PUBLIC COMMENT DRAFT

TOTAL MAXIMUM DAILY LOAD (TMDL)

FOR THE

LOWER PECOS RIVER

JULY 15, 2016

Prepared by

New Mexico Environment Department, Surface Water Quality Bureau

Monitoring, Assessments, and Standards Section

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LIST OF ABBREVIATIONS

4Q3	4-Day, 3-year low-flow frequency
6T3	Temperature not to be exceeded for 6 or more consecutive hours on more than 3 consecutive days
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general storm water permit
CoolWAL	Cool Water Aquatic Life
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
^{o}C	Degrees Celsius
^{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
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
MCWAL	Marginal Coldwater Aquatic Life
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
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SEE	Standard Error of the Estimate
SLO	State Land Office
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through June 5, 2013)
WBP	Watershed-based plan

EXECUTIVE SUMMARY

Section 303(d) of the Federal Water Pollution Control Act , a.k.a., Clean Water Act (CWA), 33 U.S.C. §1313[1], requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be impaired. A TMDL defines 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. TMDL is defined as the sum of the individual Waste Load Allocations for point sources and Load Allocations for nonpoint source and background conditions; see 40 C.F.R. §130.2(i)[2]. TMDLs also include a Margin of Safety, a required component that acknowledges and counteracts uncertainty.

The Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Lower Pecos River basin of southeastern New Mexico in 2013. Water quality monitoring stations were located within the watersheds to evaluate ambient water quality conditions and the impact of tributary streams. Assessment of data generated during this monitoring effort resulted in impairment determinations[3] of New Mexico water quality standards for *E.coli* bacteria in the Pecos River between Carlsbad and the Texas border.

This TMDL document addresses the above noted impairments as summarized in Tables ES-1 and ES-2. The SWQB has not prepared any other TMDL documents for any portions of the mainstem lower Pecos River. Other potential water quality impairments were identified but are not addressed in this document due to additional data needs, assessment protocol revisions or re-application, or impending use attainability analyses. Details of those other potential impairments may be found in the 2016-2018 Integrated CWA §303(d)/ §305(b) List[4]. If the impairments are verified, subsequent TMDLs will be prepared in a separate TMDL document.

Under the current Draft Prioritization Framework Strategy, the SWQB's Monitoring, Assessment, and Standards Section (MASS) is next scheduled to collect water quality data in the Lower Pecos watershed in 2019 and 2020. TMDL targets will be re-examined and potentially revised at that time as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate category in the Integrated Report.

The 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 WBPs will be done with participation of interested and affected parties. Further information on WBPs is in Section 6.

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[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
[3] http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm
[4] https://www.env.nm.gov/swqb/303d-305b/2016-2018/index.html

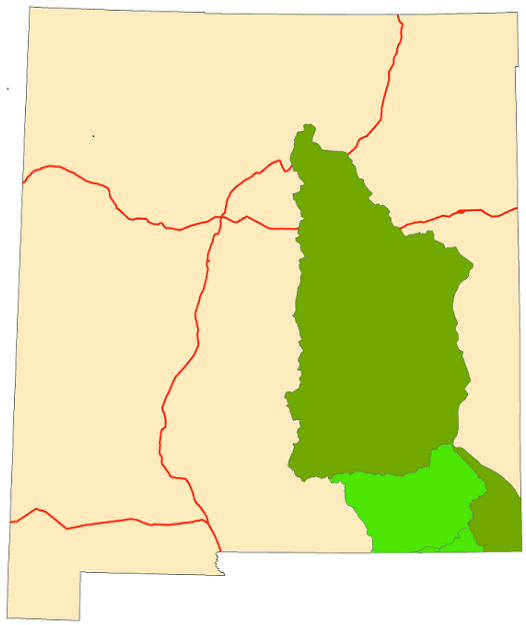

Figure ES.1 Location of the Pecos River basin (dark green) and the 8-digit Hydrologic Unit Code drainages tributary to the impaired Assessment Units (light green).

Table ES-1 Summary for Pecos River (TX Border to Black River)

New Mexico Standards Segment	20.6.4.201
Waterbody Identifier	NM-2201_00
Segment Length	35.54 miles
Parameters of Concern	*E. coli*
Uses Affected	Primary Contact
Geographic Location	Upper Pecos-Black River USGS Hydrologic Unit Code 13060011
Scope/size of Watershed	4312 mi^2
Land Type	Chihuahuan Basins and Playas (Ecoregion 24a)
Land Use/Cover	69% rangeland, 26% forest, 4% agriculture
Probable Sources	Dumping/Garbage/Trash/Litter; Residences/Buildings; Pavement/ Impervious Surfaces; Rangeland Grazing; Waterfowl; Bridges/ Culverts/RR Crossings; Low Water Crossing; Paved Roads
Land Management	54% BLM, 17% private, 16% SLO, 8% Forest Service
IR Category	5/5C
Priority Ranking	High
TMDL for: *E. coli* (cfu/day)	**WLA + LA + MOS = TMDL** High Flow 0 + 9.90×10^{11} + 1.10×10^{11} = 1.10×10^{12} Mod Flow 0 + 1.56×10^{11} + 1.73×10^{10} = 1.73×10^{11} Low Flow 0 + 3.61×10^{10} + 4.01×10^{9} = 4.01×10^{10}

Table ES-2 Summary for Pecos River (Black River to Six Mile Dam Lake)

New Mexico Standards Segment	20.6.4.202
Waterbody Identifier	NM-2202.A_00
Segment Length	16.13 miles
Parameters of Concern	*E. coli*
Uses Affected	Primary Contact
Geographic Location	Upper Pecos-Black River USGS Hydrologic Unit Code 13060011
Scope/size of Watershed	4312 mi^2
Land Type	Chihuahuan Basins and Playas (Ecoregion 24a)
Land Use/Cover	69% rangeland, 26% forest, 4% agriculture
Probable Sources	Dumping/Garbage/Trash/Litter; Waterfowl; Irrigated Crop Production; Gravel or Dirt Roads; Bridges/Culverts/RR Crossings; Irrigation Return Drains; Wildlife other than Waterfowl
Land Management	54% BLM, 17% private, 16% SLO, 8% Forest Service
IR Category	5/5A
Priority Ranking	High
TMDL for: *E. coli* (cfu/day)	**WLA + LA + MOS = TMDL** High Flow 0 + 6.78×10^{11} + 7.53×10^{10} = 7.53×10^{11} Mod Flow 0 + 1.12×10^{11} + 1.24×10^{10} = 1.24×10^{11} Low Flow 0 + 2.79×10^{10} + 3.10×10^{9} = 3.10×10^{10}

1.0 INTRODUCTION

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

This document is divided into several sections. Section 1.0 provides background information on the location and history of the Lower Pecos River basin, and provides applicable water quality standards for the assessment units addressed in this document. Section 2.0 provides information on the water quality survey performed in the watershed in 2013. Section 3.0 presents the TMDLs developed for bacteria in the lower Pecos River. Pursuant to Section 106(e)(1) of the federal CWA, Section 5.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 6.0 discusses implementation of TMDLs and the relationship between TMDLs and Watershed Based Plans (WBPs). Section 7.0 discusses assurance; Section 8.0 public participation in the TMDL process; and Section 9.0 provides references for this document.

2.0 PECOS RIVER BASIN CHARACTERISTICS

2.1 Location Description and Land Ownership

The Pecos heads in the Sangre de Cristo mountain range at almost 12,000 ft elevation, and exits New Mexico at the Texas border approximately 500 river miles later at an elevation of 866 m (2840 ft), the lowest point in the state. Major land owners in the watershed include the Bureau of Land Management (BLM), U.S. Forest Service (USFS), and private parcels (Figure 2.1). Urban areas in the watershed include Roswell, Artesia and Carlsbad.

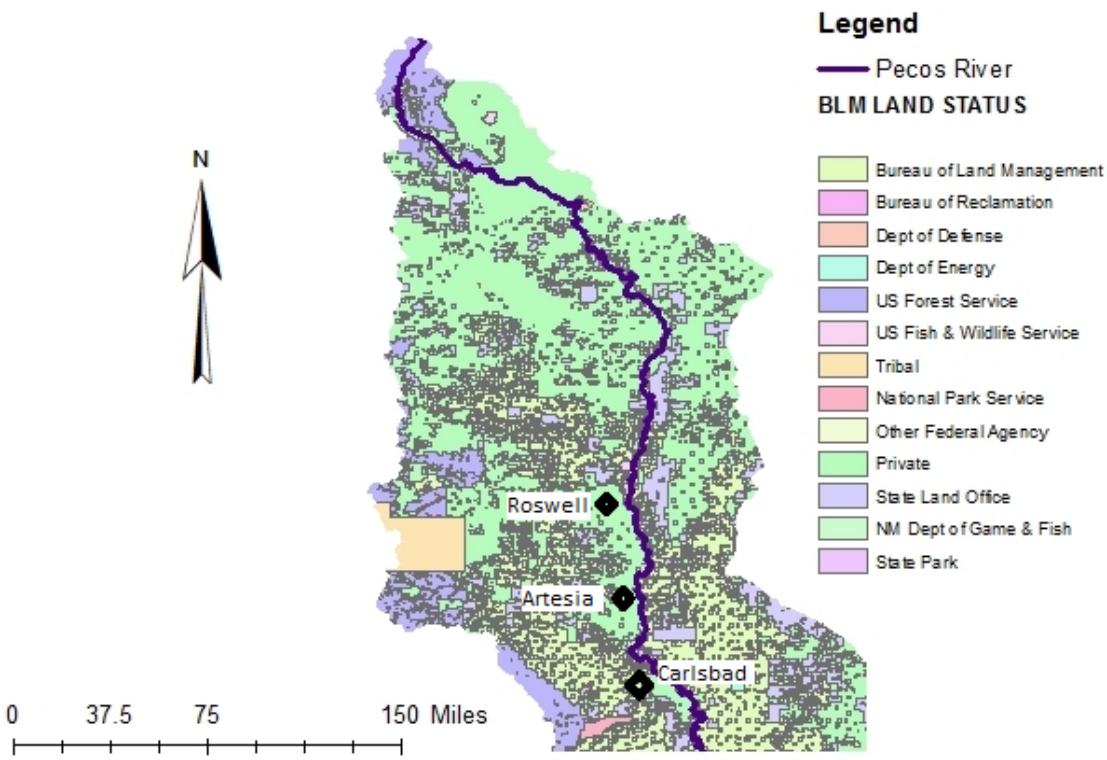

Figure 2.1 **Pecos River basin in New Mexico, land ownership.**

2.2 Geology

The lower Pecos watershed lies in the Southern High Plains, Rio Grande Rift, and Basin and Range geological provinces (NMBGMR). Major geologic features include the Delaware Basin and the Guadalupe and Sacramento Mountains. Surface geology is dominated by limestone and other

carbonates to the east and recent alluvium in the west (Figures 2.2 and 2.3). Evaporites are common throughout the watershed.

The Delaware Basin is a sedimentary basin located in southwestern New Mexico and Texas. It is a sub-basin of the larger Permian Basin, which is well known due to its large hydrocarbon reservoirs. The precursor to the basin began forming in the late Proterozoic, most likely at the site of a depression in the North American craton. Over time, shallow marine water deposited limestones and shales in the basin, frequently interrupted by emergence, subaerial erosion, evaporite and red bed deposition, and reef formation, including the Capitan Reef complex. Tectonics associated with the Laramide orogeny resulted in uplift which created the modern Delaware Basin, where sediment thicknesses have been measured at approximately 12,000 ft, as well as the Guadalupe and Delaware Mountains (Keller *et al.*, 1980).

