USEPA-APPROVED

TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR THE
SACRAMENTO MOUNTAINS
[RIO HONDO, TULAROSA, AND RIO PEÑASCO WATERSHEDS]

September 21, 2015

Prepared by

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COVER PHOTO: Rio Peñasco below Helena Road, August 2012. Scott Murray-NMED/SWQB.

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4Q3	4-Day, 3-year low-flow frequency
AU	Assessment Unit
BLM	Bureau of Land Management
BMP	Best management practices
BST	Bacterial Source Tracking
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Coliform forming units
CGP	Construction general storm water permit
CWA	Clean Water Act
^{o}C	Degrees Celsius
DO	Dissolved Oxygen
EQIP	Environmental Quality Incentive Program
^{o}F	Degrees Fahrenheit
HUC	Hydrologic unit code
j/m^2/s	Joules per square meter per second
km^2	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
MASS	Monitoring, Assessment and Standards Section
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
MOS	Margin of safety
MOU	Memorandum 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
NRCS	Natural Resource Conservation Service
NTU	Nephelometric Turbidity Units
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SEE	Standard Error of the Estimate
SEV	Severity of Ill Effect
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen

TP	Total Phosphorous
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WBS	Watershed-based plan
WQCC	Water Quality Control Commission
WQS	Water quality standards
WQX	Water quality exchange
WWTP	Wastewater treatment plant

EXECUTIVE SUMMARY

Under Section 303(d) of the Federal Water Pollution Control Act , a.k.a., Clean Water Act ("CWA"), 33 U.S.C. §§ 1251 to 1388, states establish water quality standards which are submitted and subject to the approval of the U.S. Environmental Protection Agency ("USEPA"). 33 U.S.C. §1313[1]. The CWA requires states to develop Total Maximum Daily Load ("TMDL") management plans for water bodies determined to be impaired. *Id*. 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 that a waterbody can assimilate without exceeding the state's water quality standard for that waterbody and allocates loads to known point sources and nonpoint sources. It further identifies potential methods, actions, or limitations that could be implemented to achieve water quality standards. "Total Maximum Daily Load" is defined as the sum of the individual Waste Load Allocations ("WLA") for point sources and Load Allocations ("LA") for nonpoint source and background conditions. (see 40 C.F.R. §130.2(i))[2]. TMDLs also include a Margin of Safety ("MOS"), a required component that acknowledges and counteracts uncertainty.

The New Mexico Environment Department ("NMED") Surface Water Quality Bureau ("SWQB") conducted water quality surveys of the Sacramento Mountains in 2012. Water quality monitoring stations were located within the watersheds to evaluate ambient water quality conditions and the impact of tributary streams. As a result of assessing data generated during these monitoring efforts, the following impairments of water quality standards were found:

- *E.coli* for Carrizo Creek (Rio Ruidoso to Mescalero Apache boundary), Rio Bonito (NM 48 near Angus to headwaters), Nogal Creek (Tularosa Creek to Mescalero Apache boundary), Rio Ruidoso (Eagle Creek to US Hwy 70 bridge), and Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek).
- Turbidity for Agua Chiquita (perennial portions McEwan Canyon to headwaters), Rio Peñasco (Hwy 24 to Cox Canyon), and Rio Ruidoso (Eagle Creek to US Hwy 70 bridge).

This TMDL addresses the above impairments as summarized in Tables ES1 – ES7. The 2012 field studies identified other potential water quality impairments which are not addressed in this document due to additional data needs, assessment protocol revisions or re-application, or impending use attainability analyses. If additional impairments are verified or found, subsequent TMDLs will be developed for those impairments. SWQB prepared TMDLs in 2006 for portions of these watersheds including: TMDLs for *E.coli* on Carrizo Creek, Rio Bonito, and Rio Hondo; as well as TMDLs for plant nutrients, temperature, and turbidity on the Rio Ruidoso.

SWQB's Monitoring, Assessment, and Standards Section ("MASS") will next collect water quality data in the Sacramento Mountains in 2020. TMDLs will be re-examined and potentially revised at that time as this document is considered to be an evolving management plan. In the

[1] http://www.epw.senate.gov/water.pdf

[2] http://www.gpo.gov/fdsys/pkg/CFR-2002-title40-vol18/pdf/CFR-2002-title40-vol18-part130.pdf

event that the new data indicate that the targets used in the analyses are not appropriate and/or if new standards are adopted, the TMDLs will be adjusted accordingly. When attainment of applicable water quality standards has been achieved, the impairment will be removed from New Mexico’s CWA §303(d) List of Impaired Waters.

SWQB’s Watershed Protection Section will continue to work with watershed groups to develop Watershed-Based Plans (“WBPs”) to implement strategies that attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the WBP will be done with participation of all interested and affected parties. Further information on WBPs is in Section 8.

ES1. TOTAL MAXIMUM DAILY LOAD FOR AGUA CHIQUITA (PERENNIAL PORTIONS MCEWAN CANYON TO HEADWATERS)

New Mexico Standards Segment	20.6.4.208 NMAC
Waterbody Identifier	NM-2208_01
Segment Length	22.87 miles
Parameters of Concern	Turbidity
Uses Affected	Coldwater Aquatic Life
Geographic Location	Rio Peñasco USGS Hydrologic Unit Code 13060010
Land Type	Arizona/New Mexico Mountains (Ecoregion 21f)
Probable Sources	Bridges/culverts/railroad crossings, channelization, drought-related impact, highway/road/bridge runoff, legacy logging operations, paved roads, gravel or dirt roads, pavement/impervious surfaces, rangeland grazing, residences/buildings.
IR Category	5
Priority Ranking	High
TMDL for: Turbidity	**WLA + LA + MOS = TMDL**

Duration (consecutive hrs)	WLA (lbs/day)*	LA (lbs/day)	MOS (15%) (lbs/day)	TMDL (lbs/day)
720	0	33.06	5.83	38.90
336	0	44.71	7.89	52.60
168	0	56.73	10.01	66.75
144	0	59.74	10.54	70.28
120	0	65.37	11.54	76.91
96	0	71.39	12.60	83.98
72	0	80.03	14.12	94.15

ES2. TOTAL MAXIMUM DAILY LOAD FOR CARRIZO CREEK (RIO RUIDOSO TO MESCALERO APACHE BOUNDARY)

New Mexico Standards Segment	20.6.4.209 NMAC
Waterbody Identifier	NM-2209.A_22
Segment Length	2.03 miles
Parameters of Concern	*E.coli*
Uses Affected	Primary Contact
Geographic Location	Rio Hondo USGS Hydrologic Unit Code 13060008
Land Type	Arizona/New Mexico Mountains (Ecoregion 21f)
Probable Sources	Bridges/culverts/railroad crossings, channelization, highway/road/bridge runoff, on-site treatment systems, paved roads, pavement/impervious surfaces, residences/buildings, site clearance, urban runoff/storm sewers, storm water runoff due to construction, waterfowl.
IR Category	5
Priority Ranking	High
TMDL for: *E.coli*	**WLA + LA + MOS = TMDL** 0 + 4.87×10^8 + 8.6×10^7 = 5.73×10^8 cfu/day

ES3. TOTAL MAXIMUM DAILY LOAD FOR NOGAL CREEK (TULAROSA CREEK TO MESCALERO APACHE BOUNDARY)

New Mexico Standards Segment	20.6.4.801 NMAC
Waterbody Identifier	NM-2801_10
Segment Length	4.08 miles
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Tularosa Valley USGS Hydrologic Unit Code 13050003
Land Type	Arizona/New Mexico Mountains (Ecoregion 23b)
Probable Sources	Bridges/culverts/railroad crossings, gravel/dirt roads, highway/road/bridge runoff, on-site treatment systems, paved roads, pavement/impervious surfaces, rangeland grazing, residences/buildings, wildlife other than waterfowl.
IR Category	5
Priority Ranking	High
TMDL for: *E. coli*	**WLA + LA + MOS = TMDL** 0 + 1.38×10^9 + 2.44×10^8 = 1.62×10^9 cfu/day

ES4. TOTAL MAXIMUM DAILY LOAD FOR RIO PEÑASCO (HIGHWAY 24 TO COX CANYON)

New Mexico Standards Segment	20.6.4.208 NMAC
Waterbody Identifier	NM-2208_00
Segment Length	34.67 miles
Parameters of Concern	Turbidity
Uses Affected	Coldwater Aquatic Life
Geographic Location	Rio Peñasco USGS Hydrologic Unit Code 13060010
Land Type	Arizona/New Mexico Mountains (Ecoregion 23f)
Probable Sources	Angling pressure, bridges/culverts/railroad crossings, channelization, dams/diversions, dredging, drought-related impacts, fish stocking, flow alteration, highway/road/bridge runoff, irrigated crop production, irrigation return drains, legacy logging operations, paved roads, gravel/dirt roads, pavement/impervious surfaces, rangeland grazing, wildlife other than waterfowl.
IR Category	5/5A
Priority Ranking	High
TMDL for: Turbidity	**WLA + LA + MOS = TMDL**

Duration (consecutive hrs)	WLA (lbs/day)*	LA (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
720	0	351.36	39.04	390.40
336	0	494.17	54.91	549.07
168	0	636.97	70.77	707.75
144	0	673.24	74.80	748.05
120	0	743.51	82.61	826.13
96	0	813.79	90.42	904.21
72	0	920.33	102.26	1,022.58

ES5. TOTAL MAXIMUM DAILY LOAD FOR RIO BONITO (NM 48 NEAR ANGUS TO HEADWATERS)

New Mexico Standards Segment	20.6.4.209 NMAC
Waterbody Identifier	NM-2209.A_10
Segment Length	12.98 miles
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Rio Hondo USGS Hydrologic Unit Code 13060008
Land Type	Arizona/New Mexico Mountains (Ecoregion 23f)
Probable Sources	Bridges/culverts/railroad crossings, dams/diversions, fire suppression, flow alteration, highway/road/bridge runoff, legacy logging operations, paved roads, gravel/dirt roads, pavement/impervious surfaces, recent overbank flows. watershed runoff following forest fire.
IR Category	5/5C
Priority Ranking	High
TMDL for: *E. coli*	**WLA + LA + MOS = TMDL** 0 + 1.87×10^9 + 3.30×10^8 = 2.20×10^9 cfu/day

ES6. TOTAL MAXIMUM DAILY LOAD FOR RIO RUIDOSO (US HWY 70 BRIDGE TO CARRIZO CREEK)

New Mexico Standards Segment	20.6.4.209 NMAC
Waterbody Identifier	NM-2209.A_21
Segment Length	7.58 miles
Parameters of Concern	*E.coli*
Uses Affected	Primary contact, High Quality Coldwater Aquatic Life
Geographic Location	Rio Hondo USGS Hydrologic Unit Code 13060008
Land Type	Arizona/New Mexico Mountains (Ecoregion 23f)
Probable Sources	Bridges/culverts/railroad crossings, CAFO, channelization, drought-related impacts, dumping/garbage/litter/trash, highway/road/bridge runoff, inappropriate waste disposal, livestock grazing, municipal point source discharge, paved road, gravel/dirt roads, pavement/impervious surfaces, rangeland grazing, residences/buildings, stream channel incision, urban runoff/storm sewers, waste from pets, waterfowl, watershed runoff following forest fire.
IR Category	5/5C
Priority Ranking	High
TMDL for: *E.coli*	**WLA + LA + MOS = TMDL** 0 + 4.34×10^9 + 4.82×10^8 = 4.82×10^9 cfu/day

ES7. TOTAL MAXIMUM DAILY LOAD FOR RIO RUIDOSO (EAGLE CREEK TO US HWY 70 BRIDGE)

New Mexico Standards Segment	20.6.4.208 NMAC
Waterbody Identifier	NM-2208_20
Segment Length	8.24 miles
Parameters of Concern	*E.coli*, Turbidity
Uses Affected	Primary contact, High Quality Coldwater Aquatic Life
Geographic Location	Rio Hondo USGS Hydrologic Unit Code 13060008
Land Type	Arizona/New Mexico Mountains (Ecoregion 23b)
Probable Sources	Channelization, drought-related impacts, gravel/dirt roads, surface films/odors, mass wasting, on-site treatment systems, pavement/impervious surfaces, residences/buildings, stream channel incision, waterfowl, watershed runoff following forest fire.
IR Category	5/5A
Priority Ranking	High
TMDL for:	**WLA + LA + MOS = TMDL**
E.coli	$1.29 \times 10^{10} + 3.05 \times 10^{9} + 1.77 \times 10^{9} = 1.77 \times 10^{10}$ cfu/day

Turbidity

Duration (consecutive hrs)	WLA (lbs/day)	LA (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
720	418.83	99.12	57.55	575.51
336	531.42	125.77	73.02	730.22
168	653.02	154.55	89.73	897.30
144	684.55	162.01	94.06	940.62
120	749.85	177.46	103.03	1,030.35
96	815.15	192.92	112.01	1,120.08
72	920.99	217.97	126.55	1,265.50

1.0 INTRODUCTION

This document provides TMDLs for stream segments within the Sacramento Mountains that have been determined to be impaired based on a comparison of measured concentrations and conditions with numeric water quality criteria or with 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 Sacramento Mountains, 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 Sacramento Mountains in 2012. Section 3.0 provides *E. coli* TMDLs; Section 4.0 contains plant nutrient TMDLs; Section 5.0 contains total phosphorus TMDLs; and Section 4.0 contains turbidity TMDLs. Pursuant to CWA §106(e)(1), 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 WBPs. Section 7.0 discusses assurance; Section 8.0 discusses public participation in the TMDL process; and Section 9.0 provides references.

2.0 SACRAMENTO MOUNTAIN CHARACTERISTICS

The watersheds in the Sacramento Mountains were sampled by SWQB from April to October 2012 (NMED/SWQB 2012b). Surface water quality monitoring stations were selected to characterize water quality of perennial stream reaches of the Sacramento Mountains. Information regarding previous sampling efforts by SWQB in the Sacramento Mountains is detailed in the Sacramento Mountains Field Sampling Plan (NMED/SWQB 2012b) available on the SWQB website. A number of water quality impairments identified during this survey are addressed in this document.

2.1 Location Description

The watersheds within the Sacramento Mountains (U.S. Geological Survey [USGS] Hydrologic Unit Code [HUC] 13060003, 13060008, and 13060010) are located in south central New Mexico. The Rio Hondo, Rio Peñasco, and Tularosa watersheds encompass approximately 9,329 square miles and extend over portions of Lincoln, Chaves, and Otero Counties. The watersheds in the Sacramento Mountains are located in Omernik Level III Ecoregion 23b and 23f (Arizona/New Mexico Mountains).

