FINAL APPROVED
TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR THE
SAN JUAN RIVER WATERSHED
(PART ONE)

NAVAJO NATION BOUNDARY AT THE HOGBACK TO NAVAJO DAM

MAY 10, 2005

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LIST OF APPENDICES

LIST OF ABBREVIATIONS

AU	Assessment Unit
ADB	Assessment Database version 2
BLM	Bureau of Land Management
BMP	Best management practices
BS	Bulk sample
BST	Bacterial Source Tracking
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general storm water permit
CWA	Clean Water Act
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information Systems
HUC	Hydrologic unit code
IOWDM	Input and Output for Watershed Data Management
LA	Load allocation
lbs/day	Pounds per Day
m	Meters
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
mm	Millimeters
MOS	Margin of safety
MOU	Memoranda of Understanding
MS4	Municipal Separate Storm Sewer System
MSGP	Multi Sector General Storm Water Permit
NAPI	Navajo Agricultural Products Industry
NIIP	Navajo Indian Irrigation Project
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NROFEIS	Navajo Reservoir Operations Final Environmental Impact Statement
NSL	National Sedimentation Lab of the USDA
NTU	Nephelometric turbidity units
^oC	Degrees Celsius
^oF	Degrees Fahrenheit
PC	Particle count
%	Percent
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
RGA	Rapid geomorphic assessment

SBD	Stream bottom deposits
SJRIP	San Juan River Basin Recovery Implementation Plan
STORET	Storage and Retrieval Database
SWPPP	Storm Water Pollution Prevention Plan
SWQB	Surface Water Quality Bureau
SWSTAT	Surface Water Statistics
TMDL	Total maximum daily load
TSS	Total suspended solids
USDA	U.S. Department of Agriculture
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 October 11, 2002)
WRAS	Watershed Restoration Action Strategy
WWTF	Waste water treatment facility
WWTP	Waste water treatment plant
μg/L	Micrograms per liter
μmhos/cm	Micromhos per centimeter

EXECUTIVE SUMMARY

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

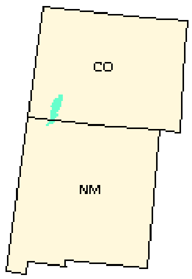
The San Juan River watershed is located in northwestern New Mexico. The Surface Water Quality Bureau (SWQB) conducted an intensive surface water quality survey of the San Juan River basin in 2002. Stations were located throughout the San Juan River basin during an intensive watershed survey to evaluate the impact of tributary streams. As a result of assessing data generated during this monitoring effort, combined with data from outside sources that met SWQB quality assurance requirements, impairment determinations of New Mexico water quality standards for fecal coliform were documented for the La Plata River (San Juan River to McDermott Arroyo), La Plata River (McDermott Arroyo to CO border), San Juan River (Navajo Nation boundary at the Hogback to Animas River), San Juan River (Animas River to Cañon Largo), and Animas River (San Juan River to Estes Arroyo). Impairment due to selenium exceedences was determined for Gallegos Canyon (San Juan River to Navajo bnd). In 2003, SWQB performed a special study with the U.S. Department of Agriculture National Sedimentation Lab to determine potential sedimentation impairment in the San Juan River and Animas River. As a result of the study, the San Juan River (Animas River to Cañon Largo) remained listed for sedimentation/siltation (stream bottom deposits). The La Plata River (San Juan River to McDermott Arroyo) was also determined to be impaired for sedimentation/siltation based on existing assessment protocols and data collected during the survey. This total maximum daily load document addresses the above noted impairments as summarized in the tables below.

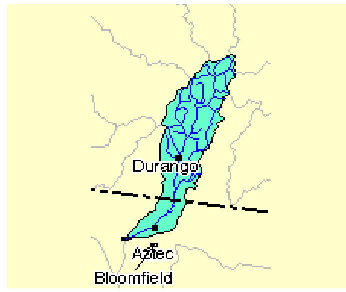
The following additional impairments were noted during the survey, but will be addressed in a separate TMDL document in the near future: low dissolved oxygen in the La Plata River (McDermott Arroyo to CO border), excessive temperature in Animas River (Estes Arroyo to CO border), and impairment of the narrative plant nutrient standard in the Animas River (San Juan River to Estes Arroyo). Additional impairments based on benthic macroinvertebrate bioassessments and ambient water and sediment toxicity were documented on stream reaches based on 2002 and 2003 data, but additional data is needed to determine the exact cause of these impairments. Portions of the San Juan River and Navajo Reservoir are also listed for mercury in fish tissue because they are on the New Mexico Fish Consumption Guidelines due to mercury contamination (NMDOH *et al.* 2001).