The Sacramento Mountains are located to the west of the Pecos River valley. The range is a wide, east-dipping limestone fault block with steep escarpments on the west, while the eastern side gradually slopes gradually towards the Pecos River (NMED/SWQB 2015). One of the key formations in the Sacramento Mountains is the San Andres formation, a primarily limestone and dolomite artesian aquifer which provides irrigation water for the Roswell-Artesia area. The aquifer is recharged by rainfall and ephemeral surface water on the slope between the Sacramentos and the river. Fractures and faults allow surface water to penetrate quickly (Johnson *et al.*, 2003).

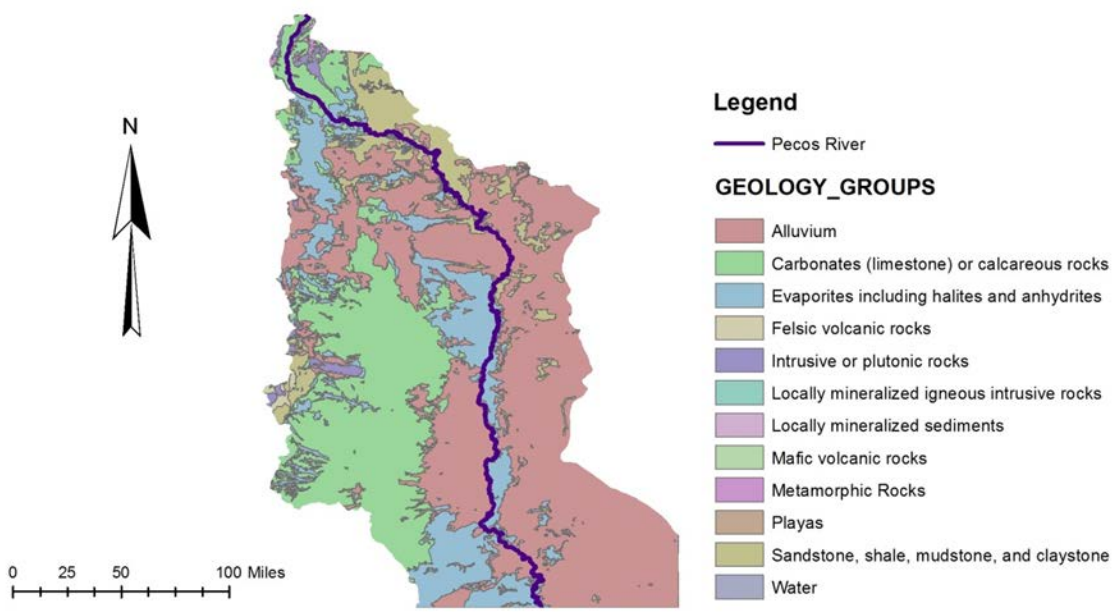

Figure 2.2 Surface geology of the Pecos River basin in New Mexico

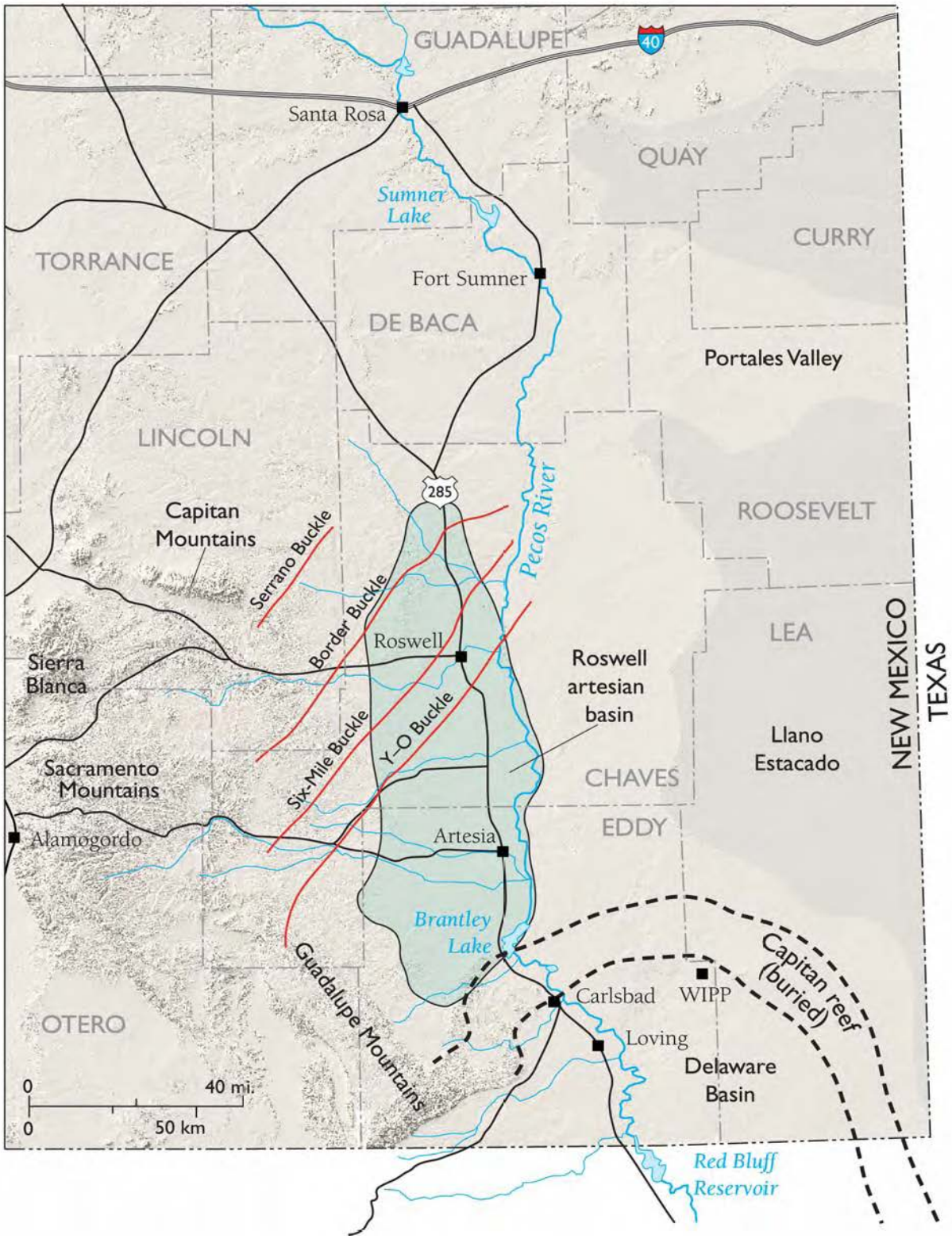

Figure 2.3 Sub-surface geology of the Pecos River basin in New Mexico (from Johnson et al, 2003)

2.3 Hydrology

Sources of water in the Pecos River are snowmelt and runoff from the headwaters, overland flow from watershed precipitation, and groundwater inflow (baseflow), of which overland flows provide most of the surface water supply. Significant amounts of baseflow occur in particular at the springs in and around Santa Rosa, from artesian and shallow aquifers between Roswell and Artesia, and in the Carlsbad area, but groundwater diversions have reduced the amount of input from these sources. There is also base inflow caused by seepage from Lake Avalon (an irrigation storage basin) and return flows from irrigation ditches. In addition, saline waters of the Rustler Formation discharge into the Pecos River near Malaga Bend, south of Loving, resulting in a dramatic increase in salinity of the river downstream (Miyamoto et al, 2007).

There are primarily three processes that contribute to the reduction of flows in the Pecos River: evapotranspiration from vegetation and from reservoir storage; seepage of water into the underlying ground water system; and human consumptive use, mainly for irrigation. On average, approximately 110,000–120,000 acre-feet of Pecos River water are diverted each year for irrigation of crops. Approximately 85 percent of this is used by two large irrigation districts, the Carlsbad Irrigation District (CID) and the Fort Sumner Irrigation District. Fort Sumner is many miles upstream from the TMDL focus area and does not directly influence flows below Carlsbad. Four main stem reservoirs provide flood control for the basin and irrigation water supply for the CID. The CID storage system operates as a whole to store and redistribute the highly variable flows of the Pecos. CID diverts approximately 75,000 acre-feet annually from these four reservoirs to irrigate about 20,000 acres of farmland. “Block releases” of high volumes of water (over 1,000 cfs) are released at a constant rate for 14–20 days. These block releases occur two to three times per year, depending on supply and demand within the CID. The remaining usage is by the many irrigators who pump water directly from the river, and by small acequias (BOR, 2006).

The Pecos River Compact between New Mexico and Texas was intended to provide a means for allocating the surface waters of the river. New Mexico’s obligation is determined by a complex set of instructions called the River Master’s Manual. Since 1993 the New Mexico Interstate Stream Commission has been leasing water from CID members and has purchased water rights throughout the basin for the purpose of meeting New Mexico’s compact obligations. Compact delivery is measured at the USGS Red Bluff gage (BOR, 2006).

2.4 Water Quality Standards

Water quality standards (WQS) for all assessment units in this document are set forth in sections 20.6.4.52, 20.6.4.201, and 20.6.4.202 of *New Mexico Standards for Interstate and Intrastate Surface Waters,* as amended through June 5, 2013 (NMAC 2013. These standards have been approved by the USEPA for Clean Water Act purposes. The following are the relevant NMAC sections:

20.6.4.52 PECOS RIVER BASIN - In order to protect existing and designated uses, it is a goal of the state of New Mexico to prevent increases in TDS in the Pecos river above the following benchmark values, which are expressed as flow-weighted, annual average concentrations, at three USGS gaging stations: at Santa Rosa 500 mg/L; near Artesia 2,700 mg/L; and near Malaga 3,600 mg/L. The benchmark values serve to guide state action. They are adopted pursuant to the New Mexico Water Quality Act, not the Clean Water Act. [20.6.4.52 NMAC - N, 12-01-10]

20.6.4.201 PECOS RIVER BASIN - The main stem of the Pecos river from the New Mexico-Texas line upstream to the mouth of the Black river (near Loving).

A. Designated Uses: irrigation, livestock watering, wildlife habitat, primary contact and warmwater aquatic life.

B. Criteria:

(l) 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 criterion applies: dissolved boron for irrigation use 2,000 µg/L or less.

(2) At all flows above 50 cfs: TDS 20,000 mg/L or less, sulfate 3,000 mg/L or less and chloride 10,000 mg/L or less. [20.6.4.201 NMAC - Rp 20 NMAC 6.1.2201, 10-12-00; A, 05-23-05; A, 12-01-10]

20.6.4.202 PECOS RIVER BASIN - The main stem of the Pecos river from the mouth of the Black river upstream to lower Tansil dam, including perennial reaches of the Black river, the Delaware river and Blue spring.

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

B. Criteria:

(l) 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 criterion applies: temperature 34°C (93.2°F) or less.

(2) At all flows above 50 cfs: TDS 8,500 mg/L or less, sulfate 2,500 mg/L or less and chloride 3,500 mg/L or less.

C. Remarks: diversion for irrigation frequently limits summer flow in this reach of the main stem Pecos river to that contributed by springs along the watercourse. [20.6.4.202 NMAC - Rp 20 NMAC 6.1.2202, 10-12-00; A, 05-23-05; A, 12-01-10]

[**NOTE:** The segment covered by this section was divided effective 05-23-05. The standards for Lower Tansil Lake and Lake Carlsbad are under 20.6.4.218 NMAC.]

The numeric criteria identified in these sections are used to assess waters for use attainment. 20.6.4.900 NMAC provides standards applicable to designated uses unless otherwise specified in an AU's specific section. 20.6.4.12 NMAC lists general standards that apply to all surface waters of the state at all times, unless a specified standard is provided elsewhere in the NMAC.

New Mexico's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC) establishes 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 Part 131.12 (Establishment of Water Quality Standards), describes how waters are to be protected from degradation (Subsection A of 20.6.4.8 NMAC) while the *Antidegradation Policy Implementation Procedures* 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* must be met. TMDLs are consistent with the 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 Procedure* can be found in

Appendix A of the *Statewide Water Quality Management Plan and Continuing Planning Process* document.