As presented in **Figure 2.1**, the Tularosa Valley HUC (13060003) land use is 79% rangeland, 14% forest, and 6% barren. **Figure 2.2** shows ownership as 30% private, 26% BLM, 16% U.S. Forest Service ("USFS"), 9% State, 8% Tribal, 3% National Park Service, and 1% U.S. Fish and Wildlife Service. Federally listed threatened and endangered species include the Pecos Bluntnose Shiner, Rio Grande Silvery Minnow, Pecos Gambusia, and the Mexican Spotted Owl.

As presented in **Figure 2.1**, the Rio Hondo HUC (13060008) land use is 55% rangeland, 40% forest, 4% agriculture, and 2% built-up. **Figure 2.2** shows ownership as 57% private, 18% USFS, 11% Tribal, 10% Bureau of Land Management ("BLM"), an 4% State. Federally listed threatened and endangered species include the Pecos Bluntnose Shiner, Chihuahua Chub, Rio Grande Silvery Minnow, Pecos Gambusia, Mexican Spotted Owl, Pecos Sunflower, Kuenzler's Hedgehog Cactus, Pecos Assiminea, Koster's Springsnail, and the Roswell Springsnail.

As presented in **Figure 2.1**, the Rio Peñasco HUC (13060010) land use is 58% forest, 40% rangeland, and 2% agriculture. **Figure 2.2** shows ownership as 38% USFS, 29% private, 11% State, 11% BLM, and 10% Tribal. Federally listed threatened and endangered species include the Chihuahua Chub, Mexican Spotted Owl, Southwestern Willow Flycatcher, Sacramento Mountains Thistle, and the Kuenzler's Hedgehog Cactus.

According to the Smokey Bear Ranger District in the Lincoln National Forest, the White Fire burned 10,361 acres from Trash and Lookout Canyons to Lone Pine Canyon in the Sacramento Mountains adjacent to the Village of Ruidoso and Highway 70 in April 2011 (Smokey Bear Ranger District 2011). The Little Bear Fire burned approximately 44,330 acres in the White Mountain Wilderness and the mountains adjacent to the communities of Ruidoso, Alto, and Angus in June 2012 (Smokey Bear Ranger District 2012).

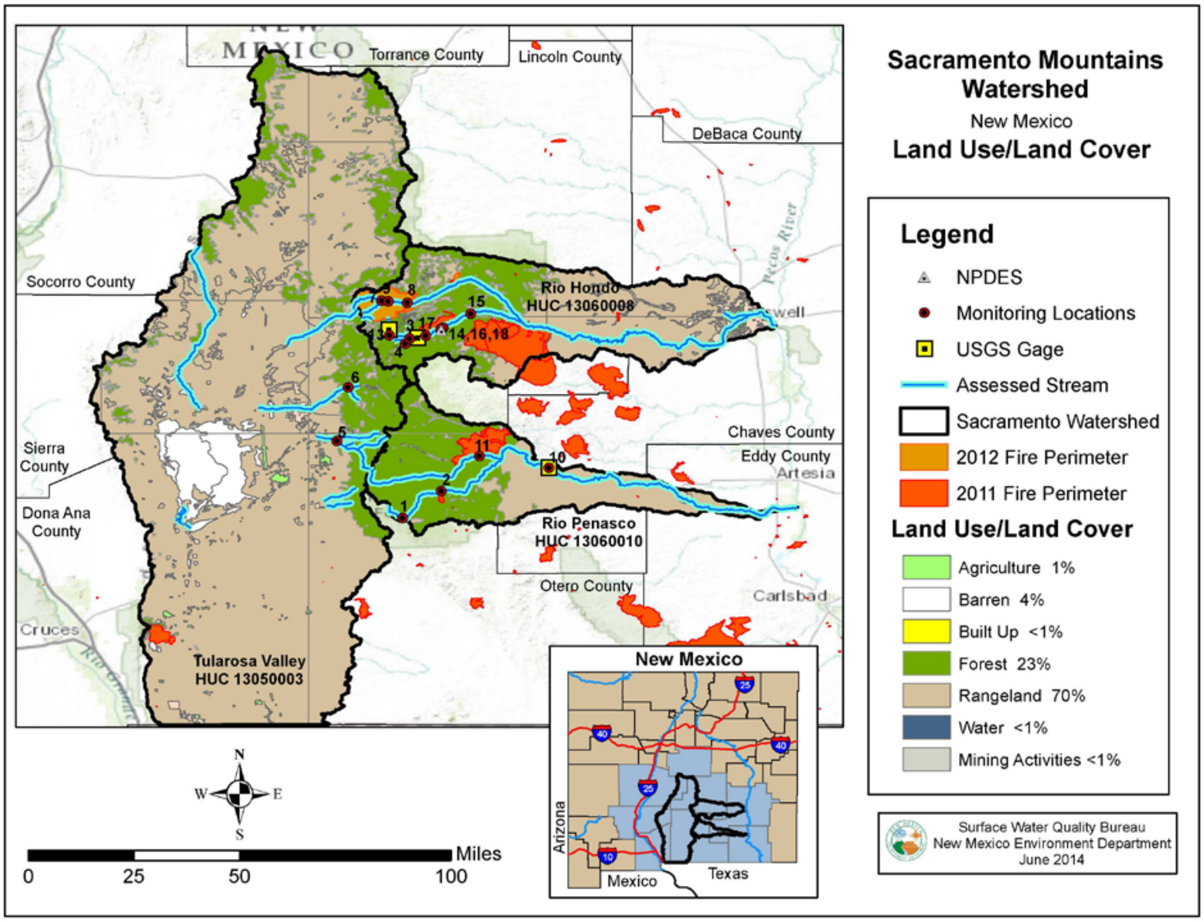

Figure 2.1 Land Use and 2012 Sampling Stations in the Sacramento Mountains. See Table 2.1 for station information.

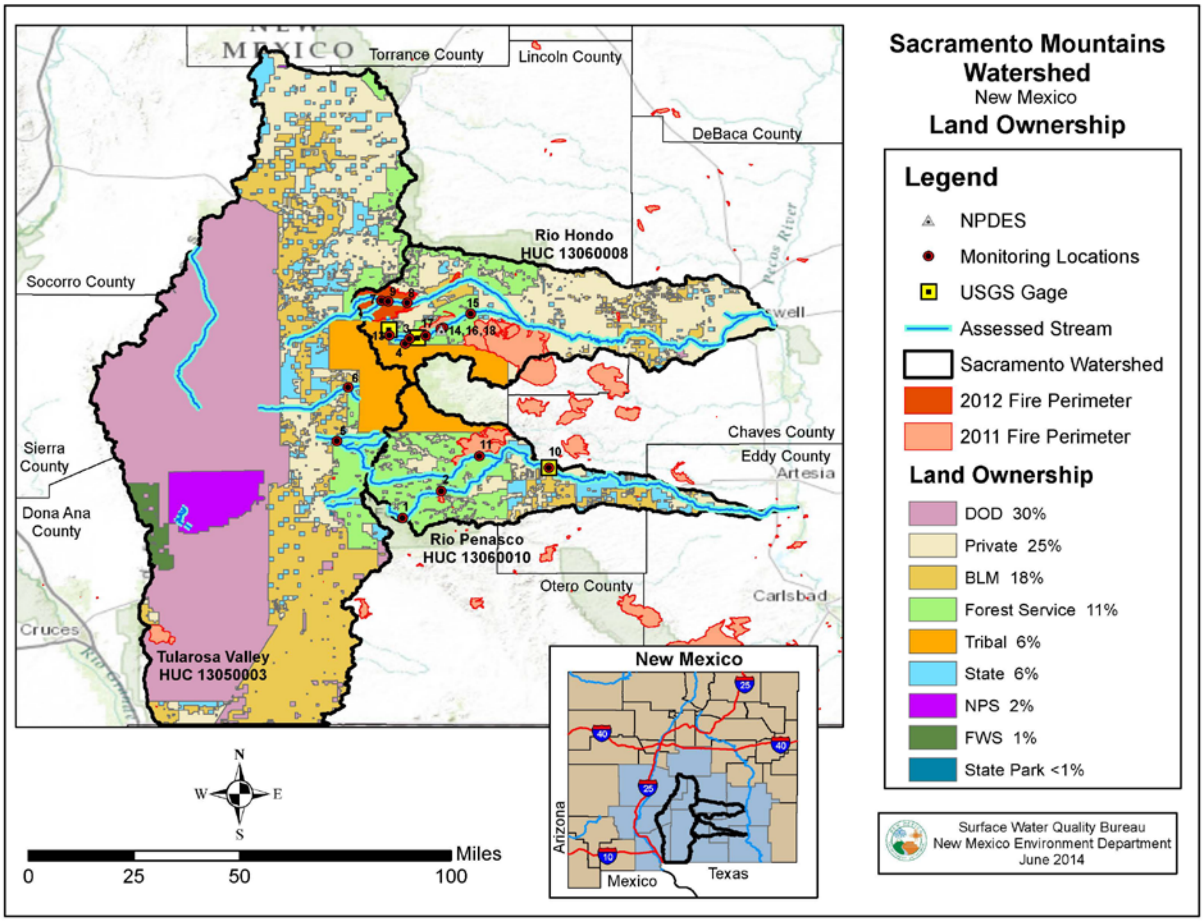

Figure 2.2 Land Management and 2012 Sampling Stations in the Sacramento Mountains Watershed

2.2 Geology and History

The geology of the Rio Hondo watershed consists of a complex distribution of Cretaceous intrusive rocks, Permian sedimentary rocks, and Cretaceous sedimentary rocks (Table 2.1, Figure 2.3). The high dome of Mt Sierra Blanca is an intrusion of Tertiary igneous rocks associated with many nearby faults and dikes (Chronic 1987). Sierra Blanca is separated from the smaller Tertiary intrusions of the Carrizo and Capitan Mountains by the valley of soft, Cretaceous shale around its north end (*Ibid*). The Cenozoic igneous rocks of Sierra Blanca and the northwestern part of the Mescalero Apache Reservation include intrusive plugs, stocks, and dikes of the Sierra Blaca volcanic pile (Ahlen and Hanson 1986). Breccias and purplish-green porphyrys are commonly exposed on Sierra Blanca towards the Ski Area on Sierra Blanca Peak (*Ibid*). Cenozoic rocks are also exposed on Sierra Blanca that include igneous intrusive, volcanic, and sedimentary rocks (*Ibid*). There are also glacial deposits in the cirque on the northeast slopes of the Peak at the head of the North Fork of the Rio Ruidoso (*Ibid*). San Andres Limestone forms the surface between Tularosa and Ruidoso; the stream valleys in this watershed cut down into the red and yellow soil zone of the Yeso Formation (Chronic 1987). Cub Mountain Formation consists of white sandstone, multicolored siltstone, and light-colored igneous rocks (Ash and Davis 1964). The Yeso formation consists of beds of siltstone, sandstone, shale, limestone, anhydrite, gypsum, and salt and does not readily transmit water (Mourant 1963). The Yeso Formation was formed by the precipitation of gypsum and salt from an evaporating inland sea (Chronic 1987). The San Andres Limestone forms the aquifer for Roswell's water (*Ibid*). The upper part of the San Andres Limestone consists of dolomite and chert-limestone, as well as siltstone, sandstone, gypsum, anhydrite, and shale. The Artesia Formation consists of similar sedimentary rocks (Mourant 1963). The Cretaceous Dakota Sandstone consists of quartzose sandstone interbedded with grey shale and conglomerate (*Ibid*). Mancos Shale is black shale, limestone and sandstone while the Mesaverde Formation is grey, yellow, and buff quartzose sandstone, grey shale, and coal (*Ibid*).

Mining activity in Lincoln County has produced a number of minerals and metals including: gold, coal, iron, lead, copper, zinc, fluorite, gypsum, tungsten, and bastnaesite (Griswold 1959). Spaniards likely performed the earliest mining in Lincoln County, but no evidence of their activity exists (*Ibid*). However, the first mining in Lincoln County by Americans appears to be a gold vein at the Helen Rae and American mines in 1868 (*Ibid*).

Three Rivers Petroglyphs (west of Sierra Blanca) is a mile-long display of pictures carved into the volcanic rock mostly made by prehistoric Native Americans and may be contemporary with the nearby Mimbres site dating from 900-1,000 A.D. (Ash and Davis 1964). Hale Springs (south of Ruidoso Downs) once fed a Native American irrigation ditch and the caliche formed in this ditch is used to line the driveways in the area (Ash and Davis 1964). One of the first battles of the Lincoln County War occurred at Blazer's Mill (southwest of Ruidoso) on April 5, 1878 when Billy the Kid and the McSween faction attempted to make an arrest (Ash and Davis 1964). The 116-mile Bonito pipeline built in 1908 supplied water for railroad and domestic use from Nogal Lake (Ash and Davis 1964). Bonito Lake was built in the 1930's to store the water from Nogal Lake when the first lake started leaking (Barker *et al.* 1991). As a cub, Smokey the Bear was rescued from a forest fire in Capitan Gap in 1950, nursed back to health, and flown to Washington, D.C. to become the mascot for the U.S. Forest Service's fire prevention program (Ash and Davis 1964). Hispanic farmers from the Rio Grande valley established the Village of Tularosa in 1862 and the village was named after the Spanish description for the rose-colored reeds that grow along the Rio Tularosa (Village of Tularosa, 2014).