Additional water quality data will be collected by New Mexico Environment Department during the standard rotational period for intensive stream surveys. As a result, targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate attainment category on the Clean Water Act Integrated §303(d)/§305(b) list of waters (NMED/SWQB 2004a).

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

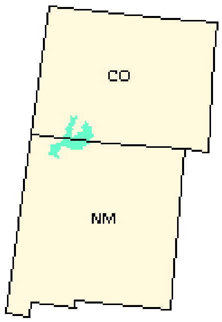
TOTAL MAXIMUM DAILY LOAD FOR FECAL COLIFORM
ANIMAS RIVER (SAN JUAN RIVER TO ESTES ARROYO)

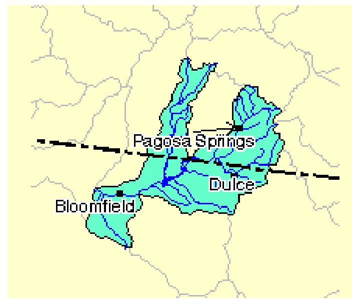




New Mexico Standards Segment	San Juan Basin 20.6.4.403
Assessment Unit Identifier	Animas River (San Juan River to Estes Arroyo), NM-2403.A_00 (formerly SJR4-10000)
Assessment Unit Length	16.9 miles
Parameters of Concern	Fecal Coliform
Designated Uses Affected	Marginal Coldwater Fishery
Geographic Location	Animas USGS Hydrologic Unit Code 14080104
Scope/size of Watershed	1,357 mi^2 (277 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (56%), Agriculture (8%), Rangeland (29%), Built-up (5%), Barren (<1%), Water (1%), Wetlands (<1%)
Identified Sources	Drought-related Impacts, Flow Alterations from Water Diversions, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Source Unknown, Streambank Modifications/destabilization
Land Management (NM only)	Private (34%), BLM (60%), State (6%)
Priority Ranking	High
TMDL for: Fecal Coliform	**WLA (7.58×10^9) + LA (4.107×10^{12}) + MOS (2.20×10^{10}) = 4.40×10^{11} cfu/day**

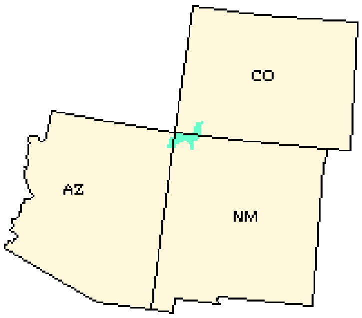
TOTAL MAXIMUM DAILY LOAD FOR SELENIUM
GALLEGOS CANYON (SAN JUAN RIVER TO NAVAJO BOUNDARY)

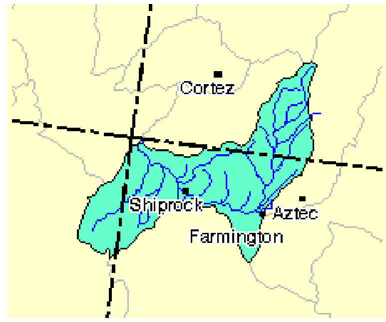




New Mexico Standards Segment	Unclassified
Assessment Unit Identifier	Gallegos Canyon (San Juan River to Navajo boundary), NM-9000.A_060 (no WBS identifier)
Assessment Unit Length	0.45 miles
Parameters of Concern	Selenium
Designated Uses Affected	Wildlife Habitat
Geographic Location	Upper San Juan USGS Hydrologic Unit Code 14080101
Scope/size of Watershed	323 mi^2 (entire Gallegos Canyon watershed)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover	Forest (3%), Agriculture (9%) Rangeland (86%), Built-up (<1%), Barren (1%), Water (<1%), Wetlands (<1%)
Identified Sources	Irrigated crop production, natural sources
Land Management	Native Lands (99%), BLM (<1%), State (<1%)
Priority Ranking	High
TMDL for: Selenium	**WLA (0) + LA (0.040) + MOS (0.014) = 0.054 lbs/day**