The Pecos River AUs addressed in this TMDL are immediately upstream of the Texas border. The adjacent water quality unit in Texas is Segment 2312, Red Bluff Reservoir from Red Bluff Dam to the New Mexico state line. Segment 2312 is designated for Primary Contact Recreation 1 (PCR1), defined as "Activities that are presumed to involve a significant risk of ingestion of water". Because Red Bluff Reservoir is high in salinity and *Enterococci* are better adapted to saline conditions, the indicator bacteria for Segment 2312 are *Enterococci* rather than *E. coli*. For high saline inland waters with primary contact recreation, the geometric mean criterion for *Enterococci* is 33 per 100 ml and the single sample criterion is 78 per 100 ml (TCEQ, 2014a). SWQB sampling results would not be directly applicable to Red Bluff Reservoir since we do not test for *Enterococci*. Texas Water Quality Segment 2312 does meet its standard for bacteria, based on data assessed by the Texas Commission on Environmental Quality which was collected from 2005 to 2012 (Chris Loft, TCEQ, personal communication, 3/7/16) and it is not listed on the 2014 Texas Integrated Report Index of Water Quality Impairments (TCEQ, 2014b).

2.5 Water Quality Survey

The lower Pecos River basin was intensively sampled by the SWQB in 2013. For purposes of the survey, the lower Pecos watershed was defined as the main stem Pecos River from Sumner Dam downstream to the New Mexico-Texas border, and its tributaries (including tributaries of tributaries) entering the river within the above described reach. Tributaries sampled in this survey included the Rio Hondo, North Spring River, Black River, Delaware River, Sitting Bull Creek, and Rattlesnake Spring. A brief summary of the survey and the hydrologic conditions during the sampling period is provided in the following subsections. The 2013 survey area on the lower Pecos River basin in New Mexico encompassed portions of Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Otero, Quay, Roosevelt and Torrance counties in the southeastern portion of the state. The full 2013 Water Quality Survey Summary can be found online at https://www.env.nm.gov/swqb/MAS/surveys/LowerPecosSurvey-2013.pdf.

2.5.1 Survey Design

Surface water quality was monitored on a monthly basis year-round for the 2013 intensive SWQB study (however no *E.coli* samples were collected in January, February or December). Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. See Figure 2.4 and Table 2.1 for the location of stations relevant to this TMDL document. Surface water grab samples from these stations were analyzed for a variety of chemical, physical and biological parameters. Data results from grab sampling are housed in the SWQB water quality database and uploaded to USEPA's Water Quality Exchange (WQX) database.

Results of the survey are detailed in the Water Quality Survey Summary for the Lower Pecos River Watersheds 2013 (NMED/SWQB, 2015a). Data from these stations were assessed using established assessment protocols (NMED/SWQB, 2013) to determine whether or not designated uses were being met. As a result, the Pecos River (TX Border to Black River) and Pecos River (Black River to Six Mile Dam Lake) AUs are included in the Integrated 2016-2018 CWA §303(d)/§305(b) list (NMED/SWQB, 2016) as impaired for *E. coli.*

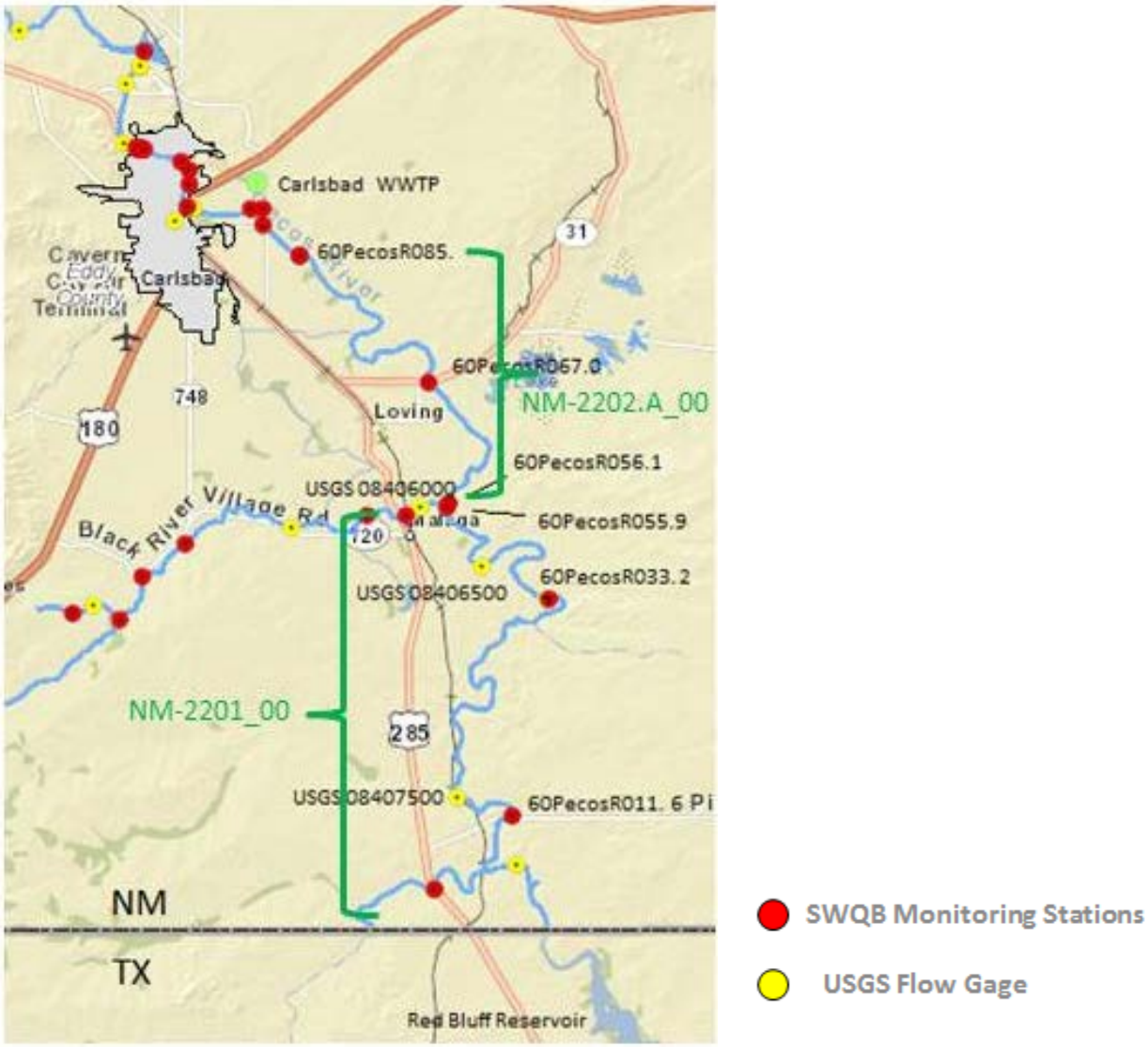

Figure 2.4 Location of monitoring stations and USGS gages referenced in this TMDL. Station and gage names are identified on Table 2.1.

Table 2.1 SWQB monitoring stations and USGS gages used for the bacteria TMDL

Assessment Unit	Station/gage ID	Station/gage Name
NM-2201_00 Pecos River (TX Border to Black River)	USGS 08407500	Pecos River at Red Bluff, NM
	60PecosR011.6	Pecos River near Red Bluff at County Road 725
	60PecosR033.2	Pecos River at Pierce Canyon Crossing, NM
	60PecosR055.9	Pecos River below Black River Harroun Crossing
NM-2202.A_00 Pecos River (Black River to Six Mile Dam Lake)	USGS 08407000	Pecos River at Pierce Canyon Crossing, NM
	USGS 08406500	Pecos River near Malaga, NM
	60PecosR056.1	Pecos River above Black River
	60PecosR067.0	Pecos River below Harroun (Ten-Mile) Dam
	60PecosR085.0	Pecos River below 6 Mile Dam

2.5.2 Hydrologic Conditions

There are several active, real-time U.S. Geological Survey (USGS) gaging stations in the Pecos River associated with the reaches described in this document. Gage locations are shown on Figure 2.4 and gage characteristics are described on Table 2.2. Daily stream flow for these USGS gages are presented graphically in Figures 2.5 through 2.8 for the 2013 calendar year. Flows during the 2013 survey year were below the average annual discharge for the period of record, as recorded at relevant USGS gage stations, except for flood events in June, July and September.

Table 2.2 USGS flow gages on the Pecos River and its tributaries south of Carlsbad, NM

Gage number	Gage name	Period of record
08405200	Pecos River below Dark Canyon at Carlsbad, NM	1989-2016
08406500	Pecos River near Malaga, NM	1914-2016
08407000	Pecos River at Pierce Canyon Crossing, NM	2007-2016
08407500	Pecos River at Red Bluff, NM	1937-2016
08409500	Pecos River near Angeles, TX	1904-1941*

* Annual peak flow only

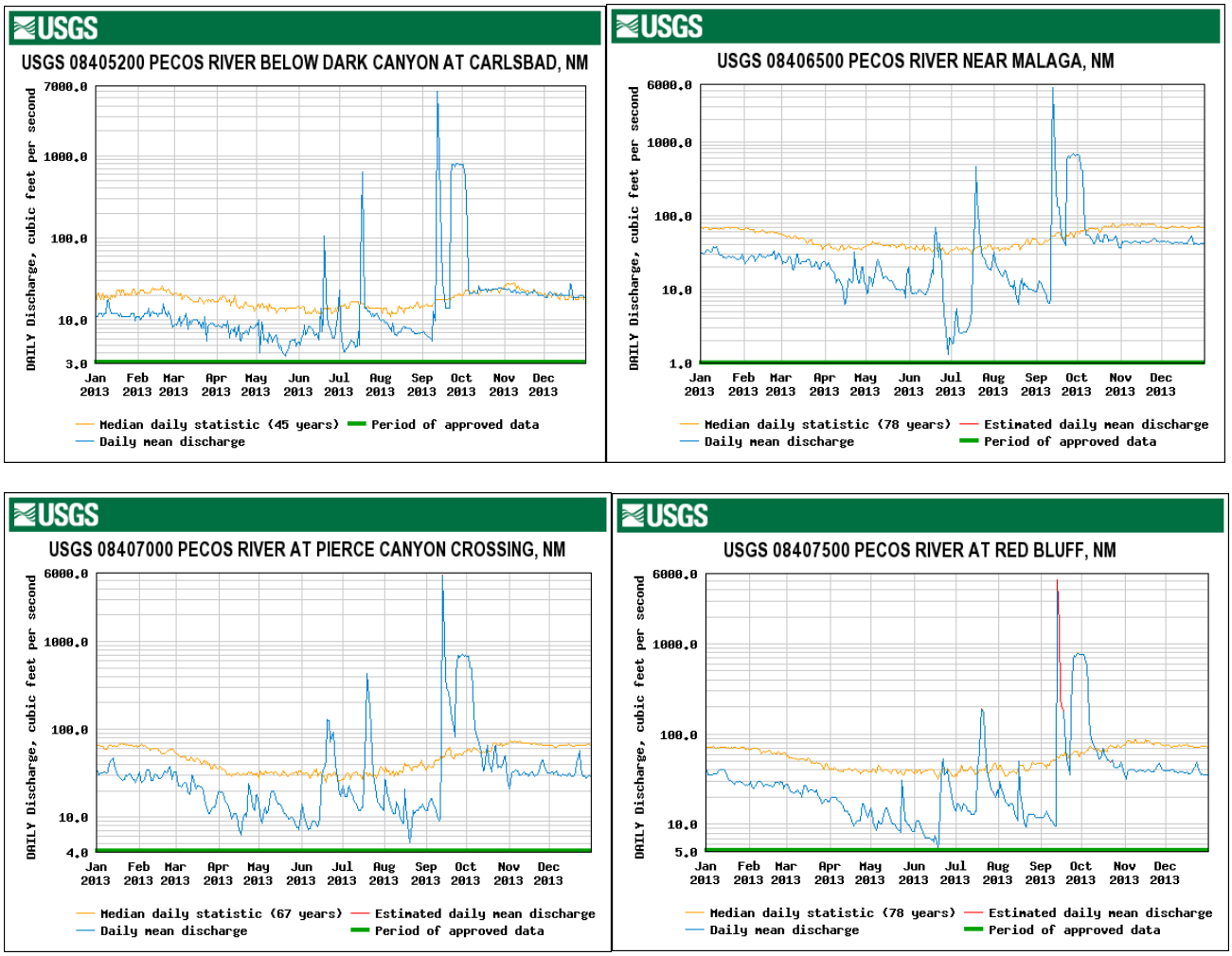

Figure 2.5 2013 water year flow data at USGS gages in the Pecos River below Carlsbad

3.0 INDIVIDUAL WATERSHED DESCRIPTIONS & IMPAIRMENTS

TMDLs have been developed for AUs for which constituent or pollutant concentrations measured during the 2013 water quality survey indicated impairment. Because characteristics of the watershed provide insight into probable sources of impairment, they are presented in this section for the individual 8-digit hydrologic unit code (HUC) watershed within the Pecos River basin that is discussed in this document (see Figure ES.1). There are two additional 8-digit HUCs that contribute flow to the impaired AUs: one comprises the valley of the Delaware River, which flows into the Pecos about seven river miles north of the state line; the other contributes direct overland flow to the Pecos south of the Delaware, but is located mostly in Texas. Because the there is no SWQB monitoring station south of the Delaware River, water quality along that reach is unknown.