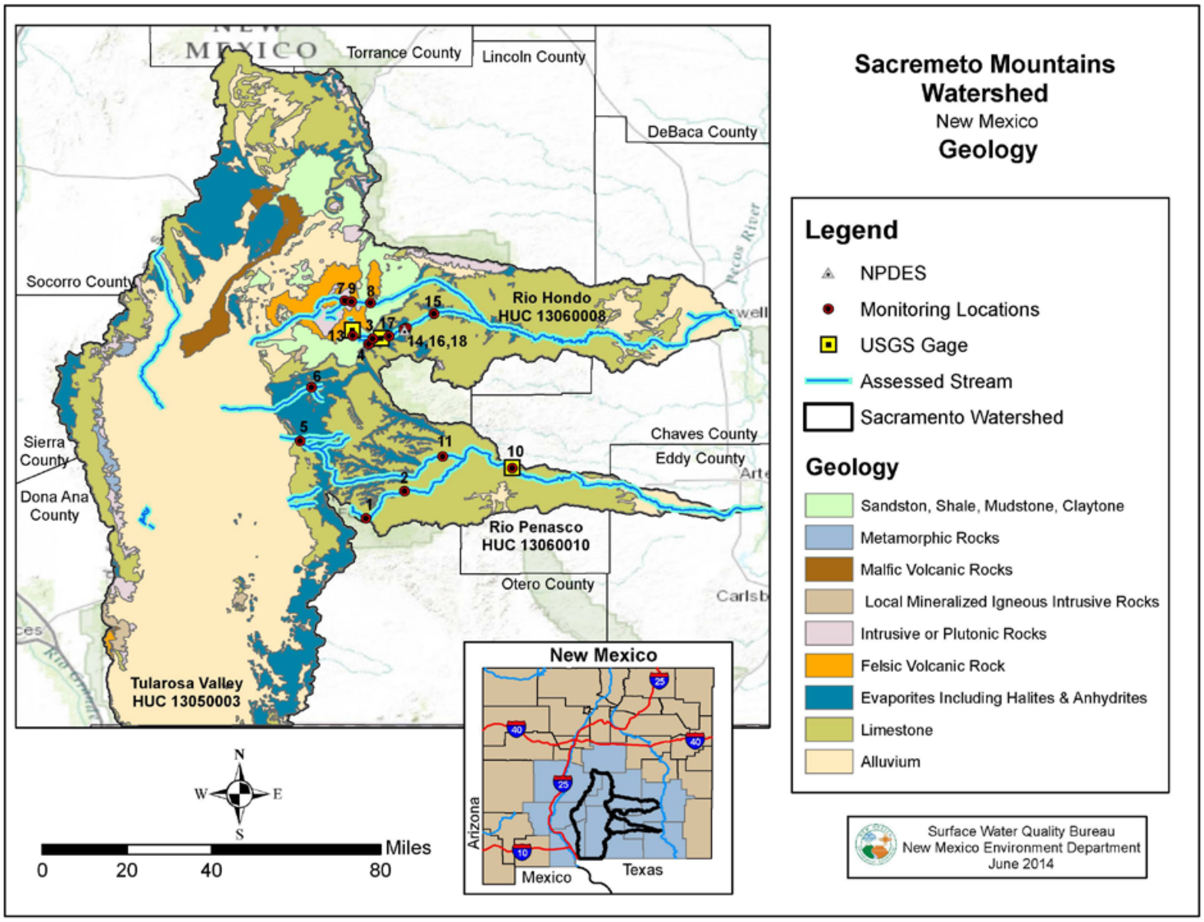

Figure 2.3 Geologic Map of the Sacramento Mountains and 2012 Sampling Stations

2.3 Water Quality Standards and Designated Uses

Water quality standards ("WQS") for all assessment units in this document are set forth in Sections 208, 209, and 801 of the *Standards for Interstate and Intrastate Surface Waters,* 20.6.4 New Mexico Administrative Code ("NMAC"), as amended through February 14, 2013 (NMAC 2013). These standards have been approved by the USEPA for CWA purposes.

20.6.4.208 PECOS RIVER BASIN - Perennial reaches of the Rio Peñasco and its tributaries above state highway 24 near Dunken, perennial reaches of the Rio Bonito downstream from state highway 48 (near Angus), the Rio Ruidoso downstream of the U.S. highway 70 bridge near Seeping Springs lakes, perennial reaches of the Rio Hondo upstream from Bonney canyon and perennial reaches of Agua Chiquita.

A. Designated Uses: fish culture, irrigation, livestock watering, wildlife habitat, coldwater aquatic life and primary contact. 20.6.4 NMAC 28

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: temperature 30°C (86°F) or less, and phosphorus (unfiltered sample) less than 0.1 mg/L.

20.6.4.209 PECOS RIVER BASIN - Perennial reaches of Eagle creek upstream of Alto dam to the Mescalero Apache boundary, perennial reaches of the Rio Bonito and its tributaries upstream of state highway 48 (near Angus) excluding Bonito lake, and perennial reaches of the Rio Ruidoso and its tributaries upstream of the U.S. highway 70 bridge near Seeping Springs lakes, above and below the Mescalero Apache boundary.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public water supply and primary contact.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 600 µS/cm or less in Eagle creek, 1,100 µS/cm or less in Bonito creek and 1,500 µS/cm or less in the Rio Ruidoso; phosphorus (unfiltered sample) less than 0.1 mg/L; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.801 CLOSED BASINS - Rio Tularosa east of the old U.S. highway 70 bridge crossing east of Tularosa and all perennial tributaries to the Tularosa basin except Three Rivers and excluding waters on the Mescalero tribal lands.

A. Designated Uses: coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public water supply and primary contact.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: the monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

The numeric criteria identified in these sections are used for assessing waters for use attainability. The referenced Section 20.6.4.900 NMAC provides a list of water chemistry analytes for which SWQB tests and identifies numeric criteria for specific designated uses. In addition, waters are assessed against the narrative criteria identified in Section 20.6.4.13 NMAC, including bottom sediments and suspended or settleable solids, plant nutrients, and turbidity. The individual water quality criteria or narrative standards are detailed for each parameter in the chapters that follow.

Current impairment listings for the Sacramento Mountain watersheds are included in the 2014-2016 State of New Mexico Clean Water Act §303(d)/ §305(b) Integrated List (NMED/SWQB 2014). The Integrated List is a catalog of assessment units ("AUs") throughout the state with a summary of their current status as assessed/not assessed or impaired/not impaired. Once a stream AU is identified as impaired, a TMDL guidance document is developed for that segment with guidelines for stream restoration. Target values for TMDLs are determined based on: 1) applicable numeric criteria or appropriate numeric translator to a narrative standard; 2) the degree of experience in applying various management practices to reduce a specific pollutant's loading; and 3) the ability to easily monitor and produce quantifiable and reproducible results. AU names and WQS have changed over the years and the history of these individual changes is tracked in the Record of Decision document associated with the 2012-2014 Integrated List available on the SWQB website.

New Mexico's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC) establish surface water quality standards that consist of designated uses of surface waters of the State, the water quality criteria necessary to protect the uses, and an antidegradation policy. New Mexico's antidegradation policy, which is based on the requirements of 40 CFR 131.12, describes how waters are to be protected from degradation (Subsection A of 20.6.4.8 NMAC) while the *Antidegradation Policy Implementation Procedure*s establish the process for implementing the antidegradation policy (NMED/SWQB 2011). At a minimum, the policy mandates that "the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state." In addition, whether or not a segment is impaired, the State's antidegradation policy requirements, as detailed in the *Antidegradation Policy Implementation Procedures* (NMED/SWQB 2011), must be met. TMDLs are consistent with this policy because implementation of a TMDL restores water quality so that existing uses are protected and water quality criteria are achieved. The *Antidegradation Policy Implementation Procedures* can be found in Appendix A of the *Statewide Water Quality Management Plan and Continuing Planning Process* document.

2.4 Water Quality Sampling

The Sacramento Mountain watersheds were sampled by the SWQB in 2012. A brief summary of the survey and the hydrologic conditions during the sample period is provided in the following subsections. A more detailed description can be found in the Sacramento Mountains Field Sampling Plan (NMED/SWQB 2012b).

2.4.1 Survey Design

The Monitoring, Assessment, and Standards Section ("MASS") of the SWQB conducted a water quality survey of the Sacramento Mountains in 2012 between April and October. Most sites were sampled eight (8) times, while some secondary sites were sampled one to four times. Monitoring these sites enabled an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream from the sites. Data results from grab sampling are housed in the SWQB provisional water quality database and uploaded to USEPA's Water Quality Exchange ("WQX") database. Sampling sites in **Figure 2.1** and listed in **Table 2.1** represent only those sites that are discussed in this document.

All temperature and chemical/physical sampling and assessment techniques are detailed in the *Quality Assurance Project Plan* (NMED/SWQB 2012a) and the SWQB assessment protocols (NMED/SWQB 2013). As a result of the 2012 monitoring effort and subsequent assessment of results, several surface water impairments were determined. Accordingly, these impairments were added to New Mexico's Integrated CWA §303(d)/305(b) List in 2014 (NMED/SWQB 2014).

Table 2.1 SWQB 2012 Sacramento Mountains Sampling Stations

Station #	Station Description	STORET/ WQX ID
1	Agua Chiquita below Barrel Springs	59AquaCh050.2
2	Agua Chiquita between Weed and Sacramento	59AguaCh029.0
3	Carrizo Creek above Rio Ruidoso	57Carriz000.1
4	Carrizo Creek at Mescalero Boundary	57Carriz003.0

Station #	Station Description	STORET/ WQX ID
5	Fresnal Canyon at Alamogordo water intake	48FresCa001.0
6	Nogal Creek at County Road B-17	48NogalC000.2
7	Rio Bonito at FR 107	57RBonit061.1
8	Rio Bonito at Hwy 48 bridge-USGS Gage 0838850	57RBonit053.4
9	Rio Bonito below Dam	57RBonit059.9
10	Rio Peñasco above NM 24-USGS Gage 08397600	59RPenas108
11	Rio Peñasco on USFS (below Mayhill)	59RPenas140.2
12	Rio Ruidoso at Carrizo Creek	57RRuido045.3
13	Rio Ruidoso at Mescalero boundary at USGS Gage 08386505	57RRuido052.4
14	Rio Ruidoso @ CR E002	57RRuido030.5
15	Rio Ruidoso at Glencoe FR 443	57RRuido019.8
16	Ruidoso new WWTP outfall pipe	NM0029165
17	Rio Ruidoso abv Hwy 70 bridge	57RRuido031.5
18	Rio Ruidoso blw Ruidoso Downs Racetrack @ Joe Welch Dr	57RRuido039.4

2.4.2 Hydrologic Conditions

There are two active USGS gaging stations on the portion of the Sacramento Mountains encompassed in this survey. As described in the following sections, USGS gage 08397600 and 08387000 were used, as appropriate, in flow calculations in the TMDLs. **Figure 2.4** displays the mean discharges for 2012 and **Figure 2.5** displays the mean discharges for the period of record for each USGS gage.

Table 2.2 USGS gages in the Sacramento Mountains

Agency	Site Number	Site Name	Period of Record
USGS	08397600	Rio Peñasco near Dunken, NM	1956-present
USGS	08387000	Rio Ruidoso at Hollywood	1953-present
USGS	08386505	Rio Ruidoso at Ruidoso	1998-present

As stated in the Assessment Protocol (NMED/SWQB 2013), data collected during all flow conditions, including low flow conditions (e.g., flows below 4-day, 3-year flows [4Q3]), will be used to determine designated use attainment status during the assessment process. For the purpose of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

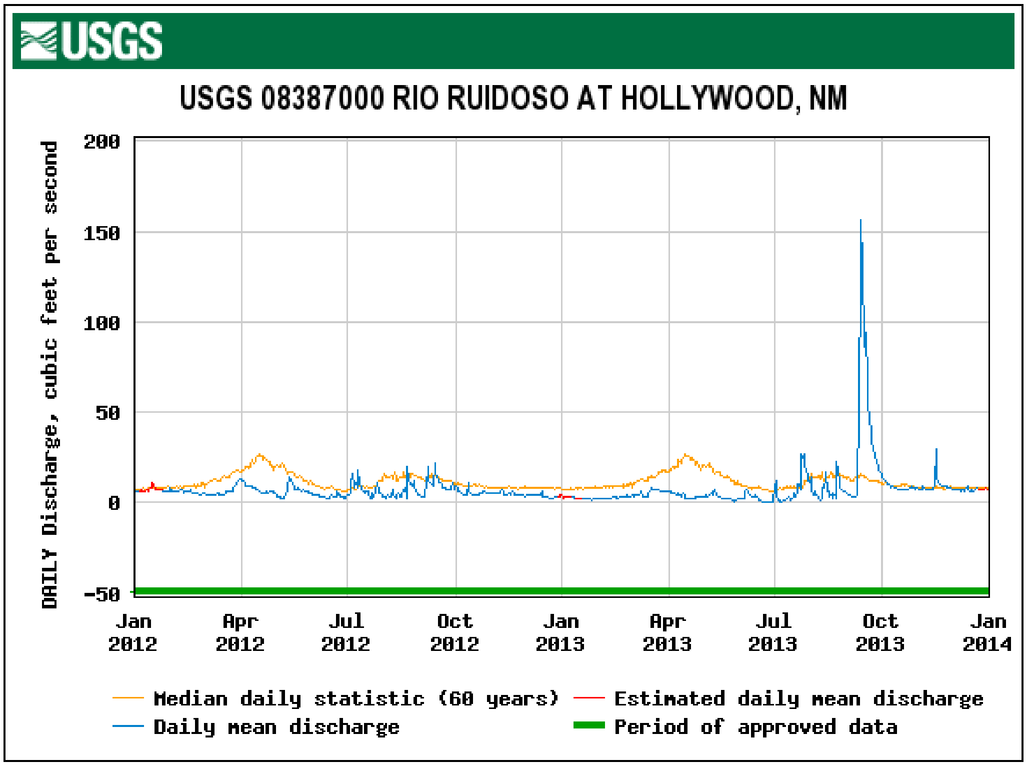

Figure 2.4 Daily mean and historic median discharge for the Rio Ruidoso near Hollywood, NM (2012-2013)

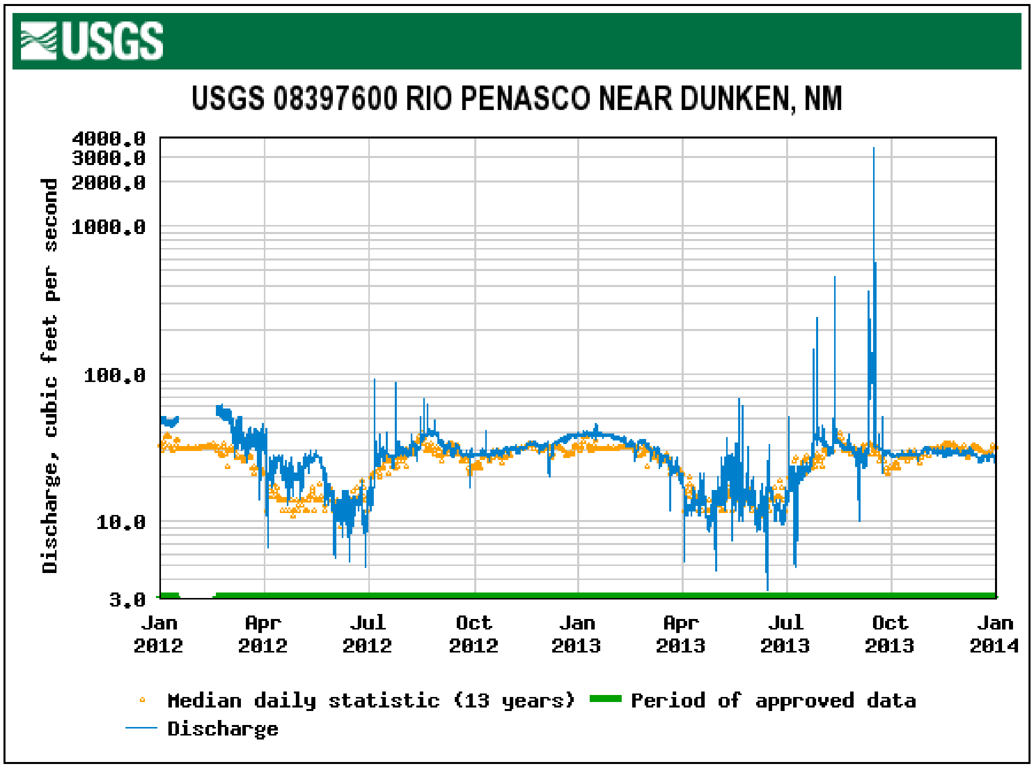

Figure 2.5 Daily mean and historic median discharge for the Rio Peñasco near Dunken, NM (2012 – 2013)

