted comments. Timeliness, not substantiveness ~~is~~ was mandated; comment before scoping, scoping after comment; when the public-at-large gathers.

I would also like to ask the WQCC, again, as I did in response to the fragmentation of the Jemez River System on August 8, 2006, to refrain from approving any TMDL document on the Rio Grande Watershed until NMEDSWQB has presented, simultaneously, all of the TMDL documents it will complete. ~~(for example, simultaneously viewing completed TMDL documents for the Lower Rio Grande Watershed, at the same time as the Middle Rio Grande Watershed, as well as at the same time as the Upper Rio Grande Watershed [encompassing flows from the Colorado border to the Texas border]).~~ With

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all due respect to all involved, WQCC should simultaneously review all TMDL documents for:

1.) Rio Grande (Red River to New Mexico-Colorado border),

2.) Rio Grande (Red River to Taos Pueblo Boundary),

3.) Rio Grande (Taos Pueblo Boundary to Embudo Creek),

4.) Rio Grande (Embudo Creek to San Juan Pueblo Boundary),

5.) Rio Grande (San Ildefonso Pueblo Boundary to Cochiti Pueblo Boundary),

6.) Rio Grande (Cochiti Pueblo Boundary to Santa Domingo Pueblo Boundary),

7.) Rio Grande (Santa Ana Pueblo Boundary to Sandia Pueblo Boundary),

8.) Rio Grande (Sandia Pueblo Boundary to Isleta Pueblo Boundary),

9.) Rio Grande (Isleta Pueblo Boundary to Río Puerco [Bernardo]),

10.) Rio Grande (Río Puerco [Bernardo] to Rio Salado [San Acacia]),

11.) Rio Grande (Rio Salado [San Acacia] to La Percha Dam),

12.) Rio Grande (La Percha Dam to Elephant Butte), and

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13.) Rio Grande (Elephant Butte to the Texas Border). This way, the interrelationship of all tributaries and the main stem, that could be legally surveyed in honoring tribal sovereignty, of the Rio Grande can be viewed as one comprehensive TMDL in a holistic model.

I assert that NMEDSWQB is purposely denying New Mexicans their right~~s~~ to publicly participate in developing ~~this~~ a comprehensive TMDL document; on all the measurable assessment units of the Upper, Middle and Lower Rio Grande Watersheds combined into the Rio Grande Watershed; while receiving Clean Water Act funding that is based upon equal access for any member of the public-at-large to participate, both in a timely and a substantive manner. WQCC needs to refuse SWQB's TMDL document on the Lower Rio Grande Watershed (Texas Border to La Percha Dam) being approved until ~~it~~ this TMDL document on the

Repeat of "Spirit Ring" -Ryan
Mailed 3-10-07

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~~Lower~~ Rio Grande Watershed is substantive. WQCC must approve a Rio Grande Watershed TMDL that is truly substantive in its degree of public participation allowed and in its allocation of data being corroborated with analysis of best management practices' impact arising out of the allocated data. Fragmentation prevents this."

-end-

Respectfully,

Rebecca G. "Gert" Perry-Piper

(P.S.: I have not sent 15 copies of this revised non-technical oral public comment, for pre-hearing review, to Administrator Medina to share with WQCC. I sent a letter.)

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Mailed 3-10-07

RESPONSE:

Thank you for your continued dedication to water quality in the state of New Mexico. As you requested, a copy of the updated TMDL that will include Appendix D *Response to Comments* will be sent to you at least 10 days before the May 8, 2007 meeting at which SWQB expects to request approval of the Main Stem of the Lower Rio Grande (International Boundary with Mexico to Elephant Butte Dam) TMDL. Responses to your concerns are detailed below.

Public participation was solicited in development of this TMDL as stated in the Public Participation Flowchart in Appendix C. The draft TMDL was made available for a 45-day comment period starting on February 23, 2007. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and public notices to area newspapers. The draft document notice of availability was also mailed or emailed to approximately 394 addresses and the TMDL was made available to the public via the SWQB web site, at the public meeting in Las Cruces, and upon request.

As you pointed out on page 3 of your March 9th letter, the public notice originally published in the Santa Fe New Mexican, the Albuquerque Journal, and the Las Cruces Sun-News mistakenly omitted the date and time of the public meeting for this TMDL. In response to this error, SWQB published additional notices and advertisements in the Legal section, Community Calendar, & Local News section of the local area newspaper, the Las Cruces Sun-News. A flyer announcing the date and time of the public meeting was also posted in Las Cruces businesses and local public offices. The public meeting for this TMDL was held in Las Cruces on March 13, 2007. All public meeting notices were mailed to the SWQB mailing list prior to the meeting. Responses to public comments were attached as Appendix D of the TMDL.

SWQB does not exclude or discriminate against anyone from participating in the public participation process. Public notices, however, are generally printed in local papers and posted in local places of note in order to solicit the local interest. Any member of the public is welcome to submit their name and contact information to SWQB in order to be included in statewide mailings, either through electronic mailings or regular post mailings. Many of SWQB's core documents are made available to the public via the SWQB website, but the Bureau is always willing to provide information via phone calls or surface mail.