Therefore a description is provided here only for HUC 1306011, which drains into AU NM-2202.A_00 and that portion of AU NM-2201_00 north of the Delaware.

3.1 Upper Pecos - Black (HUC 1306011)

Land management in the HUC is 54% BLM, 17% private, 16% SLO, 8% USFS, 1.7% NPS, and less than 1% each of BOR, DOD, DOE, SGF, SP and private. As presented in Figure 2.1, land use includes 69% rangeland, 26% forest, 4% agriculture, and less than 1% each of barren land, urban or developed land, water and wetlands. Major crops in the irrigation district are alfalfa, cotton and sorghum (BOR, 2006). In addition to agriculture, there is a lot of oil and gas exploration and production.

Inflow to Red Bluff Reservoir derives approximately 75% from the Pecos River and 25% from the Delaware River. Flow in the Pecos where it enters Texas declined drastically following construction of the Avalon and Sumner reservoirs in the 1930s (Miyamoto et al, 2007). The reduced flows are one cause of high salinity in the lower reaches. The source of salt is the dissolution of gypsum and halite evaporates of the former Permian Sea (Miyamoto et al, 2007). Significant brine intrusion occurs at Malaga bend, just south of the Black River confluence.

From Sumner Dam to the Texas border, the main stem of the Pecos River flows through two Omernick Level IV ecoregions, Conchos/Pecos Plains (26n) and Chihuahuan Basins and Playas (24a) (Griffith, et al., 2006). The AUs in the TMDL area are within ecoregion 24a., Chihuahuan Basins and Playas, contained within the Chihuahuan Deserts Level III ecoregion. It is characterized by saline and alkaline soils. Native vegetation has evolved to withstand high seasonal and diel temperature swings and extreme aridity. Upland vegetation is dominated by creosotebush (*Larrea tridentata*), and also includes fourwing saltbush (*Atriplex canescens*), tarbush (*Flourensia cernua*), various acacias (*Senegalia gregii, Vachellia constricta*, etc.), gypsum grama (*Bouteloua breviseta*), alkali sacaton (*Sporobolus airoides*), and various cacti (several of which are listed under the Endangered Species Act).

The original native vegetation of the lower Pecos was grass or shrub dominated, with scattered stands of tall woody vegetation (Dick-Peddie, 1993). Salt-cedar, or tamarisk (*Tamarix sp*.), a non-native tree originating in Asia, became common along the river corridor following its deliberate introduction for the purpose of erosion control. Efforts by multiple agencies to control this plant by chemical and mechanical means have been extensive and ongoing along the Pecos since the 1960s. An expected outcome of these efforts was to increase base flow in the river by decreasing transpiration through the tamarisk trees, however studies conducted in the 1970s and 1980s by the USGS of water budgets pre- and post-tamarisk clearing along the Pecos and Gila Rivers suggest that measurable water salvage following tamarisk clearing is only 0-1.5 acre-feet/year due to evapotranspiration of replacement vegetation, increased evaporation, loss to ground water, or other difficult-to-quantify "sinks" (USGS, 2006). An introduced biocontrol agent called tamarisk beetle (*Diorhabda elongata*) was released on the Pecos River in 2002 (Simental, 2014). The release did not succeed in establishing an effective population, but, according to the Tamarisk Coalition (http://www.tamariskcoalition.org/programs/tamarisk-beetle-maps), another introduced *Diorhabda* species has moved up the Pecos from Texas into New Mexico, first appearing here in 2013. This beetle was observed by SWQB survey staff from the Roswell area south to the confluence of the Pecos and Black rivers (NMED/SWQB, 2015).

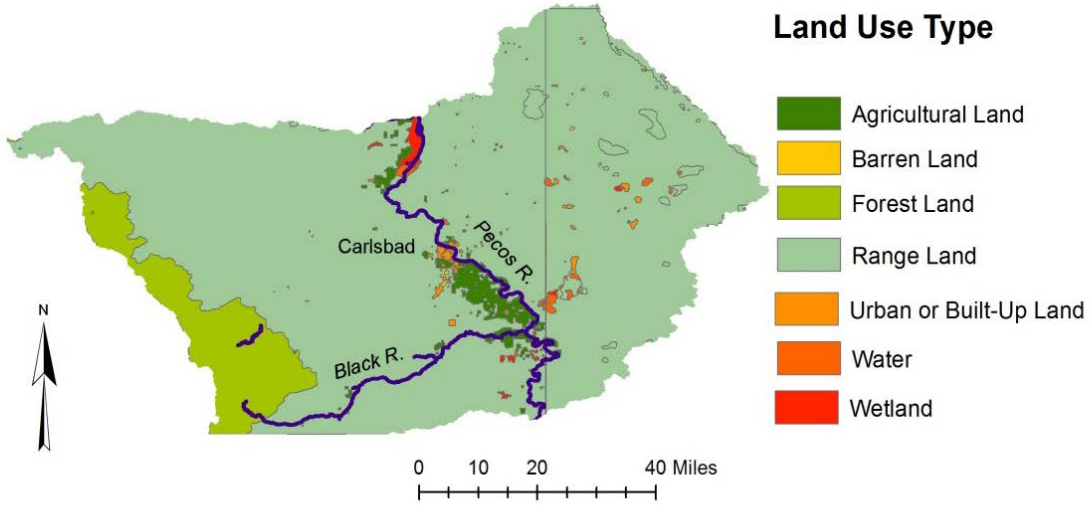

Figure 3.1 Land Use in HUC 13060011

The lower Pecos contains the most speciose native fish community in New Mexico, with at least 35 native species believed to have existed historically, and 33 documented in museum records. Of these, eight are federally or state-listed as threatened or endangered. A list of threatened and endangered animal species which occur in Eddy County, and are associated with aquatic or riparian habitats, was derived from the Biota Information System of New Mexico (BISON-M, 2016) and is shown in Appendix A.

Golden alga (*Prymnesium parvum*) is a single-celled organism found primarily in coastal waters but also in inland waters with high salt or mineral content. When it "blooms" (enters a period of rapid growth and reproduction), golden alga can release toxins that cause fish kills (TPWD, 2016). Golden alga was first identified in the Pecos River near Loving in the early 1980s. More recently fish kills started in 2003 and have seemed to lessen in the last few years (personal communication, Shawn Denny, NMDGF, 3/16/16).

4.0 BACTERIA

Escherichia coli is a species of fecal coliform bacteria that is present in the intestinal tracts and feces of warm-blooded animals. Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness, either diarrhea or illness outside of the intestinal tract. It is also used as an indicator of the potential presence of other pathogens that may present human health concerns. The primary form of recreational contact with the water on the lower Pecos is likely to be fishing. According to the latest available NM Department of Game & Fish (NMDGF) survey data, angler use averaged 73,069 angler days from 1997 through 2004. Usage may be somewhat lower due to golden algae kills in the past decade (Eric Frey and Shawn Denny, NMDGF, personal communication, 3/16/16).

Bacteria data collected for the Pecos River (TX Border to Black River) and Pecos River (Black River to Six Mile Dam Lake) AUs are shown in Appendix B and summarized on Table 4.1, below. Assessment of the data from the 2013 SWQB water quality survey in the lower Pecos River watershed identified exceedences of the New Mexico water quality standards for *E. coli* bacteria in the above AUs. As a result, these AUs are listed on the 2016-2018 Integrated CWA §303(d)/ §305(b) List (NMED/SWQB, 2016) with *E. coli* as an impairment of the primary contact designated use (NMED/SWQB 2016).

Table 4.1 Exceedences of E. coli documented during the 2013 SWQB survey. A table of monitoring results is presented as Appendix B to this report.

Assessment Unit	Water Quality Criterion (single sample)	Number of Exceedences	Number of Samples
Pecos River (TX Border to Black River)	410 cfu/100mL	7	24
Pecos River (Black River to Six Mile Dam Lake)	410 cfu/100mL	2	15

4.1 Target Loading Capacity

For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to achieve the numeric criteria associated with the primary contact designated use:

> *20.6.4.900 NMAC Subsection D – Primary Contact: The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.*

Samples were assessed by comparing the *E. coli* results to the single sample criteria of 410 cfu/100mL.

The Pecos River AUs addressed in this TMDL are immediately upstream of the Texas border. The adjacent water quality unit in Texas is Segment 2312, Red Bluff Reservoir from Red Bluff Dam to the New Mexico state line. As discussed in Section 2.4 of this report, SWQB sampling results would not be directly applicable to Red Bluff Reservoir since we do not test for the bacterium on which the relevant Texas standard is based. Texas water quality Segment 2312 does meet its standard for bacteria, based on data assessed by the Texas Commission on Environmental Quality

which was collected from 2005 to 2012 (Chris Loft, TCEQ, personal communication, 3/7/16) and it is not listed on the 2014 Texas Integrated Report Index of Water Quality Impairments (TCEQ, 2014b).

4.2 Flow

The TMDL is a value calculated at a defined critical flow 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. Therefore we evaluated the bacterial loading target using flow duration curve analysis, which looks at the cumulative frequency of historic flow data over a specified period. A flow duration curve relates flow values to the percent of time those values have been met or exceeded. The use of *"percent of time"* provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently (USEPA, 2007).

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

Data from the Red Bluff gage (USGS 08407500) was used to generate a flow duration curve for the Pecos River (Texas border to Black River) (gage locations are shown on Figure 2.4). Daily flow data from 1989 to the present was selected, in order to reflect conditions following the construction of Brantley Dam upstream of Carlsbad in 1988. Since there is no flow gage near the bottom of the Pecos River -Black River to Six Mile Dam AU, the flow duration curve was calculated using data from the Black River gage (USGS 08406000) subtracted from same-day flow at the next lower gage on the Pecos (USGS 08406500, Pecos River near Malaga, NM). This curve was generated using data from the year 2000 to the present, as that is the period of available data from gage 08406000. Out of 5819 data points (days), 33 results (less than 1%) of the flow subtraction calculations were in the negative range. On the assumption that these data points result from errors in the flow data from one or both gages, the 26 values lower than -1 were deleted from consideration, and the 7 values between -1 and 0 were changed to 0.1.