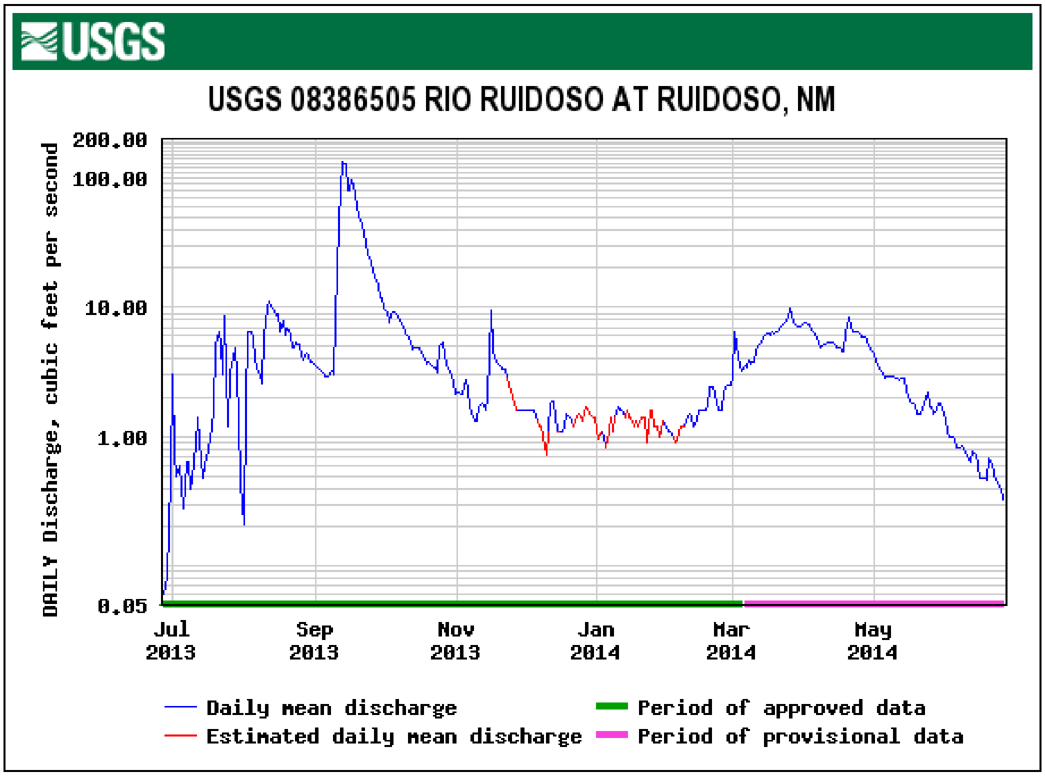

Figure 2.6 Daily mean and historic median discharge for the Rio Ruidoso at Ruidoso, NM (1998-2014)

3.0 BACTERIA

Assessment of data from the 2012 SWQB water quality survey in the Sacramento Mountains watershed identified exceedances of the numeric criteria of New Mexico water quality standards for *E. coli* bacteria in Carrizo Creek, Nogal Creek, Rio Bonito, and two reaches of the Rio Ruidoso.

As a result, these assessment units were listed on the Integrated CWA §303(d)/§305(b) List with *E. coli* as a pollutant of concern (NMED/SWQB 2014). If and when water quality criteria have been met, the reach will be moved to the appropriate category on the Clean Water Act Integrated §303(d)/§305(b) List of assessed waters. A TMDL for fecal coliform was developed for the Rio Bonito as part of the 2006 Rio Hondo (Lincoln County) TMDL document (NMED/SWQB 2006). This *E.coli* TMDL will replace the 2006 TMDL for Rio Bonito (Angus Canyon to headwaters).

3.1 Target Loading Capacity

For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to meet numeric criteria for the primary contact designated use in 20.6.4.900 NMAC of 126 cfu/100 mL *E. coli* geometric mean and 410 cfu/100 mL *E. coli* single sample, except for the segment specific criteria in 20.6.4.209 and 20.6.4.801 NMAC of 126 cfu/100 mL *E. coli* geometric mean and 235 cfu/100 mL *E. coli* single sample.

The presence of *E. coli* bacteria is an indicator of the possible presence of other pathogens that may limit beneficial uses and present human health concerns. Exceedences for each assessment unit are presented in Table 3.1 and *E. coli* data are in Appendix C.

Table 3.1 *E. coli* exceedences

Assessment Unit	WQS Segment	Associated Criterion (a) (cfu/100mL)	Exceedence Ratio (b)
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	20.6.4.209	235	3/13=23%
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	20.6.4.801	235	2/4=50%
Rio Bonito (NM 48 near Angus to headwaters)	20.6.4.209	235	2/10=20%
Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek)	20.6.4.209	235	11/14=79%
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	20.6.4.208	410	6/15=40%

Notes: *(a)* = single sample criterion
(b) = # exceedances/total # samples
cfu = colony forming units
mL = milliliters

3.2 Flow

TMDLs are calculated at a specific flow but bacteria concentrations can vary as a function of flow. SWQB determined streamflow either by using the active USGS gage network or by taking direct in-stream flow measurements utilizing standard procedures (NMED/SWQB 2010a). Water quality standard exceedances for all impaired reaches occurred during low and moderate flows. Therefore, for these reaches, the critical flow value used to calculate the TMDLs was obtained using a 4-day, 3-year low-flow frequency ("4Q3") regression model. The 4Q3 is the annual lowest four (4) consecutive day flow that occurs with a frequency of at least once every three (3) years. According to the New Mexico Water Quality Standards, the low flow critical condition is defined as 4Q3 (20.6.4.11(B)(2) NMAC) for numeric criteria. Critical low flow was determined on an annual basis utilizing all available daily flow values rather than on a seasonal basis for these TMDLs because exceedences occurred across both low and high flow conditions.

When available, USGS gages were used to estimate the critical flow. The USGS gage on the Rio Ruidoso at Hollywood (08387000) was the only active gage on the Rio Ruidoso. The 4Q3 flow for Rio Ruidoso was estimated using the appropriate gage data and DFLOW software, Version 3.1b (USEPA 2006). DFLOW 3.1b is a Windows-based tool developed to estimate user selected design stream flows for low flow analysis by utilizing algorithms based on Log Pearson Type III distribution. However, the 4Q3 was calculated using the 10-year period from 2004-2014. This period was selected because it represents the most recent hydrologic conditions but also is representative of long term precipitation based on tree ring data from AD 1000 – 2000 (Gutzler 2007).

The calculated 4Q3 for the USGS 08387000 gage using DFLOW software is 1.01 mgd. In the case of ungaged streams, analysis methods developed by Waltemeyer can both be used to estimate flow (Waltemeyer 2002). In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of New Mexico (i.e., statewide and mountainous regions above 7,500 feet in elevation). The 4Q3s for Carrizo Creek, Fresnal Canyon, and Nogal Creek were estimated using the mountainous regression equation regions (Eq. 3-1) because the mean elevations for these assessment units were greater than 7,500 feet in elevation (Table 3.3).

$$4Q3 \quad = \quad 7.3287 \times 10^{-5}\ DA^{0.70}\ P_w^{\ 3.58}\ S^{1.35} \qquad \text{(Eq. 3-1)}$$

where,

DA = Drainage area (mi^2)
P_w = Average basin mean winter precipitation (inches)
S = Average basin slope (%)

For details and development of this equation, please see Analysis of the Magnitude and Frequency of the 4-Day Annual Low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams in New Mexico, USGS Water-Resources Investigations Report 01-4271 (Waltemeyer 2002).

Table 3.2 Calculation of 4Q3 Low-Flow Frequencies

Assessment Unit	Average Elevation (ft.)	Drainage Area (mi^2)	Mean Winter Precipitation (in.)	Average Basin Slope (percent)	4Q3 (cfs)	4Q3 (mgd)
Carrizo Creek	7,680	22.5	8.13	0.26	0.19	0.12
Nogal Creek	7,864	34.4	9.28	0.31	0.52	0.34
Rio Bonito	8,320	46.5	8.64	0.40	0.71	0.46

The critical streamflow values were converted from cubic feet per second ("cfs") to units of million gallons per day ("mgd") as follows:

$$\_\_\_\_\_ \frac{ft^3}{\sec} \times 1{,}728 \frac{in^3}{ft^3} \times 0.004329 \frac{gal}{in^3} \times 86{,}400 \frac{\sec}{day} \times 10^{-6} = \_\_\_\_\_ \; mgd \qquad \text{(Eq. 3-2)}$$

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of a planning process designed to meet 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. Meeting the calculated TMDL may be a difficult objective.

3.3 Calculations

Bacteria criteria are expressed as colony forming units ("cfu") per unit volume. The *E. coli* criteria used to calculate the allowable stream loads for the impaired assessment units are listed in Table 3.4. Target loads for bacteria are calculated based on flow values, water quality standards, and a conversion factor (Equation 3-3). The more conservative monthly geometric mean criteria are utilized in TMDL calculations to provide an implicit MOS. Furthermore, if the single sample criteria were used as targets, the geometric mean criteria may not be met.

*C as cfu/100 mL * 1,000 mL/1 L * 1 L/ 0.264 gallons * Q in 1,000,000 gallons/day = cfu/day* (Eq. 3-3)

where,

C = the water quality criterion for bacteria,
Q = the critical stream flow in million gallons per day (mgd)

Table 3.3 Calculation of TMDL for *E. coli*

Assessment Unit	Critical Flow (mgd)	*E. coli* geometric mean criteria (cfu/100mL)	Conversion Factor*(a)*	TMDL (cfu/day)
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	0.12	126	3.79×10^7	5.73×10^8
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	0.34	126	3.79×10^7	1.62×10^9
Rio Bonito (NM 48 near Angus to headwaters)	0.46	126	3.79×10^7	2.20×10^9
Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek)	1.01	126	3.79×10^7	4.82×10^9
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	3.71*(b)*	126	3.79×10^7	1.77×10^{10}

Notes: *(a)* Based on equation 3-3.

(b) Gage is upstream of WWTP. Combined flow based on 4Q3 (1.01 mgd) plus the WWTP design capacity (2.70 mgd)

The measured loads for *E. coli* were similarly calculated. The arithmetic mean of the data used to determine the impairment was substituted for the criterion in Equation 3-3. The same conversion factor was used. The measured load was calculated using the arithmetic mean of the data. Because the arithmetic mean of a dataset is always greater than the geometric mean (Muirhead 1903), the arithmetic mean acts as a component of the implicit MOS. Results are presented in Table 3.4.

Table 3.4 Calculation of measured loads for *E. coli*

Assessment Unit	Critical Flow (mgd)	*E. coli* Arithmetic Mean[(a)] (cfu/100mL)	Conversion Factor[(b)]	Measured Load (cfu/day)
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	0.12	273.49	3.79×10^{7}	1.24×10^{9}
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	0.34	194.68	3.79×10^{7}	2.51×10^{9}
Rio Bonito (NM 48 near Angus to headwaters)	0.46	95.02	3.79×10^{7}	1.66×10^{9}
Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek)	1.01	1158.70	3.79×10^{7}	4.44×10^{10}
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	3.71[(c)]	630.61	3.79×10^{7}	8.87×10^{10}

Notes: *(a)* The field measurement is the arithmetic mean of the available *E. coli* samples.
(b) Based on equation 3-3.
(c) Combined flow based on 4Q3 (1.01 mgd) plus the WWTP design capacity (2.70 mgd).

The samples collected and the impairment determinations are based on exceedences of the State's single sample criterion, and the TMDL is written to address the monthly geometric mean criteria. As such, any simple comparison of these numbers is fraught with challenge and, in this case, will result in an over-estimation of the actual reduction necessary. Furthermore, neither Section 303 of the CWA nor Title 40, Part 130.7 of the Code of Federal Regulations ("CFR") require states to include discussions of percent reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the "percent reduction" value can be calculated in multiple ways and as a result can often be misinterpreted. Therefore, a percent reduction is not presented for *E. coli*.

3.4 Waste Load Allocations and Load Allocations

3.4.1 Waste Load Allocation

There are no active point source dischargers on Carrizo Creek, Nogal Creek, and Rio Bonito. The Cloudcroft Wastewater Treatment Plant (“WWTP”) National Pollutant Discharge Elimination System (“NPDES”) permit (NM0023370) includes *E.coli* permit limits of 126 cfu/100 mL (30 day average) and 235 cfu/100 mL (daily maximum). However, the Cloudcroft WWTP discharges into Fresnal Creek (Salado Creek to headwaters) which is upstream of the Fresnal Creek assessment unit discussed in this TMDL and, therefore, no WLA is assigned to this facility. There are no NPDES permits in the Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek) assessment unit; however the City of Ruidoso Downs/Village of Ruidoso WWTP discharges into the Rio Ruidoso (Eagle Creek to US Hwy 70 Bridge) assessment unit. The NPDES permit (NM0029165) includes *E.coli* permit limits of 126 cfu/100 mL (30 day average) and 410 cfu/100 mL (daily maximum). The WLA assigned in Table 3.6 is consistent with the *E.coli* criteria in 20.6.4.208 NMAC and the current NPDES permit. There are no Municipal Separate Storm Sewer System (“MS4”) storm water permits in these AUs.

Storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES Construction General Storm Water Permit (“CGP”) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (“SWPPP”) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (“BMPs”) and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids (“TSS”), turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that WLAs or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Storm water discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Storm Water Permit (“MSGP”). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by these General Permits at this time using the available tools. Discharges from these permits are typically transitory and enforcement is complex as permittees are temporary. Loads that are in compliance with the General Permits are therefore currently included as part of the LA. However, excess bacteria concentrations may be a component of some storm water discharges covered under general NPDES permits, so the load for these dischargers should be addressed. While these sources are not given individual allocations, they are addressed through other means, including BMPs, storm water pollution prevention conditions, and other requirements.