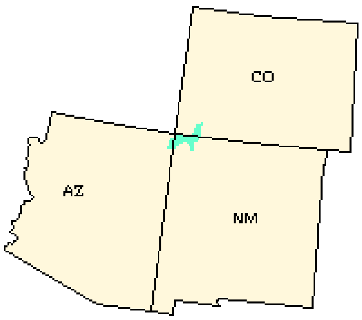
TOTAL MAXIMUM DAILY LOAD FOR SEDIMENTATION/SILTATION AND FECAL COLIFORM
LA PLATA RIVER (SAN JUAN RIVER TO MCDERMOTT ARROYO)

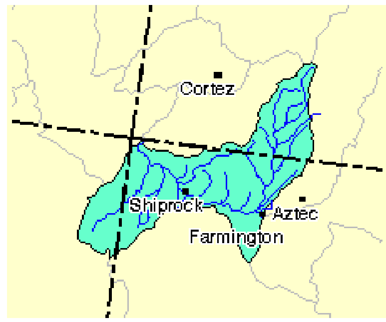




New Mexico Standards Segment	San Juan Basin 20.6.4.402
Assessment Unit Identifier	La Plata River (San Juan River to McDermott Arroyo), NM-2402.A_00, (formerly SJR5-20100 split)
Assessment Unit Length	16.8 miles
Parameters of Concern	Sedimentation/Siltation (previously referred to as Stream Bottom Deposits) and Fecal Coliform
Designated Uses Affected	Limited Warmwater Fishery and Secondary Contact
Geographic Location	Middle San Juan USGS Hydrologic Unit Code 14080105
Scope/size of Watershed	583 mi^2 (162 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (48%), Agriculture (6%), Rangeland (45%), Built-up (,1%), Barren (<1%), Water (<1%), Wetlands (<1%)
Identified Sources	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/Destabilization
Land Management (NM only)	Private (29%), Native Lands (20%), BLM (45%), State (6%)
Priority Ranking	High
TMDL for: Sedimentation/Siltation Fecal Coliform	 **WLA (0) + LA (17.2) + MOS (4.3) = 21.5 percent fines** **WLA (0) + LA (6.05 x 10^8) + MOS (3.19 x 10^7) = 6.37 x 10^8 cfu/day**

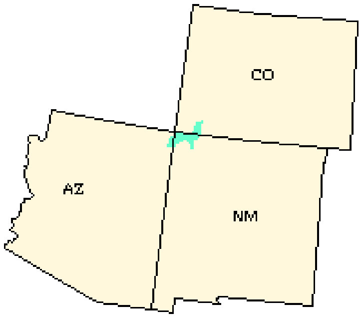
TOTAL MAXIMUM DAILY LOAD FOR FECAL COLIFORM
LA PLATA RIVER (MCDERMOTT ARROYO TO COLORADO BORDER)

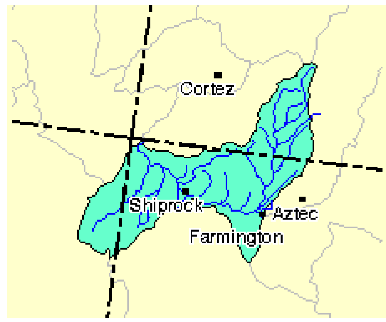




New Mexico Standards Segment	San Juan Basin 20.6.4.402
Assessment Unit Identifier	La Plata River (McDermott Arroyo to Colorado border), NM-2402.A_01, (formerly SJR5-20100 split)
Assessment Unit Length	7.1 miles
Parameters of Concern	Fecal Coliform
Designated Uses Affected	Marginal Coldwater Fishery and Secondary Contact
Geographic Location	Middle San Juan USGS Hydrologic Unit Code 14080105
Scope/size of Watershed	435 mi^2 (30 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (42%), Agriculture (20%), Rangeland (37%), Built-up (1%), Barren (<1%), Water (<1%)
Identified Sources	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/Destabilization
Land Management (NM only)	Private (47%), Native Lands (15%), BLM (32%), State (6%)
Priority Ranking	High
TMDL for: Fecal Coliform	**WLA (0) + LA (4.89 x 10^8) + MOS (2.58 x 10^7) = 5.15 x 10^8 cfu/day**