Duration curve analysis identifies intervals which can be used as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree). Flow duration curve intervals can be grouped into broad categories or zones in order to provide additional insight about conditions and patterns associated with the impairment. In this case we have selected three zones, as illustrated in Figures 4.1 and 4.2: one representing high flows (0-10%), another for moderate flows (10-90%), and one representing low flows (90-100%). This particular approach places the midpoints of the high, moderate and low zones at the 5th, 50th, and 95th percentiles respectively. The 90th and 95th percentiles are commonly used to represent "low flow" in various hydrologic settings (Pryce, 2004).

The boundary for high flow was set at the 10th percentile, in the interest of symmetry, and because it appears to coincide with an inflection point in the flow duration curves.

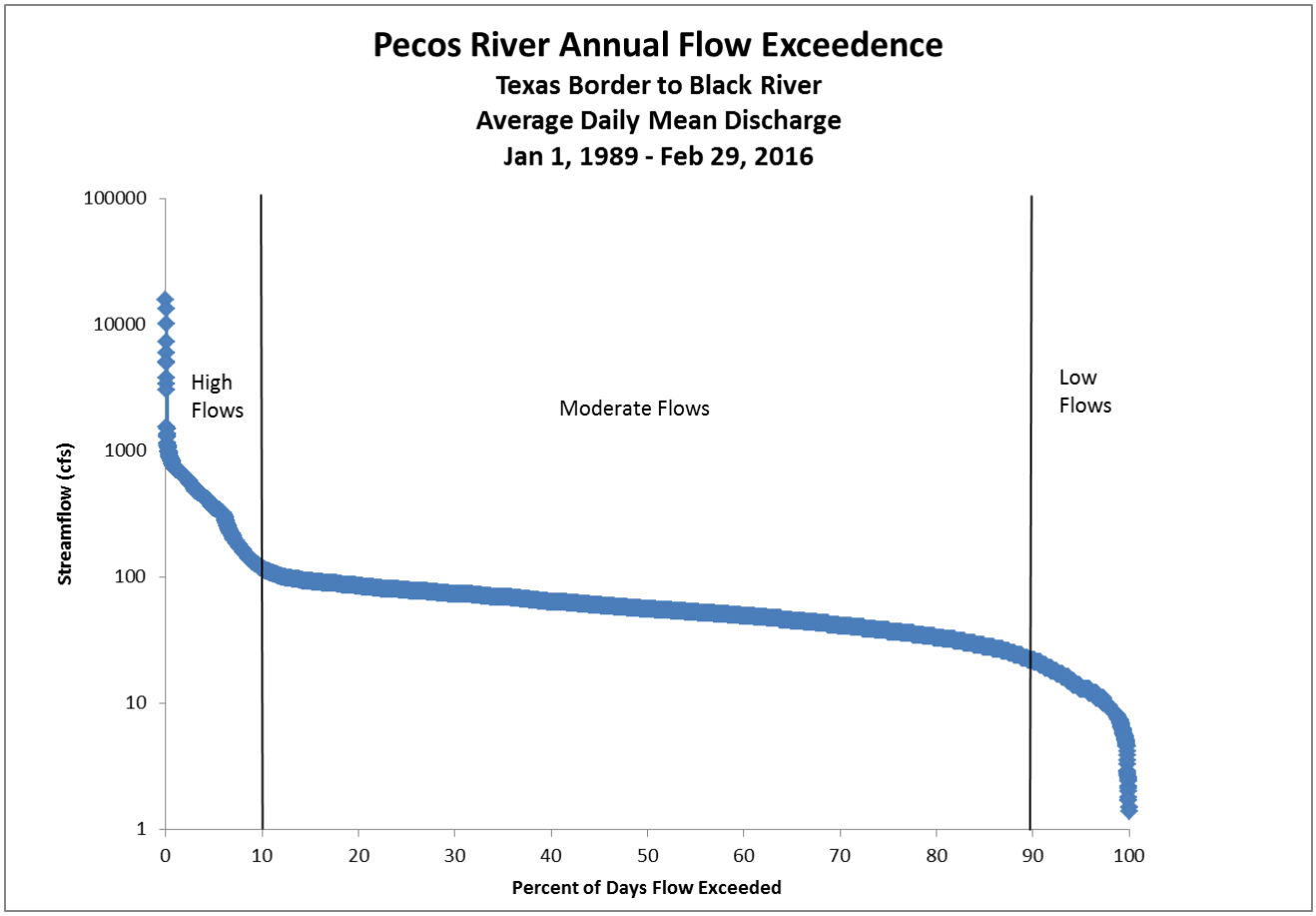

Figure 4.1 Flow duration curve for the Pecos River (Texas Border to Black River) AU.

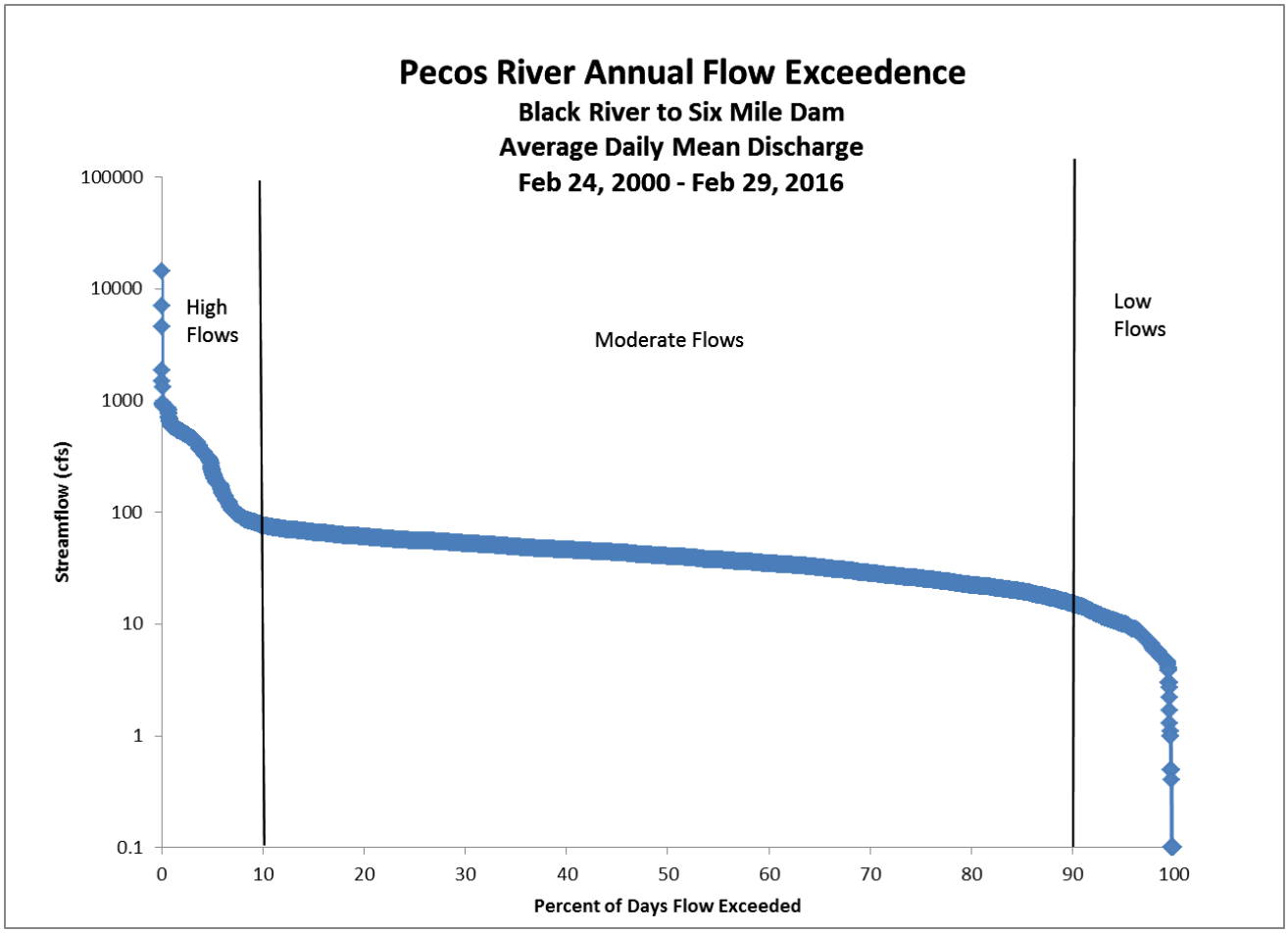

Figure 4.2 Flow duration curve for the Pecos River (Black River to Six Mile Dam) AU.

4.3 Load Calculations

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

By displaying instantaneous loads calculated from ambient water quality data and the daily average flow on the date of the sample (expressed as a flow duration curve interval), a pattern develops, which describes the characteristics of the water quality impairment. Loads that plot above the curve indicate an exceedence of the water quality criterion, whereas those below the load duration curve show compliance. The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments

observed in the low flow zone typically indicate the influence of point sources, while those in higher flow zones generally reflect probable nonpoint source contributions.

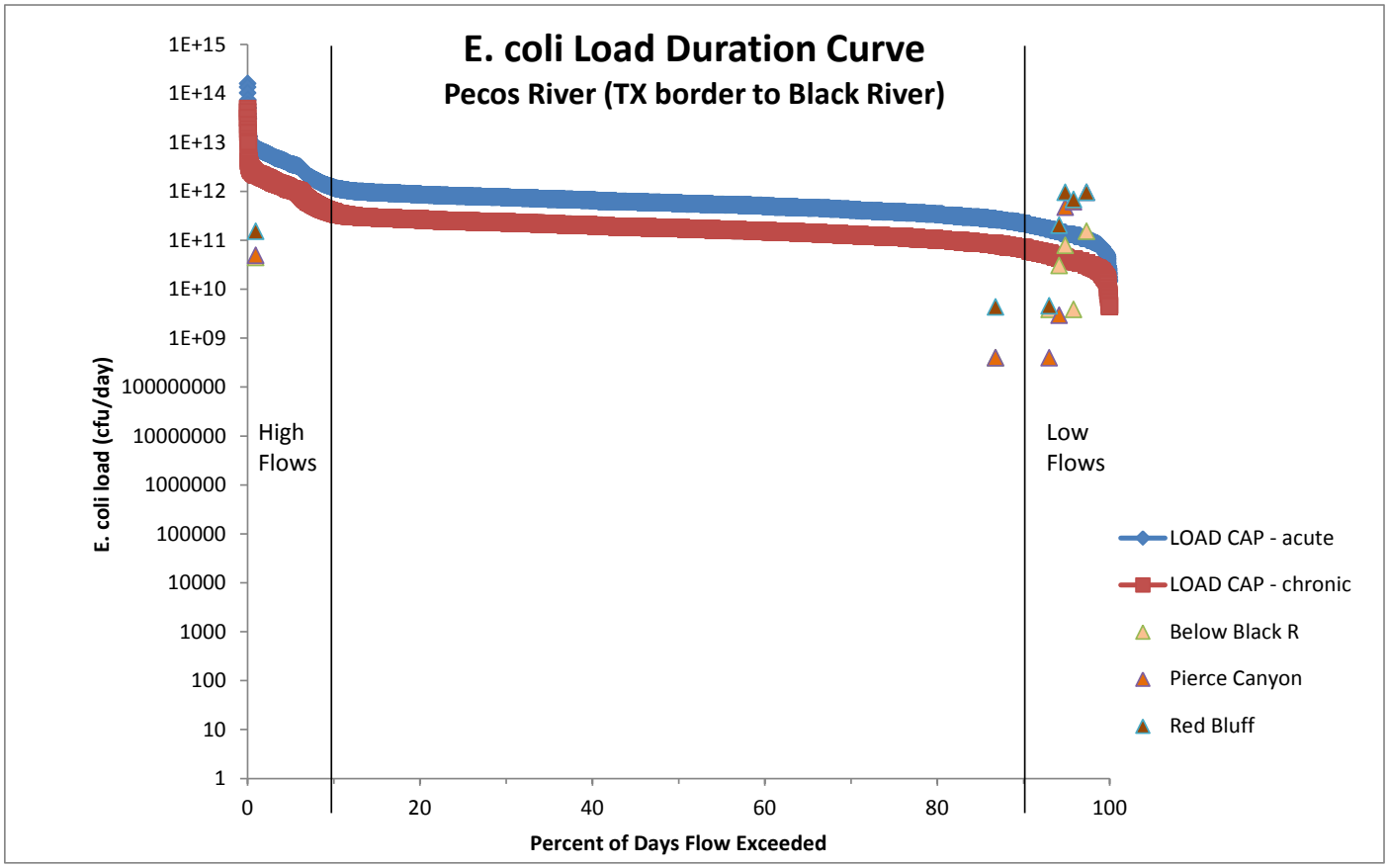

Figure 4.3 Load duration curve for the Pecos River (Texas Border to Black River) AU.