3.4.2 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity TMDL following Equation 3-4:

$$WLA + LA + MOS = TMDL \qquad \text{(Eq. 3-4)}$$

The MOS is estimated to be 15 percent of the target load calculated in Table 3.4. Results are presented in Table 3.5 Additional details on the MOS chosen are presented in Section 3.7.

The extensive data collection and analyses necessary to determine background *E. coli* loads for the Sacramento Mountain watershed were beyond the resources available for this study, however this type of data collection could be appropriate for a future Bacteria Source Tracking study. It is therefore assumed that a portion of the LA is made up of natural background loads.

It is important to note that WLAs and LAs are estimates based on a specific flow condition. Under differing hydrologic conditions, the loads will change. Successful implementation of this TMDL will be determined based on achieving the *E. coli* standards.

Table 3.5 TMDL for *E. coli*

Assessment Unit	WLA (cfu/day) [a]	LA (cfu/day)	MOS (15%) (cfu/day)	TMDL (cfu/day)
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	0	4.87×10^{8}	8.6×10^{7}	5.73×10^{8}
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	0	1.38×10^{9}	2.44×10^{8}	1.62×10^{9}
Rio Bonito (NM 48 near Angus to headwaters)	0	1.87×10^{9}	3.30×10^{8}	2.20×10^{9}
Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek)	0	4.34×10^{9}	4.82×10^{8} [c]	4.82×10^{9}
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge) [b]	1.29×10^{10}	3.05×10^{9}	1.77×10^{9} [c]	1.77×10^{10}

Notes: [a] Zero WLA indicates that no NPDES permit discharges into the AU.
[b] See discussion in Section 3.4.1. WLA calculated using design capacity of 2.70 mgd.
[c] Margin of Safety for Rio Ruidoso (Eagle Creek to US Hwy 70 bridge) and Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek) AUs are 10%. See Section 3.7 for details.

3.5 Identification and Description of Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment (Appendix B). The approach for identifying "Probable Sources of Impairment" was modified in 2010 by SWQB to include additional input from a variety of stakeholders including landowners, watershed groups, and local, state, tribal and federal agencies. Probable Source Sheets are filled out by

SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list will be reviewed and modified, as necessary, with watershed group/ stakeholder input during the TMDL public meeting and comment period. Probable sources that may be contributing to the observed load are displayed in **Table 3.6**:

Table 3.6 Pollutant source summary for *E. coli*

Assessment Unit	NPDES permits	Probable Sources[(a)]
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	None	Bridges/culverts/railroad crossings, channelization, highway/road/bridge runoff, on-site treatment systems, paved roads, pavement/impervious surfaces, residences/buildings, site clearance, urban runoff/storm sewers, storm water runoff due to construction, waterfowl.
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	None	Bridges/culverts/railroad crossings, gravel/dirt roads, highway/road/bridge runoff, on-site treatment systems, paved roads, pavement/impervious surfaces, rangeland grazing, residences/buildings, wildlife other than waterfowl.
Rio Bonito (NM 48 near Angus to headwaters)	None	Bridges/culverts/railroad crossings, dams/diversions, fire suppression, flow alteration, highway/road/bridge runoff, legacy logging operations, paved roads, gravel/dirt roads, pavement/impervious surfaces, recent overbank flows. watershed runoff following forest fire.
Rio Ruidoso (US Hwy 70 Bridge to Carrizo Creek)	None	Bridges/culverts/railroad crossings, channelization, drought-related impacts, dumping/garbage/litter/trash, highway/road/bridge runoff, inappropriate waste disposal, livestock grazing, municipal point source discharge, paved road, gravel/dirt roads, pavement/impervious surfaces, rangeland grazing, residences/buildings, stream channel incision, urban runoff/storm sewers, waste from pets, waterfowl, watershed runoff following forest fire.
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	NM0029165	Channelization, drought-related impacts, gravel/dirt roads, surface films/odors, mass wasting, on-site treatment systems, pavement/impervious surfaces, residences/buildings, stream channel incision, waterfowl, watershed runoff following forest fire.

Notes: This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed nor quantified at this time.

The Probable Source Identification Sheets 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 a watershed. The list of “Probable Sources” 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 sources for each impairment. Table 3.6 displays probable sources of impairment along the reach as determined by field reconnaissance and assessment. Probable sources of *E. coli* will be evaluated, refined, and changed as necessary through the WBP.

3.6 Linkage of Water Quality and Pollutant Sources

Among the probable sources of bacteria are municipal point source discharges such as wastewater treatment facilities, poorly maintained or improperly installed (or missing) septic tanks, livestock grazing of valley pastures and riparian areas, upland livestock grazing, in addition to wastes from pets, waterfowl, and other wildlife. Howell et. al. found that bacteria concentrations in underlying sediment increase when cattle have direct access to streams, such as the waters in the Sacramento Mountains. (Howell *et al*. 1996). Natural sources of bacteria are also present in the form of other wildlife such as elk, deer, and any other mammals and birds. In addition to direct input from grazing operations and wildlife, *E. coli* concentrations may be subject to elevated levels as a result of resuspension of bacteria laden sediment during storm events. Temperature can also play a role in bacteria concentrations. Howell *et al*. (1996) observed that bacteria viability in sediments increases with water temperature.

In order to determine exact sources and relative contributions, further study is needed. 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. While sufficient data currently exist to support development of *E. coli* TMDLs to address the stream standards exceedances, a BST dataset will likely prove useful in the future to better identify the sources of *E. coli* impacting the stream.

3.7 Margin of Safety

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 inputs and explicit recognition of potential errors in flow calculations. Therefore, the MOS is the sum of the following assumptions:

- *Conservative Assumptions:*
  - *E. coli* bacteria do not readily degrade in the environment;
  - Basing the target load capacity on the geometric mean criterion rather than the higher-concentration single sample criterion; and
  - Calculating the measured load with the arithmetic mean rather than the geometric mean of the sample results produces a greater mean and therefore a more conservative load estimate.
- *Explicit recognition of potential errors:*

- Uncertainty exists in sampling nonpoint sources of pollution. A conservative MOS for this element is therefore **5%**.
- The critical flow value for the ungaged streams was estimated based on a regression equation from Waltemeyer (2002) and ungagged sites on gaged streams was estimated based on the Thomas (1997) method. There is inherent error in all flow calculations, including those based on gage data. A conservative MOS for this element for AUs which used the regression equation or area-weighted equation is therefore **10 %**.
- There is inherent error in all flow measurements; a conservative MOS for this element in gaged streams is **5%**.

3.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Data used in the calculation of these TMDLs were collected during the spring, summer, and fall of 2012 in order to ensure coverage of any potential seasonal variation in the system. Bacteria exceedances occurred during both high and low flow events. Higher flows may flush more nonpoint source runoff containing bacteria. It is possible the criterion may be exceeded under a low flow condition when there is insufficient dilution.

3.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2040. The Lincoln County population is projected to grow by an estimated 1.3% over the 2010-2040 time period. Similarly, the Chaves County population is projected to grow by an estimated 4.71% and the Otero County population is project to grow by an estimated 0.79% over the same time period. The 2010 Census population for Lincoln County is 20,497, Chaves County is 65,783, and Otero County is 64,275 (NMBBER 2012).

Estimates of future growth are not anticipated to lead to a significant increase in bacteria concentrations that cannot be controlled with BMPs in this watershed. However, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit. Any future growth would be considered part of the existing load allocation, assuming persistence of the hydrologic conditions used to develop these TMDLs.

4.0 TURBIDITY

During the 2012 survey, exceedances of the numeric turbidity thresholds, resulting in an impairment of the narrative criterion for turbidity in 20.6.4.13 NMAC, were documented in three AUs: Agua Chiquita (perennial portions McEwan Canyon to headwaters), Rio Peñasco (Hwy 24 to Cox Canyon), and Rio Ruidoso (Eagle Creek to US Hwy 70 bridge).

4.1 Target Loading Capacity

Target values for this turbidity TMDL were based on the turbidity thresholds identified in the NMED 2013 Assessment Protocol. According to the New Mexico WQS (20.6.4.13(J) NMAC), the general narrative standard for turbidity reads:

> *"Turbidity: Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function, or reproduction of aquatic life is impaired or that will cause substantial visible contract with the natural appearance of the water…"*

The assessment approach used to determine turbidity impairments relies upon the use of biotranslators to derive numeric thresholds from the narrative standard above (NMED/SWQB 2013). A biotranslator is a physical or chemical water quality parameter that has been isolated and effects an impairment of a quantifiable attribute of an indicator organism. In some cases, the quantifiable attribute may be the lethal dose or concentration of the parameter. In the case of turbidity, the attribute is typically based upon observed behavior and Severity of Ill Effects ("SEV") index (NMED/SWQB 2013).

The three AUs for which turbidity TMDLs have been developed in this document are designated as either coldwater or high quality cold water. The most representative fish to use in determining the appropriate turbidity thresholds for coldwater aquatic life and high quality coldwater aquatic life stream segments are salmonids, as a majority of studies on turbidity in fish have been conducted with them. The numeric thresholds have been supported with studies of turbidity and benthic macroinvertebrates (NMED/SWQB 2013).

An SEV index of 3.5 was selected to develop thresholds for turbidity impairment in New Mexico. This value corresponds to the boundary between conditions that effect changes to feeding and those that reduce growth rate and habitat size. The relationship between turbidity, duration, and an SVE of 3.5 is given in Equation 6-1 for durations from 7 hours to 720 hours. Shorter-term turbidity excursions are unlikely to impair the growth and reproduction of aquatic life, as required by New Mexico's narrative turbidity water quality criterion, while thresholds for durations longer than 720 consecutive hours result in turbidity values that are lower than supported by literature available at the time of the assessment protocol development.

$$x = 37{,}382y^{-1.9887} \qquad \text{(Eq. 6-1)}$$

x = duration in hours and
y = turbidity in Nephelometric Turbidity Units ("NTUs")

Table 1 in the turbidity assessment protocol (NMED/SWQB 2013) provides a series of turbidity thresholds and durations, which are listed in Table 4.1.

Table 4.1 Turbidity impairment thresholds and durations

Turbidity Threshold (NTU)	Allowable Duration (consecutive hours)	Allowable Duration (consecutive days)
23	72	3
20	96	4
18	120	5
16	144	6
15	168	7
11	336	14
7	720	30

Notes:
NTU = Nephelometric Turbidity Units

Because a TMDL requires a numeric loading component, TSS has been used in previous SWQB TMDLs as a numeric target. The TSS analytical method is a commonly-used measurement of suspended material in surface water. This method was originally developed for use on wastewater samples, but has widely been used as a measure of suspended materials in stream samples because it is acceptable for regulatory purposes and is an inexpensive laboratory procedure. Since there are no WWTPs discharging into or upstream of the AUs targeted in this TMDL, it is assumed that TSS measurements in these ambient stream samples are representative of erosional activities and thus comprised primarily of suspended sediment versus any potential biosolids, such as those from WWTP effluent.

Turbidity levels can be inferred from studies that monitor suspended sediment concentrations. Extrapolation from these studies is possible when a site-specific relationship between concentrations of suspended sediments and turbidity is confirmed. Activities that generate varying amounts of suspended sediment will proportionally change or affect turbidity (USEPA 1991). The impacts of suspended sediment and turbidity are well documented in the literature. An increased sediment load is often the most important adverse effect of activities on streams, according to a monitoring guidelines report (USEPA 1991). This impact is largely a mechanical action that severely reduces the available habitat for macroinvertebrates and fish species that utilize the streambed in various life stages. An increase in suspended sediment concentration will reduce the penetration of light, decreases the ability of fish or fingerlings to capture prey, and reduce primary production (USEPA 1991). As stated in Relyea *et al*., "*increased turbidity by sediments can reduce stream primary production by reducing photosynthesis, physically abrading algae and other plants, and preventing attachment of autotrophs to substrate surfaces.*" (Relyea *et al*. 2000).

TSS and turbidity were measured in the Sacramento Mountain watershed (Table 4.2) during the 2012 survey. Turbidity impairment was determined based on available sonde data. The TSS target was derived using a regression equation developed with turbidity and TSS data obtained from grab samples. The equation and regression statistics are displayed below in Figures 4.1-4.3 and in Table 4.3.

Because the Turbidity – TSS relationship is unique to each watershed, different types of regression equations were found to offer the best fit for each AU based on both the R^2 value (coefficient of determination) and the appropriateness of the resulting TSS values. The R^2 value is essentially a measure of how well a dataset fits the applied model; R^2 values approaching 1 are considered better fits than R^2 values approaching 0.