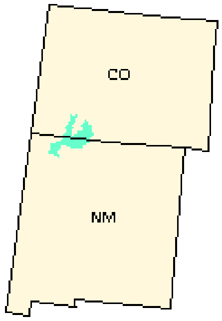
TOTAL MAXIMUM DAILY LOAD FOR FECAL COLIFORM
SAN JUAN RIVER (NAVAJO BOUNDARY AT HOGBACK TO ANIMAS RIVER)

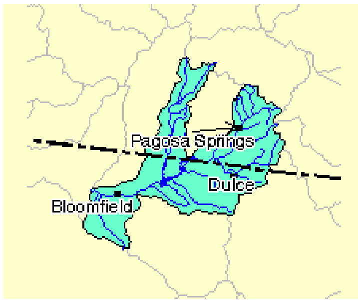




New Mexico Standards Segment	San Juan Basin 20.6.4.401
Assessment Unit Identifier	San Juan River (Navajo boundary at Hogback to Animas River), NM-2401_10, (formerly SJR5-20000)
Assessment Unit Length	32.27 miles
Parameters of Concern	Fecal Coliform
Designated Uses Affected	Secondary Contact
Geographic Location	Middle San Juan USGS Hydrologic Unit Code 14080105
Scope/size of Watershed	8,171 mi^2 (4,298 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (52%), Agriculture (1%), Rangeland (46%), Built-up (<1%), Barren (<1%), Water (<1%), Wetlands (<1%)
Identified Sources	Drought-related Impacts, Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing
Land Management (NM only)	U.S. Forest Service (6%), Private (7%), Native Lands (45%), BLM (37%), State (5%)
Priority Ranking	High
TMDL for: Fecal Coliform	**WLA (2.26 x 10^{10}) + LA (6.29 x 10^{11}) + MOS (3.43 x 10^{10}) = 6.86 x 10^{11} cfu/day**

TOTAL MAXIMUM DAILY LOAD FOR SEDIMENTATION/SILTATION AND FECAL COLIFORM
SAN JUAN RIVER (ANIMAS RIVER TO CAÑON LARGO)





New Mexico Standards Segment	San Juan Basin 20.6.4.401
Assessment Unit Identifier	San Juan River (Animas River to Cañon Largo), NM-2401_00, (formerly SJR1-10000)
Assessment Unit Length	21.44 miles
Parameters of Concern	Sedimentation/Siltation (previously referred to as Stream Bottom Deposits) and Fecal Coliform
Designated Uses Affected	Marginal Coldwater Fishery and Secondary Contact
Geographic Location	Upper San Juan USGS Hydrologic Unit Code 14080101
Scope/size of Watershed	5,825 mi^2 (3,533 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (61%), Agriculture (<1%), Rangeland (38%), Built-up (1%), Barren (<1%), Water (<1%), Wetlands (<1%)
Identified Sources	Crop Production (Crop Land or Dry Land), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Petroleum/natural Gas Activities (Legacy), Petroleum/natural Gas Production Activities (Permitted), Rangeland Grazing
Land Management (NM only)	U.S. Forest Service (8%), Private (7%), Native Lands (49%), BLM (31%), State (5%)
Priority Ranking	High
TMDL for: Sedimentation/Siltation Fecal Coliform	 **WLA (0) + LA (23.6) + MOS (5.9) = 2.9.5 percent fines** **WLA (7.22 x 10^9) + LA (1.73 x 10^{12}) + MOS (9.15 x 10^{10}) = 1.83 x 10^{12} cfu/day**

1.0 INTRODUCTION

Under Section 303 of the Clean Water Act (CWA), states establish water quality standards, which are submitted and subject to 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 (NPSs) at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for NPSs and natural background conditions, and includes a margin of safety (MOS). This document provides TMDLs for assessment units within the San Juan River Basin that have been determined to be impaired based on a comparison of measured concentrations and conditions with water quality criteria and numeric translators for narrative standards.