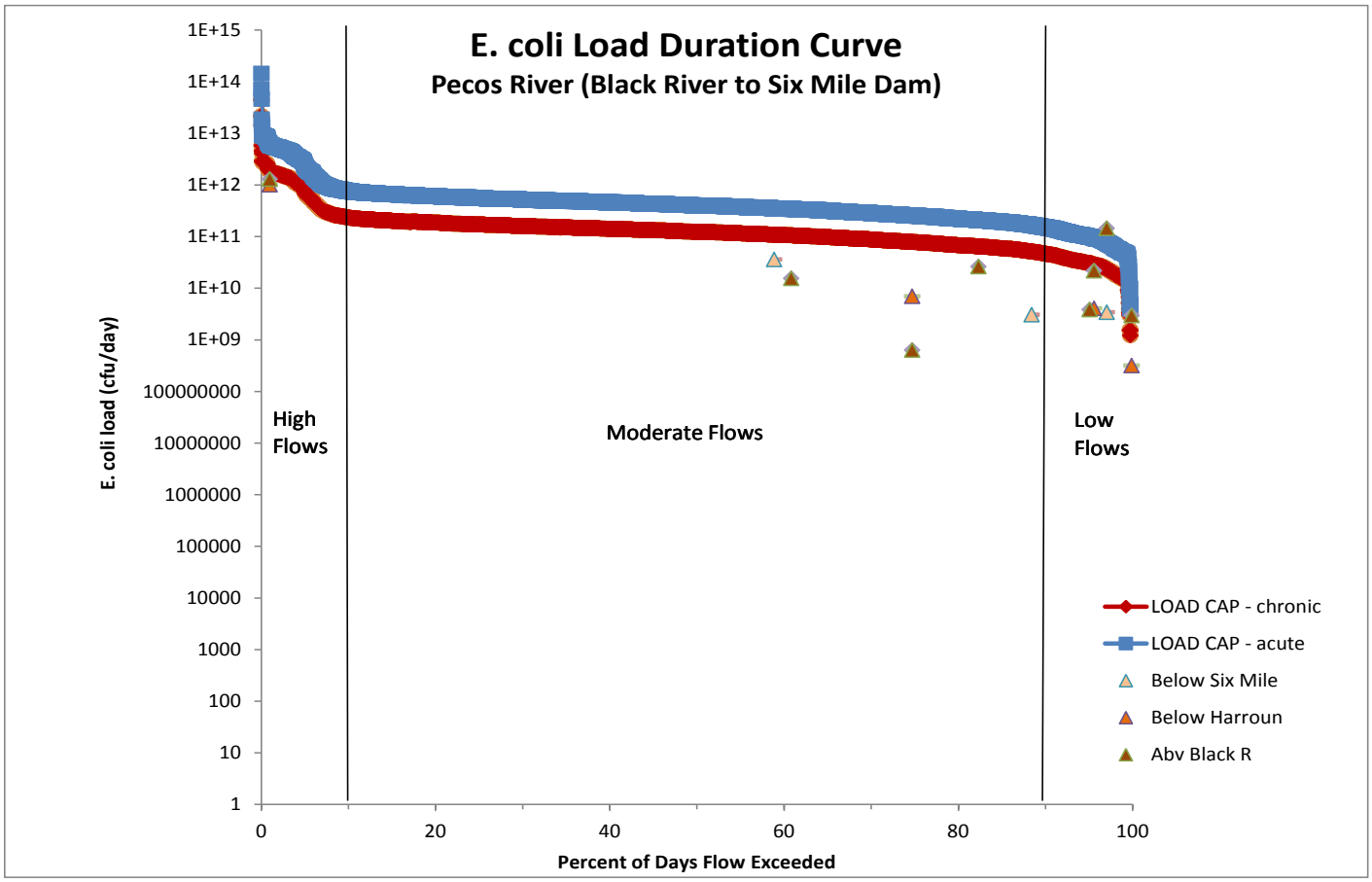

Figure 4.4 Load duration curve for the Pecos River (Black River to Six Mile Dam) AU.

Bacteria standards are expressed as colony forming units (cfu) per unit volume. TMDLs for bacteria (Table 4.3) were calculated based on flow values, water quality standards, and a conversion factor, using Equation 4.1. The monthly geometric mean criterion is utilized in TMDL calculations to provide an implicit Margin of Safety. If the single sample criterion was used and achieved as a target, the geometric mean criterion might still not be achieved.

Equation 4.1

$$C\ as \frac{cfu}{100mL} * 1000 \frac{mL}{L} * \frac{L}{0.264\ gallons} * Q\ in\ 1{,}000{,}000 \frac{gallons}{day} = cfu/day$$

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

Under the duration curve framework, the loading capacity is essentially the curve itself. The loading capacity, which sets the target load on any given day, is determined by the flow on the particular day of interest and the numerical criterion for *E. coli*. However, a continuous curve that represents the

loading capacity has some logistical drawbacks. It is often easier to communicate information with a set of fixed targets, such as the mid-point of each hydrologic zone (e.g., the 5th, 50th and 95th percentiles). A unique loading capacity for each hydrologic zone allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes. The target loads (TMDLs) predicted to attain current standards were calculated using Equation 4.1 and are shown in Table 4.3.

Table 4.3 Target Loads – *E. coli*

	FLOW CONDITIONS		
	High	Moderate	Low
Pecos River (– TX border to Black River)			
E. coli criterion (cfu/100 mL)	126	126	126
Flow (MGD)	230.0	36.2	8.4
Conversion Factor	3.79×10^7	3.79×10^7	3.79×10^7
TMDL (cfu/day)	$\mathbf{1.10 \times 10^{12}}$	$\mathbf{1.73 \times 10^{11}}$	$\mathbf{4.01 \times 10^{10}}$
Pecos River (Black River to Six Mile Dam)			
E. coli criterion (cfu/100 mL)	126	126	126
Flow (MGD)	157.6	26.0	6.5
Conversion Factor	3.79×10^7	3.79×10^7	3.79×10^7
TMDL (cfu/day)	$\mathbf{7.53 \times 10^{11}}$	$\mathbf{1.24 \times 10^{11}}$	$\mathbf{3.10 \times 10^{10}}$

Neither Section 303 of the CWA nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include descussions of percent reductions in TMDL documents. In this case, the imipairment determinations were based on exceedences of the State's single sample criterion, and the TMDL is written to address the monthly geometric mean standard. As such, a simple comparison of these numbers does not necessarily represent an amount of contaminant reduction that would result in removing the impairment.

4.4 Waste Load Allocations and Load Allocations

4.4.1 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and 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; and,

  Basing the target load capacity on the geometric mean criterion rather than the higher-concentration single sample criterion; and

- *Explicit recognition of potential errors*

  There is inherent error in all flow measurements; a conservative MOS for this element is **10%.**

4.4.2 Waste Load Allocation

There are no existing point sources with individual NPDES permits within the two AUs with *E. coli* impairments. The nearest point source permit upstream of these AUs is the City of Carlsbad Waste Water Treatment Plant, permit NM0026395. No exceedance was documented in the outfall from that facility, nor at the next three Pecos River monitoring stations downstream from its outfall. The location of the Carlsbad WWTP is shown on Figure 3.1. There are two reservoirs, Six Mile Lake and Harroun Lake, between Carlsbad and the Black River. Harroun Lake is within the Pecos River (Black River to Six Mile Dam Lake) AU. No exceedances were documented from samples taken immediately below either lake.

Row-crop agriculture and oil and gas production are significant activities in the rural Pecos River watershed below Carlsbad. Under CWA section 402(l)(1), an NPDES permit is not required for discharges composed entirely of return flows from irrigated agriculture. A general description of USEPA's requirements for Laws and Regulations that Apply to Agricultural Operation by Farm Activity is available at https://www.epa.gov/agriculture/agriculture-laws-and-regulations-apply-your-agricultural-operation-farm-activity. Under CWA section 402(l)(2) an NPDES permit is not required for discharges of stormwater runoff from oil and gas exploration, production, processing or treatment operations, or transmissions facilities. This exemption applies to both construction and industrial activities. Oil and gas activities that support or transform raw materials into final manufactured products are generally not exempt. Triggers exist for oil or gas operation needing CWA section 402 permit coverage for a discharge of stormwater that results in the discharge of a "reportable quantity" (RQ) for which notification is or was required under 40 CFR 117.21 or 40 CFR 302.6, or 40 CFR 110.6 since Nov 16, 1987; or contributes to a violation (exceedence) of a water quality standard. More information on oil and gas permit exemptions is available at https://www.epa.gov/npdes/oil-and-gas-stormwater-permitting#undefined. There are no municipal areas within these AUs.

Stormwater 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 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, 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 waste load allocations and/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.

It is not possible to calculate individual WLAs for facilities covered by the General Permits at this time using the 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 (LA). While these sources are not given individual allocations, they are addressed through other means, including BMPs, stormwater pollution prevention conditions, and other requirements. Therefore the Waste Load Allocation for this TMDL is zero.

4.4.3 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity TMDL using the equation below.

Equation 4.2

$$WLA + LA + MOS = TMDL$$

The MOS is estimated to be 10% of the target load calculated in Table 4.3. Results of the LA calculations are presented in Table 4.4. The extensive data collection and analyses necessary to determine background *E. coli* loads for the Pecos River was beyond the resources available for this study. It is assumed that a portion of the LA is made up of natural background loads.

Table 4.4 TMDL for E. coli

Assessment Unit	Flow Condition	WLA (cfu/day)	LA (cfu/day)	MOS (10%) (cfu/day)	TMDL[(a)] (cfu/day)
Pecos River (TX Border to Black River)	High	0	9.9×10^{11}	1.10×10^{11}	1.10×10^{12}
	Moderate	0	1.56×10^{11}	1.73×10^{10}	1.73×10^{11}
	Low	0	3.61×10^{10}	4.01×10^{9}	4.01×10^{10}
Pecos River (Black River to Six Mile Dam Lake)	High	0	6.78×10^{11}	7.53×10^{10}	7.53×10^{11}
	Moderate	0	1.12×10^{11}	1.24×10^{10}	1.24×10^{11}
	Low	0	2.79×10^{10}	3.10×10^{9}	3.10×10^{10}

[(a)]TMDL values are equivalent to the target load capacity.

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 achievement of the *E. coli* standards under any flow condition.

4.5 Identification and Description of Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment. Probable source sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list was reviewed and modified as necessary with watershed group/stakeholder input during the TMDL public meeting and comment period. The probable source documentation process is fully described in Appendix C. Although this procedure includes subjective and qualitative elements, 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 any individual land owner or particular land

management activity and generally includes several sources per impairment. Pollutant sources that may contribute to each segment were determined by field reconnaissance and evaluation (Table 4.6 and 4.7). Probable sources of bacteria impairments will be evaluated, refined, and changed as necessary through the Watershed Based Plan.