Table 4.2 Measured Turbidity and TSS – Grab Data

Assessment Unit	Date	Turbidity (NTU)	TSS (mg/L)	Flow (cfs)
Agua Chiquita (perennial portions McEwan Cny to headwaters)- Agua Chiquita between Weed and Sacramento - 59AguaCh029.0	4/5/2012	2.1	5	0.5
	5/10/2012	6	8	0.48
	6/13/2012	0	3	0.5
	7/26/2012	1310	1240	0.31
	9/26/2012	0.4	4	moderate
Rio Peñasco (HWY 24 to Cox Canyon)- Rio Peñasco at NM 24- USGS Gage 08397600 - 59RPenas108.4	4/5/2012	3.9	7	moderate
	5/10/2012	0.2	3	moderate
	6/14/2012	0	3	moderate
	7/26/2012	29.5	46	moderate
	8/8/2012	0.2	10	moderate
	9/26/2012	0.6	3	moderate
Rio Peñasco (HWY 24 to Cox Canyon)- Rio Peñasco on USFS (below Mayhill) - 59RPenas140.2	4/5/2012	14.5	24	15.8
	5/10/2012	17.2	33	78.3
	6/14/2012	4.9	12	10.2
	7/26/2012	41.5	188	17.5
	8/8/2012	16	41	n/a
Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)- Rio Ruidoso @ CR E002 - 57RRuido030.5	4/3/2012	2.5	5	moderate
	5/9/2012	0.5	3	4.4
	6/12/2012	1.1	4	4.8
	7/11/2012	79.5	168	10.4
	8/7/2012	0	8	moderate
	9/12/2012	18.1	37	11.2
Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)- Rio Ruidoso at Gelncoe-FR 443 - 57RRuido019.8	4/3/2012	1.7	3	4.8
	5/9/2012	1.4	65	1.5
	6/12/2012	0	3	1.3
	7/11/2012	185.1	340	10.2
	8/7/2012	3.7	6	1.1
	9/12/2012	476.4	30	25.2

Table 4.3 Regression Equation and R^2 – Turbidity and TSS

Assessment Unit	Equation Type	Regression Equation	R^2 Value
Agua Chiquita (perennial portions McEwan Cny to headwaters)	Linear	Y=0.782x + 3.3383	R^2 = 0.983
Rio Peñasco (HWY 24 to Cox Canyon)	Linear	y = 1.5689x + 4.5506	R^2 = 0.912
Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)	Polynomial	$y = 0.0118x^2 + 1.039x + 10.729$	R^2 = 0.870

Notes:
y = TSS target (mg/L)
x = given turbidity (NTU)

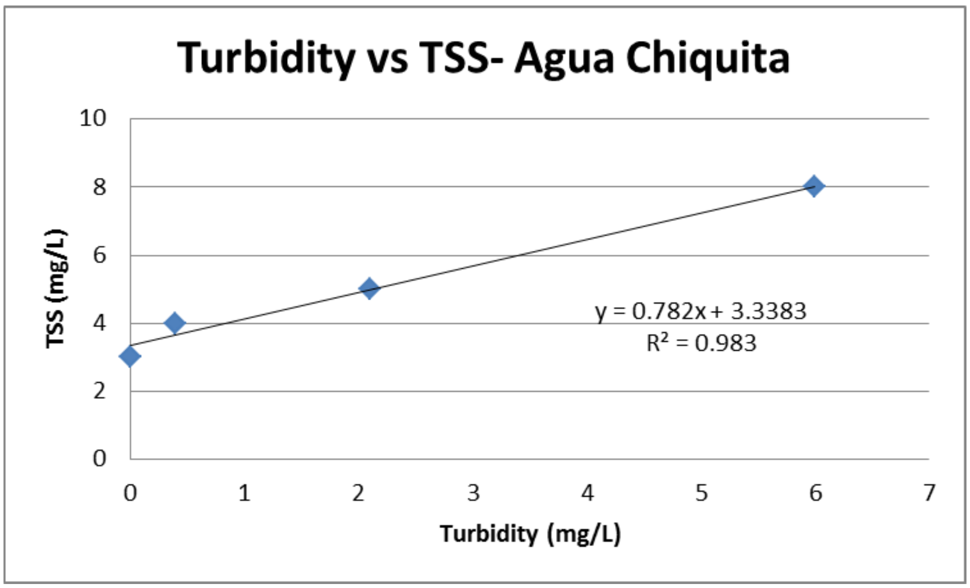

Figure 4.1 Turbidity – TSS relationship in the Agua Chiquita (perennial portions McEwan Canyon to headwaters) AU

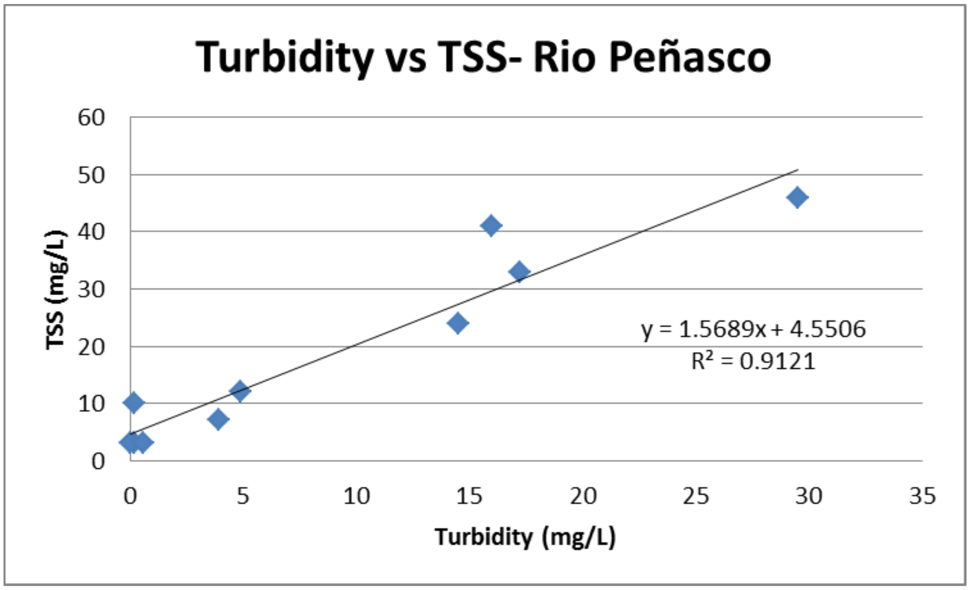

Figure 4.2 Turbidity – TSS relationship in the Rio Peñasco (HWY 24 to Cox Canyon) AU

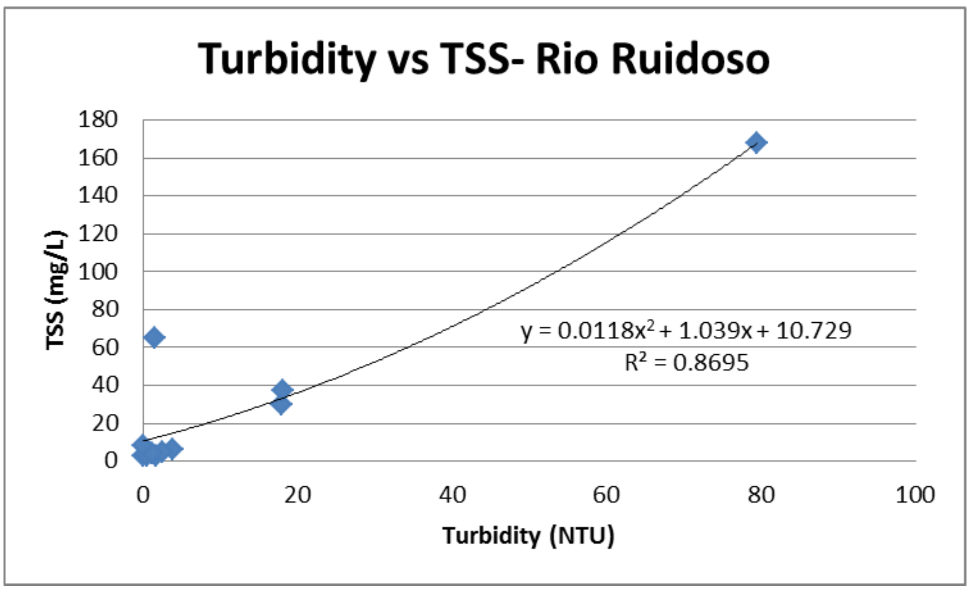

Figure 4.3 Turbidity – TSS relationship in the Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge) AU

4.2 Flow

Sediment transport in a stream varies as a function of flow. As flow increases, the amount of sediment being transported increases. The average, maximum, and minimum turbidity measurements based on sonde data are located in Table 4.4.

Table 4.4 Sonde deployments and turbidity statistics

Assessment Unit	Station	Sonde deployment	Duration of Deployment (hours)	Average (NTU)	Maximum (NTU)	Minimum (NTU)
Agua Chiquita (perennial portions McEwan Cny to headwaters)	59AguaCh029.0	August 8-September 5, 2012	678	46.72	1332	0.1
Rio Peñasco (HWY 24 to Cox Canyon)	59RPenas108.4	August 8-September 5, 2012	674	153.28	3000	0.3
Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)	57RRuido030.5	Sept 5-19 2012	332	92.49	1310.3	2.3
	57RRuido019.8	September 5-19, 2012	337	148.02	1778.7	3.4

As stated above, the 4Q3 is the annual lowest four (4) consecutive day flow that occurs with a frequency of at least once every three (3) years and the low flow critical condition is defined as 4Q3 (20.6.4.11(B)(2) NMAC). The 4Q3 flow was estimated using the appropriate gage data and DFLOW software, Version 3.1b (USEPA 2006). There are USGS gages on Rio Peñasco and Rio Ruidoso (Table 6.5), thus flow was determined using a 4Q3 regression model. However, the 4Q3 was calculated using the 10-year period from 2004-2014. This period was selected because it represents the most recent hydrologic conditions but also is representative of long term precipitation based on tree ring data from AD 1000 – 2000 (Gutzler 2007).

Table 4.5 USGS Gages in Study Area

Gage	Name	Start Date	End Date	4Q3 (cfs)	4Q3 (MGD)
08397600	Rio Peñasco near Dunken, NM	2004	2014	4.67	3.02
08387000	Rio Ruidoso at Hollywood	2004	2014	1.56	1.01

In the case of ungaged streams, an analysis method developed by Waltemeyer (2002) can be used to estimate flow. In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 ft in elevation). Because the average elevation of the Agua Chiquita (perennial portions McEwan Canyon to headwaters) watershed is above 7,500 ft, the decision was made to use the mountainous regions regression equation.

The following mountainous regions regression equation is based on data from 40 gaging stations located above 7,500 ft in elevation with non-zero discharge (Waltemeyer 2002):

$$4Q3 = 7.3287 \times 10^{-5} DA^{0.70} P_w^{\ 3.58} S^{1.35}$$

(Eq. 4-2)

Where:

4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area (mi^2)
P_w = Average basin mean winter precipitation (inches)
S = Average basin slope (%)

4Q3 values calculated using Waltemeyer's methods (Eq. 4-2) are presented in Table 4.6.

Table 4.6 Calculation of 4Q3

Assessment Unit	Average Elevation (ft)	Drainage Area (mi^2)	Mean Winter Precipitation (in)	Average Basin Slope (%)	4Q3 (cfs)	4Q3 (MGD)
Agua Chiquita (perennial portions McEwan Cny to headwaters)	8422	58.25	10.02	0.268	0.82	0.53

It is important to remember that the TMDL itself is a value calculated at a defined critical condition as part of a planning process 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. Meeting the calculated TMDL at a given time may be a difficult objective. Because impairment of a waterbody is dependent on the duration of elevated turbidity, a separate TMDL has been determined for each NTU/duration threshold identified in the turbidity assessment protocol for each assessment unit.

4.3 Calculations

This section describes the relationship between the numeric target and the allowable pollutant load by determining the total assimilative capacity of the waterbody, or loading capacity, for turbidity at each threshold. The loading capacity is the maximum amount of pollutant that a waterbody can receive, at a specific flow, while meeting its water quality objectives. This TMDL was developed using the relationship between turbidity and TSS, the 4Q3 flow condition, turbidity/duration thresholds identified in the turbidity assessment protocol, and a conversion factor.

Using the regression equations provided in Table 4.3, TSS values for each turbidity threshold were calculated for each assessment unit (Table 4.7).

Table 4.7 Calculated TSS threshold values Agua Chiquita, Rio Peñasco, and Rio Ruidoso

		Agua Chiquita	Rio Peñasco	Rio Ruidoso
Turbidity (NTU)	Duration (consecutive hrs)	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)
7	720	8.8	15.5	18.6
11	336	11.9	21.8	23.6
15	168	15.1	28.1	29.0
16	144	15.9	29.7	30.4
18	120	17.4	32.8	33.3
20	96	19.0	35.9	36.2
23	72	21.3	40.6	40.9

The TSS values calculated in Table 4.7 were then substituted into Equation 4-2 to determine the target loading capacity for each assessment unit at each turbidity threshold (Tables 4.8 – 4.10).

Critical flow (4Q3) x WQS x Conversion Factor = Target Loading Capacity (TMDL) (Eq. 4-3)

Table 4.8 TMDL / Single Day Target Load for Turbidity in Agua Chiquita (perennial portions McEwan Canyon to headwaters)

TSS (mg/L)	Duration (consecutive hrs)	4Q3 (MGD)	Conversion Factor	Target Load (mg/L)
8.8	720	0.53	8.34	38.90
11.9	336	0.53	8.34	52.60
15.1	168	0.53	8.34	66.75
15.9	144	0.53	8.34	70.28
17.4	120	0.53	8.34	76.91
19.0	96	0.53	8.34	83.98
21.3	72	0.53	8.34	94.15

Table 4.9 TMDL / Single Day Target Load for Turbidity in Rio Peñasco (HWY 24 to Cox Canyon)

TSS (mg/L)	Duration (consecutive hrs)	4Q3 (MGD)	Conversion Factor	Target Load (mg/L)
15.5	720	3.02	8.34	390.40
21.8	336	3.02	8.34	549.07
28.1	168	3.02	8.34	707.75
29.7	144	3.02	8.34	748.05
32.8	120	3.02	8.34	826.13
35.9	96	3.02	8.34	904.21
40.6	72	3.02	8.34	1,022.58

Table 4.10 TMDL / Single Day Target Load for Turbidity in Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)

TSS (mg/L)	Duration (consecutive hrs)	4Q3 (MGD)	Conversion Factor	Target Load (mg/L)
18.6	720	3.71	8.34	575.51
23.6	336	3.71	8.34	730.22
29.0	168	3.71	8.34	897.30
30.4	144	3.71	8.34	940.62
33.3	120	3.71	8.34	1,030.35
36.2	96	3.71	8.34	1,120.08
40.9	72	3.71	8.34	1,265.50

Notes: *Critical flow is 4Q3 (1.01 mgd) plus the design capacity of the WWTP (2.70 mgd)

Note that the single day target load is the TMDL for an assessment unit for a particular turbidity/duration pairing. It should not be extrapolated to longer or shorter durations.

4.4 Waste Load Allocation and Load Allocations

4.4.1 Waste Load Allocation

There are no individually permitted point source facilities or MS4/sMS4 storm water permits in the Rio Peñasco assessment unit, however the Village of Ruidoso/City of Ruidoso Downs WWTP (NM0029165) discharges into the Rio Ruidoso (Eagle Creek to US Hwy 70 bridge) assessment unit and the Sacramento Methodist Assembly WWTP (NM002886) discharges into an unnamed intermittent tributary to the Agua Chiquita AU. The Agua Chiquita (perennial portions McEwan Cny to headwaters) is located approximately ½ mile below the WWTP outfall but, except during storm flows, the effluent percolates into the ground before reaching the Agua Chiquita because this stream reach is a losing reach. In other words, it is losing water to infiltration and evaporation. In fact, the AU immediately downstream of this reach of the Agua Chiquita was determined to be naturally ephemeral through application of SWQB's Hydrology Protocol (see NMED/SWQB 2013b). Since the facility is a minor discharger (0.042 mgd design flow) that does not discharge continuously and already has TSS permit limitations, and given the likelihood that the effluent does not reach the Agua Chiquita except during storm flows, it is assumed that the Sacramento Methodist Assembly WWTP does not contribute to the loading or concentration of turbidity-TSS in the Agua Chiquita (perennial portions McEwan Cny to headwaters) in excess of de minimis amounts. Therefore, a wasteload allocation for this facility is not included in this TMDL. Conversely, the Village of Ruidoso/City of Ruidoso Downs WWTP discharges directly into the Rio Ruidoso (Eagle Creek to US Hwy 70 bridge) assessment unit. The NPDES permit (NM NM0029165) currently includes the following TSS limits: 30 mg/L (30-day average) and 45 mg/L (7-day average). The values in Table 4.7 indicate that the TSS values equivalent to the turbidity values necessary to protect aquatic life are 29 mg/L TSS for 7 days (168 hours) and 18.6 mg/L TSS for 30 days (720 hours). In order to calculate the WLA, the most conservative TSS value from Table 6.10 was used.