This document is divided into several sections. Section 2.0 provides background information on the location and history of the San Juan River basin, provides applicable water quality standards for the assessment units addressed in this document, and briefly discusses the intensive water quality survey conducted in the San Juan River basin in 2002. Section 3.0 provides detailed descriptions of the individual watersheds for which TMDLs were developed. Section 4.0 presents the TMDL developed for sedimentation/siltation (previously referred to as stream bottom deposits) in the San Juan River basin. Section 5.0 presents the TMDLs developed for bacteria in the San Juan River basin. Section 6.0 presents a TMDL developed for selenium. Pursuant to Section 106(e)(1) of the Federal CWA, Section 7.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 8.0 discusses implementation of TMDLs (phase two) and the relationship between TMDLs and Watershed Restoration Action Strategies (WRAS). Section 9.0 discusses assurance, Section 10.0 public participation in the TMDL process, and Section 11.0 provides references.

2.0 SAN JUAN RIVER BASIN BACKGROUND

2.1 Description and Land Ownership

The entire San Juan River basin encompasses portions of New Mexico, Colorado, Utah, and Arizona. The New Mexico portion extends into portions of McKinley, San Juan, and Rio Arriba counties in the northwestern portion of the state. The geographic area of the 2002 Surface Water Quality Bureau (SWQB) study was from the Navajo Nation boundary at the Hogback to Navajo Dam, as well as tributaries that enter the San Juan River in this area. Land ownership/management in the New Mexico portion of the San Juan River basin upstream of the Hogback includes the US Forest Service (USFS), US Bureau of Land Management (BLM), Native American (Navajo Nation, Ute Mountain Ute, and Jicarilla Apache), State, and Private (Figure 2.1).

2.2 Geology

The San Juan Basin lies on the Colorado Plateau. Several formations of Tertiary and Cretaceous age compose the consolidated geology in the New Mexico portion of the San Juan River basin (Table 2.1, Figures 3.1- 3.3). The predominant geologic formation is the Nacimiento Formation of Tertiary age which underlies the soils and crops out along nearly all of the reach of the San Juan River valley east of Farmington (Blanchard et al. 1993). The Cretaceous Kirtland and Fruitland Formation and the Mancos Shale layers underlie the soils and crop out west of the Hogback. These two formations underlie tile soils and compose the outcrop in most of the upland area south of the San Juan River. Near Farmington, Cretaceous rocks rise sharply in some areas, forming hogback ridges (Chronic 1987). All of the shales of Cretaceous age consist at least in part of gray arid black shale (see Selenium section for additional detail). The San Juan River valley is composed in part of Quaternary unconsolidated sand, gravel, silt, clay, and terrace gravel and boulder deposits. Valley soils typically are derived from sandstone, shale, siltstone, and mudstone and range in permeability from moderately rapid to moderately slow (Blanchard et al. 1993).

Table 2.1 Geologic Unit Definitions for the San Juan River Basin (see Figures3.1 – 3.3)

Geologic Unit Code	Definition
K_{ch}	Cliff House sandstone; transgressive marine sandstone
K_{kf}	Kirtland and Fruitland Formations; coal-bearing, coal primarily in the Fruitland; Campanian to Maastrichtian
K_{l}	Lower Cretaceous, undivided
K_{m}	Mancos Shale; divided into Upper and Lower parts by Gallup Sandstone
K_{mf}	Menefee Formation; mudstone, shale, and sandstone; coal-bearing
K_{mv}	Mesaverde Group; cretaceous sandstones that cap the mesas; includes $K_{mf,}$ $K_{ch,}$ K_{pl}
K_{pc}	Pictured cliff sandstone; prominent cliff forming marine sandstone
K_{pl}	Point Lookout sandstone; regressive marine sanstone
QT_{p}	Older Piedmont alluvial deposit and shallow basin fill
QT_{s}	Upper Santa Fe Group
Q_{al}	Alluvium, Q_{a}
TK_{a}	Combination of Tertiary and Cretaceous (age) rock units
TK_{i}	Paleogene and Upper Cretaceous intrusive rocks
TK_{oa}	Ojo Alamo Formation; fine- to medium-grained sedimentary sandstone; $T_{oa;}$ named after a New Mexico trading post where it was first found. The trading post in turn was named after a large cottonwood tree (called alamo in Spanish) that grew next to the spring nearby (http://www.palaeos.com/Vertebrates/Units/Unit330/330.600.html)
T_{n}	Nacimiento Formation; discontinuous fluvial sandstone
T_{sj}	San Jose Formation; stacked alluvial and fluvial sandstones with lateral discontinuities; recognized by rounded-ledge outcrops