Table 4.5 Probable Source Summary for *E. coli* in the Pecos River (TX border to Black River)

Dumping/Garbage/Trash/Litter	Residences/Buildings
Pavement/Impervious Surfaces	Rangeland Grazing
Waterfowl	Bridges/Culverts/RR Crossings
Low Water Crossing	Paved Roads
Gravel or Dirt Roads	Oil/Gas Activities
Wildlife other than Waterfowl	

Table 4.6 Probable Source Summary for *E. coli* in the Pecos River (Black River to Six Mile Dam Lake)

Dumping/Garbage/Trash/Litter	Waterfowl
Irrigated Crop Production	Gravel or Dirt Roads
Bridges/Culverts/RR Crossings	Irrigation Return Drains
Wildlife other than Waterfowl	

4.6 Linkage of Water Quality and Pollutant Sources

Among the potential sources of coliform bacteria are municipal point source discharges such as wastewater treatment facilities, septic tanks which are poorly maintained, improperly installed, or missing, livestock grazing of uplands and riparian areas, in addition to wastes from pets, and other wildlife. Howell et al. (1996) found that bacteria concentrations in underlying sediment increase when cattle have direct access to streams. Natural sources of *E.coli* are also present in the form of wildlife such as elk, deer, and any other warm-blooded animals. Bacterial concentrations may become elevated when bacteria-laden sediment is re-suspended during storm events or by subsequent livestock trampling. Survival of bacteria in water bodies is influenced by a number of variables including temperature and sediment size and quantity. Bacterial growth also increases as water temperature increases (Howell et al, 1996).

Further study would be needed in order to determine exact sources and relative contributions. One method of characterizing sources of bacteria is a Bacterial, or Microbial, Source Tracking (BST or MST) study. The extensive data collection and analyses necessary to determine bacterial sources were beyond the resources available for this TMDL. While sufficient data currently exist to support

development of *E. coli* TMDLs to address the stream standards exceedences, a BST dataset would likely be useful to better identify the sources of *E. coli* impacting the stream. Figure 4.1 shows possible dilution by effluent from the Carlsbad WWTP and the Black River (this pattern was not clearly evident for every sampling event that year).

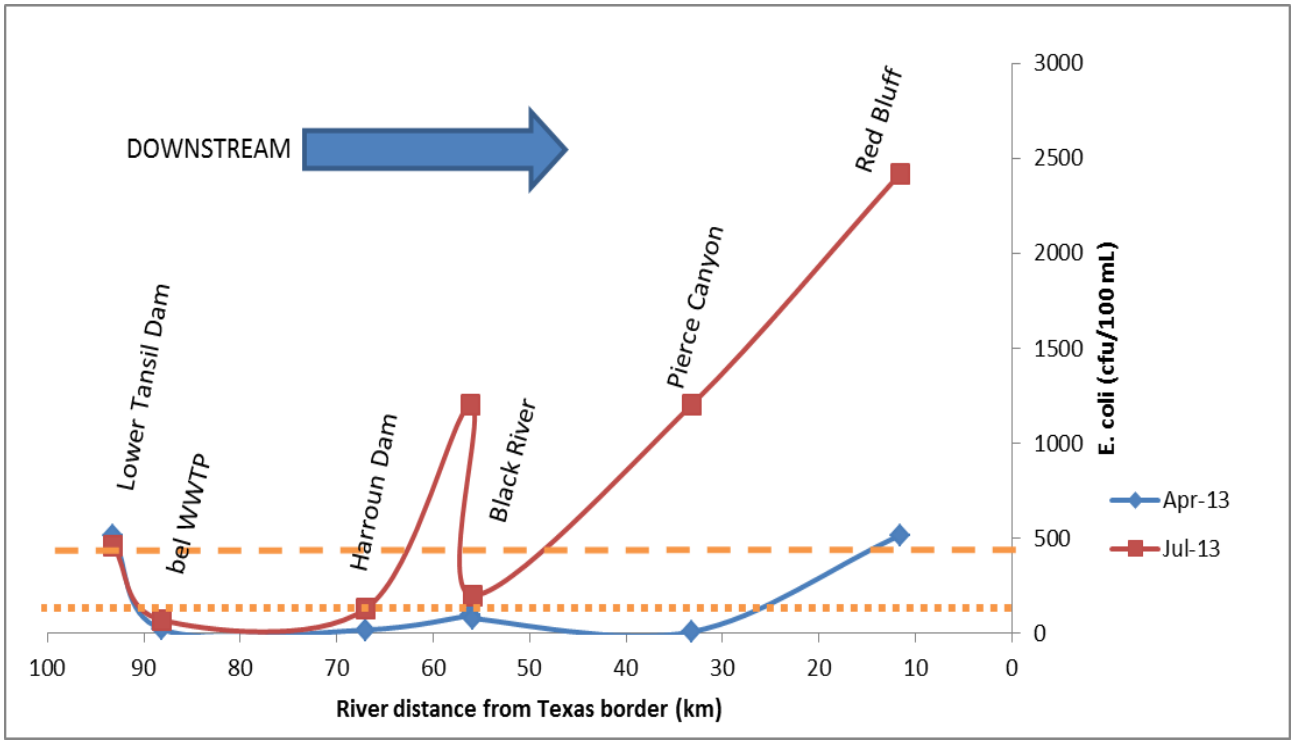

Figure 4.5 *E. coli* measurements (cfu/100 mL) along the Pecos River during the April and July sampling events of the 2013 water quality survey. Orange dashed lines show acute and chronic regulatory limits.

4.7 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 2013 in order to ensure coverage of any potential seasonal variation in the system. Examination of the 2013 hydrographs (Figure 2.5) and the survey *E. coli* data (Appendix B) shows that exceedence of the WQS did not correspond with the unusual high flow events of that year. One sampling event (September 25) coincided with a high flow event, but no exceedence was documented on that date. Exceedences occurred during the months of June, July and August, plus one exceedence on April 30 at the Red Bluff monitoring station. *E. coli* loads were greater, and exceedences were more extensive and more persistent, from the Texas border to the Black River, compared to the Black River to Six Mile Dam. All of the exceedences documented during the 2013 survey occurred during low flows. However that fact should be interpreted with caution due to the low number of samples which were taken at moderate and high flow levels.

In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions. The river is heavily diverted during the summer growing season, which in the Carlsbad Irrigation District runs from March 1 to October 31.

4.8 Future Growth

The University of New Mexico Bureau of Business and Economic Research predicts that the population of the Lower Pecos Valley water planning region will grow slowly, from 139,941 people in 2005 to 177,660 in 2060 (BBER, 2008). Bacterial loading in the affected Assessment Units is primarily due to diffuse nonpoint sources. Future growth in Eddy County, New Mexico is not anticipated to lead to a significant increase in bacteria in this watershed that cannot be controlled with best management practices (BMPs). BMPs should 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 present hydrologic conditions.

5.0 Monitoring Plan

Pursuant to CWA §106(e)(1), 33 U.S.C. §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 NMSA 1978, Sections 74-6-1 to 17, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State (NMED/SWQB 2011). The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls, and to conduct water quality assessments.

The SWQB was actively involved in national conversations with USEPA and the Association of Clean Water Administrators (ACWA) regarding the new Long Term Vision for the Clean Water Act Section 303(d) program. The goals of the Long Term Vision are prioritization of watershed or waters for restoration and protection; assessment of priority waters; protection of unimpaired waters; alternative approaches to restoration and protection; engagement with the stakeholders; and integration with other CWA programs. As a result, the monitoring and TMDL programs in New Mexico are being revised to allow a greater focus on state water quality priorities, encourage TMDL alternatives, and emphasize the value of protecting waterbodies that are not impaired. A Prioritization Framework summarizes the realignment of monitoring and TMDL activities in New Mexico. The list of monitoring and TMDL priorities through 2020 was determined using the process outlined in the Framework and is available on the SWQB TMDL website, https://www.env.nm.gov/swqb/TMDL/.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, select watersheds are intensively monitored for two years with an established return frequency of approximately every eight years. The next scheduled monitoring years for the lower Pecos River watershed are 2019-2020. 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 (NMED/SWQB, 2016a). 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 §303(d) List of streams requiring TMDLs.

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 (https://www.env.nm.gov/swqb/SOP/). Long-term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited approximately every seven years. This information will provide time relevant information for use in CWA §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 foundations for management decisions.

Outside of years of intensive survey, the rotating basin program will be supplemented with other data collection efforts such as on-going studies being performed by the USGS, USEPA, and other programs within NMED. 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

There are no existing point sources with individual NPDES permits on the Pecos River within the AUs covered by this TMDL.

6.2 Nonpoint Sources – WBP and BMP Coordination

Public awareness and involvement is crucial to the successful implementation of plans for improved water quality. A Watershed-based Plan (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 to participate in reducing and preventing nonpoint source impacts to water quality. 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 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. Stakeholders in this process are likely to include the Carlsbad Irrigation District, private landowners, BLM, and other interested parties.

6.3 Clean Water Act §319(h) Funding

The Watershed Protection Section of the SWQB can potentially provide CWA §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, or federal or state agencies. 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/.

A Watershed Restoration Action Strategy (WRAS, predecessor to the current WBP format) was written for the Lower Pecos watershed in 2005 (available online at: https://www.env.nm.gov/swqb/wps/WRAS/LowerPecosWRAS2005.pdf), although it currently remains a draft version. The WRAS has not been updated to a WBP, and therefore the watershed is currently not eligible for §319(h) funding. If necessary, updated planning documents could be drafted to meet the requirements and include identified impairments and the new TMDLs. However, the Lower Pecos River Watershed Alliance has not recently been active (personal communication, Judith McCullom, Carlsbad Soil and Water Conservation District, 4/22/16).

6.4 Other Funding Opportunities and Restoration Efforts

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 Section 319(h) projects using state revolving fund monies. The USDA Environmental Quality Incentive Program ("EQIP") program can provide assistance to private land owners in the basin. The USFS, a major land owner in the watersheds discussed in this document, aligns their mission to protect the lands that they manage with the TMDL process and are another source of assistance. The BLM has several programs in place to provide assistance to improve unpaved roads and grazing allotments.

The New Mexico Legislature appropriated $2.3 million in state funds for the River Stewardship Program during the 2014 Legislative Session and $1 million during the 2015 Special Session. 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." A competitive request for proposals was conducted for 2014 funding and twelve projects located throughout the state were selected. Responsibility for the program is assigned to NMED, and SWQB staff administers the projects. SWQB issued a competitive request for proposals for the 2015 funding in early 2016 and the selection of projects is currently being finalized for this appropriation.

SWQB annually makes available Section 604(b) funds through a Request for Quotes (RFQ) process. SWQB requests quotes from regional public comprehensive planning organizations to conduct water quality management planning as defined under sections 205(j) and 303(e) and the CWA. SWQB seeks proposals to conduct water quality management planning with a focus on projects that clearly address the State's water quality goals to preserve, protect and improve the water quality in New Mexico. SWQB encourages proposals focused on TMDLs and UAAs or other water quality management planning activities that will directly address identified water quality impairments. The SWQB 604(b) RFQ is released annually in September.

Information on additional watershed restoration funding resources is available on the SWQB website at https://www.env.nm.gov/swqb/Watershed_Protection/FundingSourcesforWatershedProtection.pdf .

7.0 Applicable Regulations and Stakeholder Assurances

New Mexico's Water Quality Act ("Act") authorizes the Water Quality Control Commission (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 coincides 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 will be solicited in development of this TMDL. The draft Lower Pecos River TMDL was made available for a 30-day comment period beginning on July 15, 2016, and a public meeting will be held on July 27, 2016 at the Riverwalk Recreation Center in Carlsbad from 6-8pm. Response to public comments will be included as Appendix D of the final TMDL.