Sediment may be a component of some (primarily construction) storm water discharges that contribute to suspended sediment impacts, and should be addressed. In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES CGP requires preparation of a SWPPP that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. In addition, the current CGP also includes state-specific requirements to implement BMPs that are designed to prevent the maximum extent practicable, an increase in sediment or a parameter that addresses sediment (e.g., TSS, turbidity, siltation, stream bottom deposits), and flow velocity during and after construction compared to pre-construction conditions. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Other industrial storm water facilities are generally covered under the current NPDES MSGP. This permit also requires the preparation of a SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In addition, the current MSGP also includes state-specific requirements to further limit (or eliminate pollutant loading) to water quality impaired/water quality limited waters from facilities where there is a reasonable potential to contain pollutants for which the receiving water is impaired. In this case, compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL. It is not possible to calculate individual WLAs for facilities covered by these General Permits at this time using available tools. The discharges from these permits are typically transitory and enforcement is complex as permittees are temporary. Loads that are in compliance with the General Permits are therefore currently included as part of the load allocation. While these sources are not given individual allocations, they are addressed through other means, including BMPs, storm water pollution prevention conditions, and other requirements.

4.4.2 Load Allocation

In order to calculate the LA for turbidity, the MOS was subtracted from the target load (TMDL) using the following Equation 4-4:

$$LA + MOS = TMDL$$

Or

$$LA = TMDL - MOS \quad \text{(Eq. 4-4)}$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors. The explicit MOS is estimated to be 15% of the target load calculated in Table 4.8-4.10 for the ungaged AU; an MOS of 10% has been assigned to the gaged AUs; see Section 4.7 for details. The TMDLs were allocated per Equation 4.4 and the allocations between point sources, nonpoint source, and the MOS are listed in Tables 4.11-4.13.

Table 4.11 TMDL for Turbidity in Agua Chiquita (perennial portions McEwan Cny to headwaters)

Duration (consecutive hrs)	WLA (lbs/day)*	LA (lbs/day)	MOS (15%) (lbs/day)	TMDL (lbs/day)
720	0	33.06	5.83	38.90
336	0	44.71	7.89	52.60
168	0	56.73	10.01	66.75
144	0	59.74	10.54	70.28
120	0	65.37	11.54	76.91
96	0	71.39	12.60	83.98
72	0	80.03	14.12	94.15

Note: *Zero WLA indicates that no NPDES permit discharges to the AU.

Table 4.12 TMDL for Turbidity in Rio Peñasco (HWY 24 to Cox Canyon)

Duration (consecutive hrs)	WLA (lbs/day)*	LA (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
720	0	351.36	39.04	390.40
336	0	494.17	54.91	549.07
168	0	636.97	70.77	707.75
144	0	673.24	74.80	748.05
120	0	743.51	82.61	826.13
96	0	813.79	90.42	904.21
72	0	920.33	102.26	1,022.58

Note: *Zero WLA indicates that no NPDES permit discharges to the AU.

Table 4.13 TMDL for Turbidity in Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)

Duration (consecutive hrs)	WLA (lbs/day)*	LA (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
720	418.83	99.12	57.55	575.51
336	531.42	125.77	73.02	730.22
168	653.02	154.55	89.73	897.30
144	684.55	162.01	94.06	940.62
120	749.85	177.46	103.03	1,030.35
96	815.15	192.92	112.01	1,120.08
72	920.99	217.97	126.55	1,265.50

Notes: * WWTP design capacity (2.70 mgd) used to calculate WLA.

4.5 Identification and Description of Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment (Appendix B). The approach for identifying "Probable Sources of Impairment" includes additional input from a variety of stakeholders including landowners, watershed groups, and local, state, tribal, and federal agencies. Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list will be reviewed and modified, as necessary, with watershed groups and other stakeholder input during the TMDL public meeting and comment period.

Although this procedure is subjective and qualitative, SWQB has concluded that it provides the best available information for the identification of probable sources of impairment in a watershed. The list of "Probable Sources" is not intended to single out a particular land owner or land management activity and generally includes several potential sources per impairment. Table 4.14 displays pollutant sources that may contribute to each segment as determined by field reconnaissance and evaluation. Probable sources of turbidity impairments will be evaluated, refined, and changed as necessary through the WBP.

Table 4.14 Probable Source Summary for Turbidity

AU	NPDES permits	Probable Sources
Agua Chiquita (perennial portions McEwan Cny to headwaters)	none	Bridges/culverts/railroad crossings, channelization, drought-related impact.highway/road/bridge runoff, legacy logging operations, paved roads, gravel or dirt roads, pavement/impervious surfaces, rangeland grazing, residences/buildings.
Rio Peñasco (HWY 24 to Cox Canyon)	none	Angling pressure, bridges/culverts/railroad crossings, channelization, dams/diversions, dredging, drought-related impacts, fish stocking, flow alteration, highway/road/bridge runoff, irrigated crop production, irrigation return drains, legacy logging operations, paved roads, gravel/dirt roads, pavement/impervious surfaces, rangeland grazing, wildlife other than waterfowl.
Rio Ruidoso (Eagle Ck to US Hwy 70 Bridge)	NM0029165	Channelization, drought-related impacts, gravel/dirt roads, surface films/odors, mass wasting, on-site treatment systems, pavement/impervious surfaces, residences/buildings, stream channel incision, waterfowl, watershed runoff following forest fire.

4.6 Linkage between Water Quality and Pollutant Sources

Turbidity is an expression of the optical property in water that causes incident light to be scattered and absorbed rather than transmitted in straight lines. It is the condition resulting from suspended solids in the water, including silts, clays, and plankton. Such particles absorb heat in the sunlight, thus raising water temperature, which in turn lowers dissolved oxygen levels. It also prevents sunlight from reaching plants below the surface. This decreases the rate of photosynthesis, so less oxygen is produced by plants. Turbidity may harm fish and their larvae. Turbidity exceedences, historically, are generally attributable to soil erosion, excess nutrients, various wastes and pollutants, and the stirring of sediments up into the water column during high flow events.

Turbidity increases, as observed in SWQB monitoring data, show turbidity values along these reaches that exceed the State Standards for the protection of designated uses. Through monitoring, and pollutant source documentation, it has been observed that the most probable cause for these exceedences are due to increased land disturbance and changing land use. Disturbances may be historical or current in nature.

The components of a watershed continually change through natural ecological processes such as vegetation succession, erosion, and evolution of stream channels. Intrusive human activity often affects watershed function in ways that are inconsistent with the natural balance. These changes, often rapid and sometimes irreversible, occur when people:

- Cut forests;
- Clear and cultivate land;
- Remove stream-side vegetation;
- Alter the drainage of the land;
- Channelize watercourses;
- Withdraw water for irrigation;
- Build towns and cities; and
- Discharge pollutants into waterways.

Possible effects of these practices on aquatic ecosystems include:

- Increased amount of sediment carried into water by soil erosion, which in turn may:
    - Increase turbidity of the water;
    - Reduce transmission of sunlight needed for photosynthesis;
    - Interfere with animal behaviors dependent on sight (foraging, mating, and escape from predators);
    - Impede respiration (e.g., by gill abrasion in fish) and digestion;
    - Reduce oxygen in the water;
    - Cover bottom gravel and degrade spawning habitat; and
    - Cover eggs, which may suffocate or develop abnormally; fry may be unable to emerge from the buried gravel bed.
- Clearing of trees and shrubs from shorelines, which in turn may:
    - Destabilize banks and promote erosion;
    - Increase sedimentation and turbidity;
    - Reduce shade and increase water temperature which could disrupt fish metabolism; and
    - Cause channels to widen and become more shallow.
- Land clearing, constructing drainage ditches, straightening natural water channels, which in turn may:
    - Create an obstacle to upstream movement of fish and suspend more sediment in the water due to increased flow;
    - Strand fish upstream and dry out recently spawned eggs due to subsequent low flows; and
    - Reduce base flows.

Where data gaps exist or the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

Additional turbidity and TSS sampling would need to be conducted in the referenced reaches to more fully characterize probable sources of turbidity. However, sufficient data exist to support development of turbidity TMDLs to address the stream standards exceedences.

4.7 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source loading estimates, and the modeling analysis. The MOS can be expressed implicitly, explicitly, or a combination of the two. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

The MOS for the TMDLs was developed using a combination of conservative assumptions and allocating an explicit portion of the TMDL in recognition of potential errors. Therefore, this MOS is the sum of the following two elements:

- *Conservative Assumptions*
    - TSS is a conservative parameter that does not settle out of the water column
- *Explicit Recognition of Potential Errors*
    - Uncertainty exists in the relationship between TSS and turbidity. A conservative MOS for this element is **5 %**.
    - The critical flow value for the ungaged streams was estimated based on a regression equation from Waltemeyer (2002). There is inherent error in all flow calculations, including those based on gage data. A conservative MOS for this element for AUs which used the regression equation is therefore **10 %**.
    - There is inherent error in all flow measurements; a conservative MOS for this element in gaged streams is **5 %**.

4.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Data used in the calculation of these TMDLs were collected during the spring, summer, and fall of 2012 in order to ensure coverage of any potential seasonal variation in the system. Since the critical flow condition is set to estimate critical low flow discharge, it is assumed that if critical conditions are met, coverage of any potential seasonal variation will also be met.

4.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2040. The Lincoln County population is projected to grow by an estimated 1.3% over the 2010-2040 time period. Similarly, the Chaves County population is projected to grow by an estimated 4.71% and the Otero County population is project to grow by an estimated 0.79% over the same time period. The 2010 Census population for Lincoln County is 20,497, Chaves County is 65,783, and Otero County is 64,275 (NMBBER 2012).

Due to the lack of unpermitted point sources in the watersheds, it is likely that turbidity is primarily due to diffuse nonpoint sources. Estimates of future growth in Lincoln, Chaves, and Otero counties are not anticipated to lead to a significant increase in turbidity that cannot be controlled with BMP. However, it is imperative that BMPs continue to be utilized to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit. Any future growth would be considered part of the existing load allocation, assuming persistence of the hydrologic conditions used to develop these TMDLs.

5.0 MONITORING PLAN

Pursuant to CWA Section 106(e)(1), 33 U.S.C. Section 1251, 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, NMSA 1978, Section 74-6-1 et seq., 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. SWQB revised its 10-year monitoring and assessment strategy (NMED/SWQB 2010a) and submitted it to EPA Region 6 for review on March 23, 2010. The strategy details both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. The SWQB utilizes a rotating basin approach to water quality monitoring. In this approach, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every eight years. The next scheduled monitoring date for the Sacramento Mountains is 2020. 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. 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 were directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997), however NMED/SWQB completed the final remaining TMDL on the consent decree in December 2006 and USEPA approved this TMDL in August 2007. The U.S. District Court dismissed the Consent Decree on April 21, 2009.

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 Standard Operating Procedures (NMED/SWQB 2010a).

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 eight 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.

It should be noted that a watershed would not be ignored during the years in between water quality surveys. 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 and on-going studies being performed by the USGS and USEPA. 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 Point Sources- NPDES permitting

Specific NPDES permit implementation discussions are included in Sections 3.4.1 and 4.4.1.

City of Ruidoso Downs and Village of Ruidoso WWTP (NPDES permit NM0029165)
The *E. coli* WLA assigned to the Ruidoso/Ruidoso Downs WWTP is based on the *E. coli* criterion in 20.6.4.208 NMAC.

The turbidity WLA assigned to the Ruidoso/Ruidoso Downs WWTP is based on the turbidity-TSS relationship calculated for the Rio Ruidoso (Eagle Creek to US Hwy 70) assessment unit. Although lower TSS concentrations were used to calculate the WLA than are applied in the current NPDES permit, NMED fully expects that the WWTP will be able to meet the WLA based on evaluation of 2012-2014 discharge monitoring report (DMR) data, which show TSS concentrations significantly below the TMDL limits (average = 0.22 mg/L for reported 30-day averages and 0.38 mg/L for reported 7-day averages).

Sacramento Methodist Assembly WWTP (NPDES permit NM0028886)
The Sacramento Methodist Assembly WWTP discharges into an unnamed intermittent tributary to the Agua Chiquita. The Agua Chiquita (perennial portions McEwan Cny to headwaters) is located approximately ½ mile below the WWTP outfall. Except during storm flows the effluent percolates into the ground before reaching the Agua Chiquita. It was assumed that the Sacramento Methodist Assembly WWTP does not contribute to the loading or concentration of turbidity-TSS in the Agua Chiquita (perennial portions McEwan Cny to headwaters) in excess of de minimis amounts. Therefore, a turbidity WLA for this facility was not included in this document (See Section 4.4.1 for more detail).

There are no other NPDES permits that discharge to assessment units addressed in this document.

6.2 Nonpoint Sources – WBP and BMP Coordination

A WBP 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 nonpoint source impacts to water quality. This long-range strategy will become instrumental in coordinating efforts to achieve water quality standards in the watershed. The WBP is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WBP leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

SWQB staff will continue to provide technical assistance such as selection and application of BMPs needed to meet WBP goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing.

The White Fire burned 10,300 acres in the Lincoln National Forest in 2011 and the Little Bear Fire burned 44,330 acres in the Lincoln National Forest in 2012. SWQB staff created the Wildfire Impacts on Surface Water Quality website http://www.nmenv.state.nm.us/swqb/Wildfire/index.html to further inform stakeholders and management agencies about the water quality impacts from fires.

6.3 Clean Water Act § 319(h) Funding

The Watershed Protection Section of the SWQB can potentially provide 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 through a Request for Proposal (RFP) process. Selected projects require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is potentially available, generally annually, for both watershed-based planning 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/.

6.4 Other Funding Opportunities and Restoration Efforts in the Sacramento Mountains

Several other sources of funding exist 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. They can also provide matching funds for appropriate CWA §319(h) projects using state revolving fund monies. The USDA Natural Resources Conservation Service (NRCS) 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 is another source of assistance. The Bureau of Land Management (BLM) has several programs in place to provide assistance to improve unpaved roads and grazing allotments.