2.3 Water Quality Standards

Water quality standards (WQS) for all assessment units in this document are set forth in the following various sections of *New Mexico Standards for Interstate and Intrastate Surface Waters* (NM Administrative Code [NMAC] 20.6.4) (NMAC 2002):

20.6.4.401 SAN JUAN RIVER BASIN - The main stem of the San Juan river from the point where the San Juan leaves New Mexico and enters Colorado upstream to U.S. highway 64 at Blanco, and any flow which enters the San Juan river from the Mancos and Chaco rivers.

A. Designated Uses: municipal and industrial water supply, irrigation, livestock watering, wildlife habitat, secondary contact, marginal coldwater fishery, and warmwater fishery.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0, and temperature shall not exceed 32.2°C (90°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

20.6.4.402 SAN JUAN RIVER BASIN - La Plata river from its confluence with the San Juan river upstream to the New Mexico-Colorado line.

A. Designated Uses: irrigation, limited warmwater fishery, marginal coldwater fishery, livestock watering, wildlife habitat, and secondary contact.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0 and temperature shall not exceed 32.2°C (90°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

20.6.4.403 SAN JUAN RIVER BASIN - The Animas river from its confluence with the San Juan upstream to U.S. highway 550 at Aztec.

A. Designated Uses: municipal and industrial water supply, irrigation, livestock watering, wildlife habitat, marginal coldwater fishery, secondary contact, and warmwater fishery.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0, and temperature shall not exceed 27°C (80.6°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

20.6.4.404 SAN JUAN RIVER BASIN - The Animas river from U.S. highway 550 at Aztec upstream to the New Mexico-Colorado line.

A. Designated Uses: coldwater fishery, irrigation, livestock watering, wildlife habitat, municipal and industrial water supply, and secondary contact.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20°C (68°F), and total phosphorus (as P) shall not exceed 0.l mg/L. The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

20.6.4.405 SAN JUAN RIVER BASIN - The main stem of the San Juan river from U.S. highway 64 at Blanco upstream to the Navajo dam.

A. Designated Uses: high quality coldwater fishery, irrigation, livestock watering, wildlife habitat, municipal and industrial water supply, and secondary contact.

B. Standards:

(1) In any single sample: conductivity shall not exceed 400 µmhos/cm (at 25°C), pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20°C (68°F), and turbidity shall not exceed 10 NTU. The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 mL; no single sample shall exceed 200/100 mL (see Subsection B of 20.6.4.13 NMAC).

NMAC 20.6.4.900 provides standards applicable to attainable or designated uses unless otherwise specified in 20.6.4.101 through 20.6.4.899. This section includes the total recoverable selenium chronic criterion of 5.0 micrograms per liter (µg/L) for Wildlife Habitat uses discussed in section 7.0 of this document. NMAC 20.6.4.12 lists general standards that apply to all surface waters of the state at all times, unless a specified standard is provided elsewhere in NMAC.

NMED proposed a variety of modifications to San Juan River basin quality standard segments during the February 2004 triennial review hearings. Most notable,

- The description of segment 20.6.4.401 will be changed to "The main stem of the San Juan river from the Navajo Nation at the Hogback upstream to its confluence with the Animas River" to acknowledge that New Mexico does not have jurisdiction over surface water quality standards in the San Juan River downstream of the Hogback. New Mexico and the Navajo Nation share jurisdiction on the main stem of the San Juan river from the Navajo Nation at the Hogback upstream to its confluence with the La Plata River. A new water quality standard segment (20.6.4.408) will cover the San Juan River from the Animas River to Cañon Largo. This split will not impact any current or proposed water quality criteria.