Once the TMDL is approved by the Water Quality Control Commission and EPA Region 6, the next step for public participation is revision of the WBP as described in Section 6.2 and participation in watershed protection projects including those that may be funded by Clean Water Act §319(h) grants. The WBP development process is open to any member of the public who wants to participate.

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APPENDIX A
SPECIAL STATUS SPECIES ASSOCIATED WITH AQUATIC OR RIPARIAN HABITAT AND KNOWN TO OCCUR IN EDDY COUNTY, NM

Common Name	Scientific Name	Status	Habitat
Spotted Bat	*Euderma maculatum*	State NM: Threatened	RIPARIAN
Brown Pelican	*Pelecanus occidentalis*	State NM: Endangered	RIPARIAN
Common Black Hawk	*Buteogallus anthracinus*	State NM: Threatened	RIPARIAN
Bald Eagle	*Haliaeetus leucocephalus*	State NM: Threatened	RIPARIAN
Peregrine Falcon	*Falco peregrinus*	State NM: Threatened	RIPARIAN
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	State NM: Threatened	RIPARIAN
Least Tern	*Sternula antillarum*	Federal: Endangered State NM: Endangered	RIPARIAN
Neotropic Cormorant	*Phalacrocorax brasilianus*	State NM: Threatened	RIPARIAN
Common Ground-dove	*Columbina passerina*	State NM: Endangered	RIPARIAN
Mexican Spotted Owl	*Strix occidentalis lucida*	Federal: Threatened	RIPARIAN
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Federal: Endangered State NM: Endangered	RIPARIAN
Thick-billed Kingbird	*Tyrannus crassirostris*	State NM: Endangered	RIPARIAN
Bell's Vireo	*Vireo bellii*	State NM: Threatened	RIPARIAN
Varied Bunting	*Passerina versicolor*	State NM: Threatened	RIPARIAN
Western River Cooter	*Pseudemys gorzugi*	State NM: Threatened	AQUATIC RIPARIAN SEMI-AQUATIC
Arid Land Ribbonsnake	*Thamnophis proximus*	State NM: Threatened	RIPARIAN
Plain-bellied Water Snake	*Nerodia erythrogaster*	State NM: Endangered	AQUATIC RIPARIAN SEMI-AQUATIC
Pecos Bluntnose Shiner	*Notropis simus pecosensis*	Federal: Threatened State NM: Endangered	AQUATIC FULLY AQUATIC
Gray Redhorse	*Moxostoma congestum*	State NM: Endangered	AQUATIC FULLY AQUATIC
Blue Sucker	*Cycleptus elongatus*	State NM: Endangered	AQUATIC FULLY AQUATIC

Mexican Tetra	*Astyanax mexicanus*	State NM: Threatened	AQUATIC FULLY AQUATIC
Pecos Gambusia	*Gambusia nobilis*	Federal: Endangered State NM: Endangered	AQUATIC FULLY AQUATIC
Pecos Pupfish	*Cyprinodon pecosensis*	State NM: Threatened	AQUATIC FULLY AQUATIC
Greenthroat Darter	*Etheostoma lepidum*	State NM: Threatened	AQUATIC FULLY AQUATIC
Bigscale Logperch (Native pop.)	*Percina macrolepida*	State NM: Threatened	AQUATIC FULLY AQUATIC
Pecos Springsnail	*Pyrgulopsis pecosensis*	State NM: Threatened	AQUATIC FULLY AQUATIC
Ovate Vertigo Snail	*Vertigo ovata*	State NM: Threatened	RIPARIAN
Texas Hornshell	*Popenaias popeii*	Federal: Candidate State NM: Endangered	AQUATIC FULLY AQUATIC

Results of a search of the BISON-M database on March 14, 2016, using the following selection parameters: all taxa; Eddy County; status Federal Endangered, Federal Threatened, Federal Candidate, Federal Proposed, NM Endangered or NM Threatened; habitat Aquatic, Fully Aquatic, Semi-Aquatic or Riparian.

APPENDIX B

PECOS RIVER *E. COLI* DATA - 2013

Pecos River (Black River to Six Mile Dam Lake) **Assessment Unit NM-2202.A_00**

Location	Date	E. coli (cfu/100 ml)	Flow (cfs)*
Below 6 Mile Dam - 60PecosR085.0	3/28/13	7.5	16.7
	6/6/13	18.1	7.7
	11/14/13	41.4	35.4
Below Harroun Dam - 60PecosR067.0	2/19/13	11	25.7
	4/30/13	17.5	9.5
	7/10/13	129.1	<1
	9/25/13	67.7	609.4
Above Black River – 60PecosR056.1	2/19/13	1	25.7
	3/26/13	50.4	2.1
	4/30/13	93.3	9.5
	6/4/13	770.1	7.7
	7/10/13	1203.3	<1
	8/13/13	15.8	10.0
	9/25/13	86.7	609.4
	10/30/13	18.3	34.4

Pecos River (TX Border to Black River) **Assessment Unit NM-2201_00**

Location	Date	E. coli (cfu/100 ml)	Flow (cfs)*
Below Black River – 60PecosR055.9	2/19/13	1	27
	3/26/13	9.8	17
	4/30/13	77.6	15
	6/4/13	387.3	11
	7/10/13	198.9	14
	8/13/13	9.8	13
	9/25/13	111.9	733
@ Pierce Canyon Crossing – 60PecosR033.2	2/19/13	1	27
	3/26/13	1	17
	4/30/13	7.4	15
	6/4/13	2419.6	11
	7/10/13	1203.3	14
	8/13/13	1553.1	13
	9/25/13	125	733
Near Red Bluff @ CR 725 – 60PecosR011.6	2/19/13	11	27
	3/26/13	11.6	17
	4/30/13	517.2	15
	6/4/13	2419.6	11
	7/10/13	2419.6	14
	8/13/13	1732.9	13
	9/25/13	387.3	733

Highlighted cells indicate an exceedence of the applicable water quality criterion. * Same-day daily average flow from nearest USGS gage

APPENDIX C
SOURCE DOCUMENTATION

"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 (TMDLs), and WBPs 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") (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., TMDLs, WBPs, 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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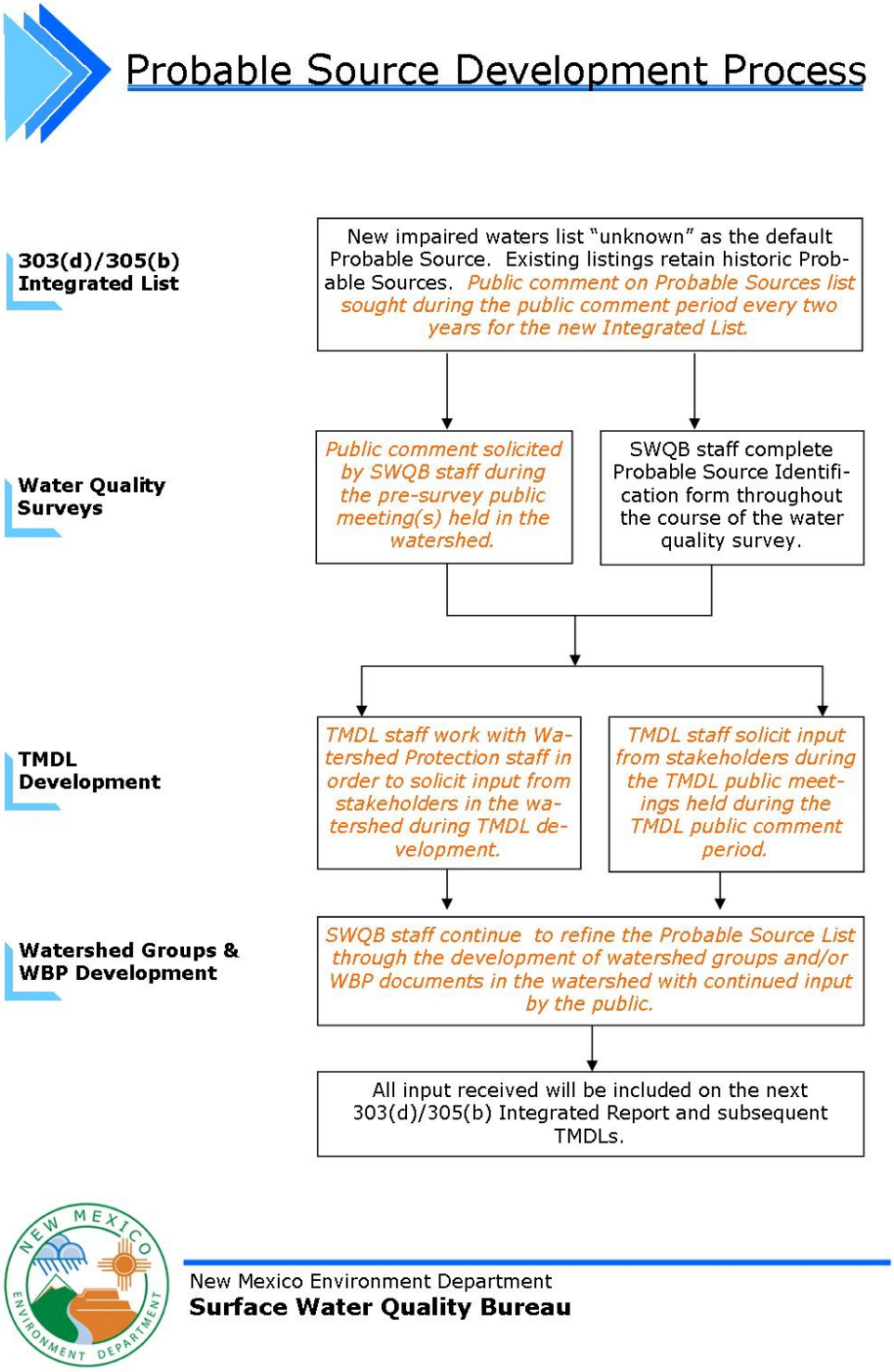

Figure B1. Probable Source Development Process and Public Participation Flowchart

Help Us Identify Probable Sources of Impairment

Name:
Phone Number (optional):
Email or Mailing Address (optional):
Date:
Waterbody or site description (example - Fish Creek near HWY 34 crossing):

From the list below, please check activities known to exist that you are concerned may be contributing to surface water quality impairment. Please score items you check based on distance to or occurrence on or near the waterbody of concern.

(1 = Low occurrence or not near waterbody)
(3 = Moderate occurrence or within ½ mile of waterbody)
(5 = High occurrence or right next to water body)

✓	ACTIVITY	Score			✓	ACTIVITY	Score		
☐	Feedlots	1	3	5	☐	Pavement and Other Impervious Surfaces	1	3	5
☐	Livestock Grazing	1	3	5	☐	Roads/Bridges/Culverts	1	3	5
☐	Agriculture	1	3	5	☐	Habitat Modification(s)	1	3	5
☐	Flow Alterations (water withdrawal)	1	3	5	☐	Mining/Resource Extraction	1	3	5
☐	Stream/River Modification(s)	1	3	5	☐	Logging/Forestry Operations	1	3	5
☐	Storm Water Runoff	1	3	5	☐	Housing or Land Development	1	3	5
☐	Drought Related	1	3	5	☐	Habitat Modification	1	3	5
☐	Landfill(s)	1	3	5	☐	Waterfowl	1	3	5
☐	Industry/Wastewater Treatment Plant	1	3	5	☐	Wildlife other than Waterfowl	1	3	5
☐	Inappropriate Waste Disposal	1	3	5	☐	Recreational Use	1	3	5
☐	Improperly maintained Septic Systems	1	3	5	☐	Natural Sources	1	3	5
☐	Waste from Pets	1	3	5	☐	Other: *(please describe)*	1	3	5

Comments/additional information:

Revised 02Aug12