On August 15, 2013, the intention for a new state-funded stream restoration program called the River Stewardship Program was announced. The River Stewardship Program has the overall goal of addressing the root causes of poor water quality and stream habitat. Objectives of the River Stewardship Program include: restoring or maintaining hydrology of streams and rivers to better handle overbank flows and thus reduce flooding downstream; enhancing economic benefits of healthy river systems such as improved opportunities to hunt, fish, float or view wildlife; and providing state matching funds required for federal CWA grants.” The New Mexico Legislature provided $2.3 million in the state FY2015 budget to support this initiative. Responsibility for the program will be assigned to NMED, and staff will develop and administer the program.

7.0 APPLICABLE REGULATIONS and STAKEHOLDER ASSURANCES

New Mexico's Water Quality Act ("Act") authorizes the WQCC to "promulgate and publish regulations to prevent or abate water pollution in the state" (NMSA 1978, § 74-6-4 (E)) 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 provides that:

> *"[t]he Water Quality Act 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."*

NMSA 1978, §74-6-12 (A). In addition, the State of New Mexico Surface Water Quality Standards, Subsection C of 20.6.4.4 NMAC also provides:

"C. Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water."

20.6.4.4 (C) NMAC. New Mexico policies are in general accord with the federal Clean Water Act Section 101 (g), 33 U.S.C. §1251 (g), goals:

"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 chapter. It is the further policy of Congress that nothing in this chapter 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."

33 U.S.C. §1251 (g). New Mexico's CWA Section 319 program has been developed in a coordinated manner with the State's 303(d) process. All Section 319 watersheds that are targeted in the annual RFP process coincide with the State's preparation of the biennial impaired waters listing as approved by the USEPA. The State has given a high priority for funding, assessment, and restoration activities to these impaired/listed watersheds.

As a constituent agency, NMED has the authority pursuant to NMSA 1978, Section 74-6-10, 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 Section 319 of the Clean Water Act (33 U.S.C. § 1329). 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 entities, NMED has established Memoranda of Understanding ("MOU") with various federal agencies, in particular the USFS and the BLM. A MOU has also been developed with other state agencies, such as the New Mexico Department of Transportation. 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 ten to twenty 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 the SWQB, and other parties identified in the WBP. 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. The draft TMDL was made available for a 30-day comment period beginning on July 7, 2014. Responses to comments are attached as **Appendix D** to the final draft 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. A public meeting was held on July 16, 2014 in Ruidoso. A meeting with all parties who submitted public comments was held on October 24, 2014 to discuss the draft TMDL and the draft Response to Comments. A meeting was held with all parties on December 5, 2014 to discuss the 2015 sampling to be performed by Parametrix and the Village of Ruidoso/City of Ruidoso Downs. SWQB staff provided comments on the draft field sampling plan to Parametrix on January 2, 2015. The SWQB plans to present the final draft TMDL to the Water Quality Control Commission (WQCC) at the regularly scheduled August 2015 meeting.

Once the TMDL is approved by the WQCC, the next step for public participation will be activities as described in Section 6.0 and participation in watershed protection projects including those that may be funded by Clean Water Act Section 319(h) grants.

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APPENDIX A

CONVERSION FACTOR DERIVATIONS

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FLOW

Flow (as million gallons per day [MGD]) and concentration values (milligrams per liter [mg/L]) must be multiplied by a conversion factor in order to express the load in units “pounds per day.” The following expressions detail how the conversion factor was determined.

TMDL Calculation:

$$Flow\ (MGD) \times Concentration\ \left(\frac{mg}{L}\right) \times CF\left(\frac{L-lb}{gal-mg}\right) = Load\left(\frac{lb}{day}\right)$$

Conversion Factor Derivation:

$$CF = 10^6 \times \frac{3.785\ L}{gal} \times \frac{1\ lb}{454{,}000\ mg} = 8.34\left(\frac{L-lb}{gal-mg}\right)$$

Flow is converted from cfs to MGD by the following equation:

$$\left(\frac{ft^3}{s}\right) * \left(\frac{86{,}400\ s}{1\ day}\right) * \left(\frac{7.48\ gal}{ft^3}\right) * \left(\frac{1\ Million\ gal}{1{,}000{,}000\ gal}\right) = MGD$$

APPENDIX B

PROBABLE SOURCES OF IMPAIRMENT

"Sources" are defined as activities that may contribute pollutants or stressors to a water body (USEPA 1997). The list of "Probable Sources of Impairment" in the Integrated 303(d)/305(b) List, Total Maximum Daily Load documents (TMDL's), and Watershed-Based Plans (WBP's) is intended to include any and all activities that could be contributing to the identified cause of impairment. Data on Probable Sources is routinely gathered by Monitoring and Assessment Section staff and Watershed Protection Section staff during water quality surveys and watershed restoration projects and is housed in the Assessment Database (ADB version 2). ADB was developed by USEPA to help states manage information on surface water impairment and to generate §303(d)/ §305(b) reports and statistics. More specific information on Probable Sources of Impairment is provided in individual watershed planning documents (e.g., TMDL's, WBP's, etc) as they are prepared to address individual impairments by assessment unit.

USEPA through guidance documents strongly encourages states to include a list of Probable Sources for each listed impairment. According to the 1998 305(b) report guidance, "…, states must always provide aggregate source category totals…" in the biennial submittal that fulfills CWA section 305(b)(1)(C) through (E) (USEPA 1997). The list of "Probable Sources" 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 sources for each known impairment.

The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB. Any new impairment listing will be assigned a Probable Source of "Source Unknown." Probable Source Sheets will continue to be filled out during watershed surveys and watershed restoration activities by SWQB staff. Information gathered from the Probable Source Sheets will be used to generate a draft Probable Source list in consequent TMDL planning documents. These draft Probable Source lists will be finalized with watershed group/stakeholder input during the pre-survey public meeting, TMDL public meeting, WBP development, and various public comment periods. The final Probable Source list in the approved TMDL will be used to update the subsequent Integrated List.

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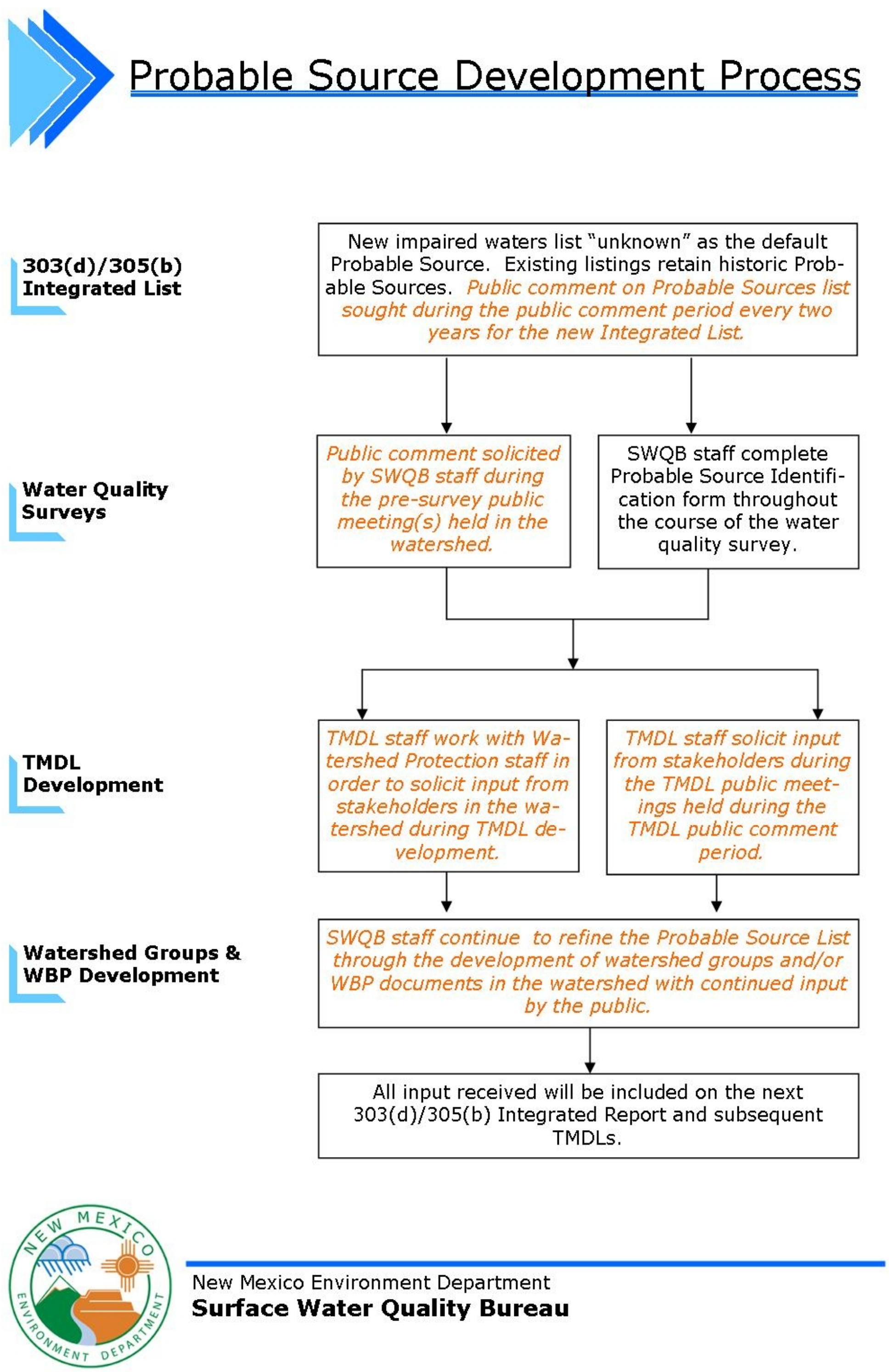
Figure B1. Probable Source Development Process and Public Participation Flowchart



APPENDIX C

WATER QUALITY DATA

Table C1. *E.coli* data

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	4/4/2012	1
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	5/8/2012	3.1
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	6/13/2012	13.5
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	7/10/2012	1413.6
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	8/7/2012	93.3
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	8/22/2012	866.4
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	9/19/2012	38.4
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz000.1	10/10/2012	4.1
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz003.0	4/4/2012	2
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz003.0	5/8/2012	15.8
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz003.0	6/13/2012	29.2
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz003.0	7/10/2012	1046.2
Carrizo Creek (Rio Ruidoso to Mescalero Apache bnd)	57Carriz003.0	8/7/2012	28.8

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	48NogalC000.2	5/8/2012	14.6
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	48NogalC000.2	5/22/2012	21.3
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	48NogalC000.2	7/25/2012	307.6
Nogal Creek (Tularosa Creek to Mescalero Apache bnd)	48NogalC000.2	8/23/2012	435.2

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit053.4	4/3/2012	1
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit053.4	5/8/2012	79.4
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit053.4	6/13/2012	488.4
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit053.4	8/7/2012	263.1
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit059.9	5/16/2012	1
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit059.9	6/13/2012	9.8
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit059.9	6/20/2012	1
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit061.1	4/3/2012	1
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit061.1	5/8/2012	27.5
Rio Bonito (NM 48 near Angus to headwaters)	57RBonit061.1	5/16/2012	78

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	4/4/2012	1
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	5/8/2012	35.9
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	6/13/2012	50.4
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	8/22/2012	2419.6
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	9/19/2012	122.3
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido045.3	10/10/2012	28.5
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido052.4	4/4/2012	1
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido052.4	5/8/2012	11.9
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido052.4	6/13/2012	67.6
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido052.4	7/10/2012	2419.6
Rio Ruidoso (Carrizo Creek to Mescalero Apache bnd)	57RRuido052.4	8/7/2012	52.1

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	4/3/2012	72.2
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	5/9/2012	1732.9
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	6/12/2012	920.8
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	7/11/2012	980.4
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	8/7/2012	579.4
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	8/22/2012	2419.6
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	9/19/2012	1553.1
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido031.5	10/10/2012	104.6
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	4/4/2012	9.7
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	5/9/2012	686.7
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	6/13/2012	2419.6
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	7/11/2012	1553.1
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	8/7/2012	770.1
Rio Ruidoso (US Hwy 70 bridge to Carrizo Creek)	57RRuido039.4	8/22/2012	2419.6

Assessment Unit	Site	Date	*E.coli* results (cfu/100mL)
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	4/3/2012	27.5
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	5/9/2012	77.1
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	6/12/2012	35
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	7/11/2012	2419.6
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	8/7/2012	325.5
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	8/22/2012	2419.6
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	9/19/2012	410.6
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	10/10/2012	66.3
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	4/3/2012	13.2
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	5/9/2012	71.7
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	6/12/2012	517.2
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	7/11/2012	866.4
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	8/7/2012	313
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	8/22/2012	2419.6
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	9/19/2012	60.2
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	10/10/2012	47.3

Table C2. Turbidity and TSS data

Assessment Unit	Site	Date	Turbidity (NTU)	TSS (mg/L)
Agua Chiquita (perennial portions McEwan Canyon to headwaters)	59AguaCh029.0	4/5/2012	2.1	5
Agua Chiquita (perennial portions McEwan Canyon to headwaters)	59AguaCh029.0	5/10/2012	6	8
Agua Chiquita (perennial portions McEwan Canyon to headwaters)	59AguaCh029.0	6/13/2012	0	3
Agua Chiquita (perennial portions McEwan Canyon to headwaters)	59AguaCh029.0	7/26/2012	1310.4	1240
Agua Chiquita (perennial portions McEwan Canyon to headwaters)	59AguaCh029.0	9/26/2012	0.4	4

Assessment Unit	Site	Date	Turbidity (NTU)	TSS (mg/L)
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	4/5/2012	3.9	7
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	5/10/2012	0.2	3
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	6/14/2012	0	3
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	7/26/2012	29.5	46
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	8/8/2012	0.2	10
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas108.4	9/26/2012	0.6	3
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas140.2	4/5/2012	14.5	24
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas140.2	5/10/2012	17.2	33
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas140.2	6/14/2012	4.9	12
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas140.2	7/26/2012	41.5	188
Rio Peñasco (Hwy 24 to Cox Canyon)	59RPenas140.2	8/8/2012	16	41

Assessment Unit	Site	Date	Turbidity (NTU)	TSS (mg/L)
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	4/3/2012	1.7	3
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	5/9/2012	1.4	65
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	6/12/2012	0	3
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	7/11/2012	185.1	340
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	8/7/2012	3.7	6
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido019.8	9/12/2012	476.4	30
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	4/3/2012	2.5	5
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	5/9/2012	0.5	3
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	6/12/2012	1.1	4
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	7/11/2012	79.5	168
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	8/7/2012	0	8
Rio Ruidoso (Eagle Creek to US Hwy 70 bridge)	57RRuido030.5	9/12/2012	18.1	37

APPENDIX D

PUBLIC COMEMNTS