- NMED proposed changing criteria related to contact uses from fecal coliform to *E. coli* (monthly geometric mean of 126/100mL or less and single sample 410/100 mL, except segment 20.6.4.405 single sample 235/100 mL).

- Animas River 20.6.4.4.3 designated contact use of "secondary contact" was changed to "primary contact." The current fecal coliform criteria are protective of primary contact use according to 20.6.4.900.G. The change was made to recognize that swimming has been observed as an existing use in this portion of the Animas River.

Proposed changes to the standards are still under review and have not been approved by US EPA at the time of this writing. Accordingly, this TMDL document was prepared using the existing water quality standards (NMAC 2002). *E. coli* calculations were included in the bacteria section of this document in anticipation of the change in the standards.

The Navajo Nation Water Quality Standards approved by the Navajo Nation Resources Committee include the following water quality standards and associated criteria for the San Juan River and associated tributaries in this document (NNEPA 2004):

San Juan River and perennial tributary drainages
Designated uses: Domestic Water Supply, Primary Human Contact, Secondary Human Contact, Agricultural Water Supply, Aquatic Habitat, Livestock and Wildlife Watering, Fish Consumption

Non perennial tributary drainages to the San Juan River
Designated uses: Secondary Human Contact, Aquatic Habitat, Livestock and Wildlife Watering

Gallegos Canyon
Designated uses: Primary Human Contact, Secondary Human Contact, Aquatic Habitat, Livestock and Wildlife Watering

Navajo Nation criteria associated with contact uses were originally (NNEPA 1999):

Primary Human Contact: fecal coliform – 100 cfu geometric mean,200 cfu single sample maximum
Secondary Human Contact: fecal coliform – 200 cfu geometric mean,400 cfu single sample maximum

In 2004, the Navajo Nation changed contact use criteria through their triennial review process to (NNEPA 2004):

> **Primary Human Contact**: *E. coli* – 126 cfu geometric mean, 235 cfu single sample maximum
> **Secondary Human Contact**: *E. coli* – 126 cfu geometric mean, 576 cfu single sample maximum

These changes were approved by the Navajo Nation Resources Committee are in effect for tribal purposes as of September 2004.

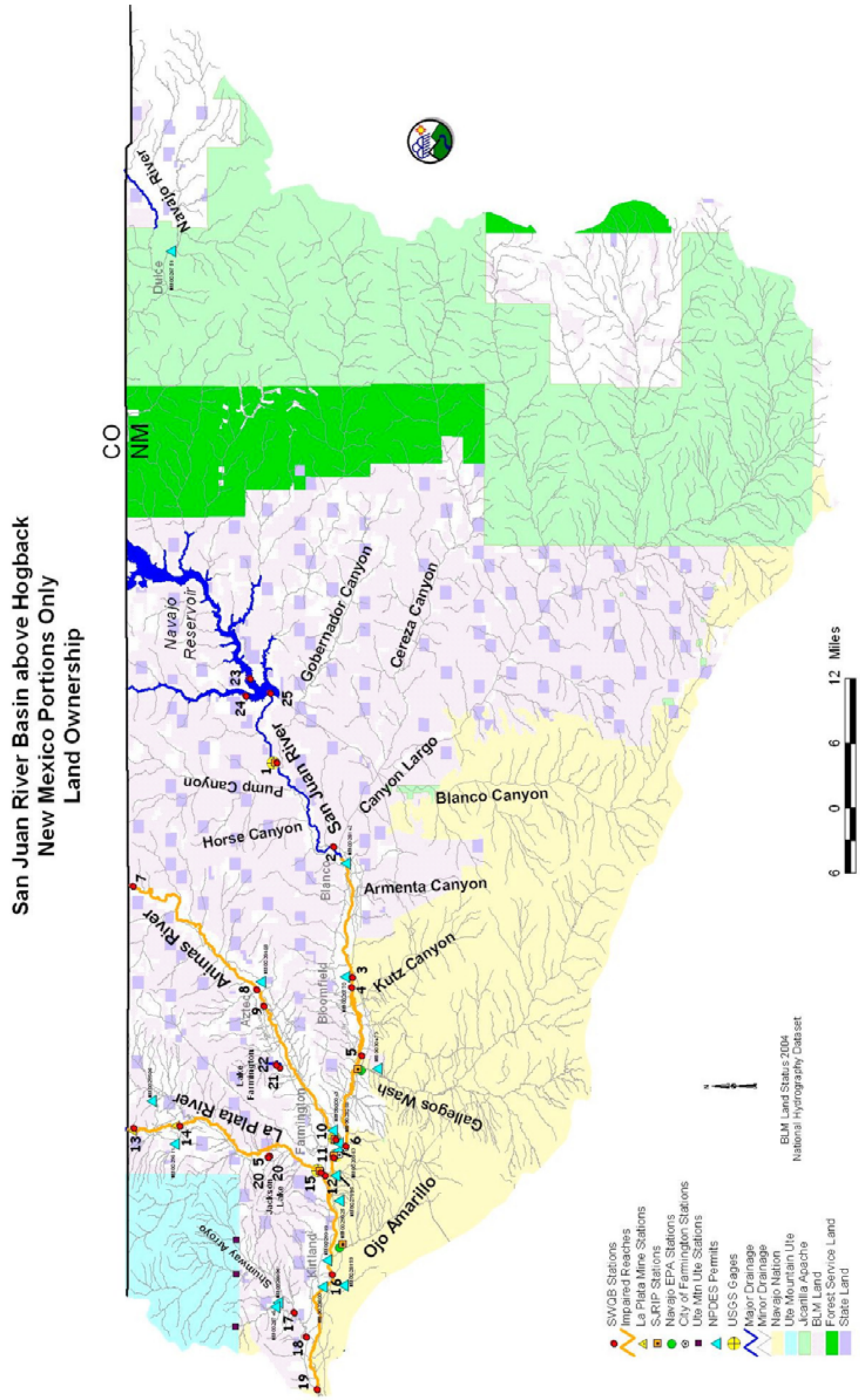


Figure 2.1 San Juan River Basin Land Ownership

2.4 Intensive Water Quality Sampling

The San Juan River basin was intensively sampled by the SWQB in 2002, with additional study during 2003. A brief summary of the survey and the hydrologic conditions during the intensive sample period is provided in the following subsections.

2.4.1 Survey Design

Surface water quality samples were collected monthly between March and October for the 2002 intensive SWQB study. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches and reservoirs) throughout the basin (Table 2.2, Figures 2.2 through 2.4). Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. Surface water grab samples stations were analyzed for a variety of chemical/physical parameters. Data results from grab sampling are housed in the SWQB provisional water quality database and will be uploaded to USEPA's Storage and Retrieval (STORET) database.

Table 2.2 SWQB 2002 San Juan River Sampling Stations

Station	Station Location
1	SAN JUAN RIVER BLW GAGE STATION
2	SAN JUAN RIVER AT BRIDGE NEAR BLANCO
3	SAN JUAN RIVER AT BLOOMFIELD BRIDGE
4	SAN JUAN RIVER BELOW BLOOMFIELD WWTP
5	SAN JUAN R AT HAMMOND BRIDGE
6	SAN JUAN R ABV THE ANIMAS RIVER IN FARMINGTON
7	ANIMAS RIVER @ COLORADO STATE LINE
8	ANIMAS R @ AZTEC @ HWY 550 BRIDGE
9	ANIMAS RIVER 300M BELOW AZTEC WWTP OUTFALL
10	ANIMAS R AT FARMINGTON
11	SAN JUAN RIVER AT BISTI BRIDGE
12	SAN JUAN R ABV LA PLATA R CONFL
13	LA PLATA RIVER @ NM-COLORDO STATE LINE
14	LaPlata at LaPlata
15	LA PLATA RIVER NR FARMINGTON, NM
16	SAN JUAN RIVER NEAR KIRTLAND
17	Shumway ab Creek 6800
18	Shumway at Hwy 550
19	SAN JUAN R AT HOGBACK
20	Jackson Lake at Dam
20.5	Jackson Lake Shallow
21	Lake Farmington Deep
22	Lake Farmington Shallow
23	Navajo Reservoir at Sims
24	Navajo Reservoir at Gooseneck
25	Navajo Reservoir towards dam

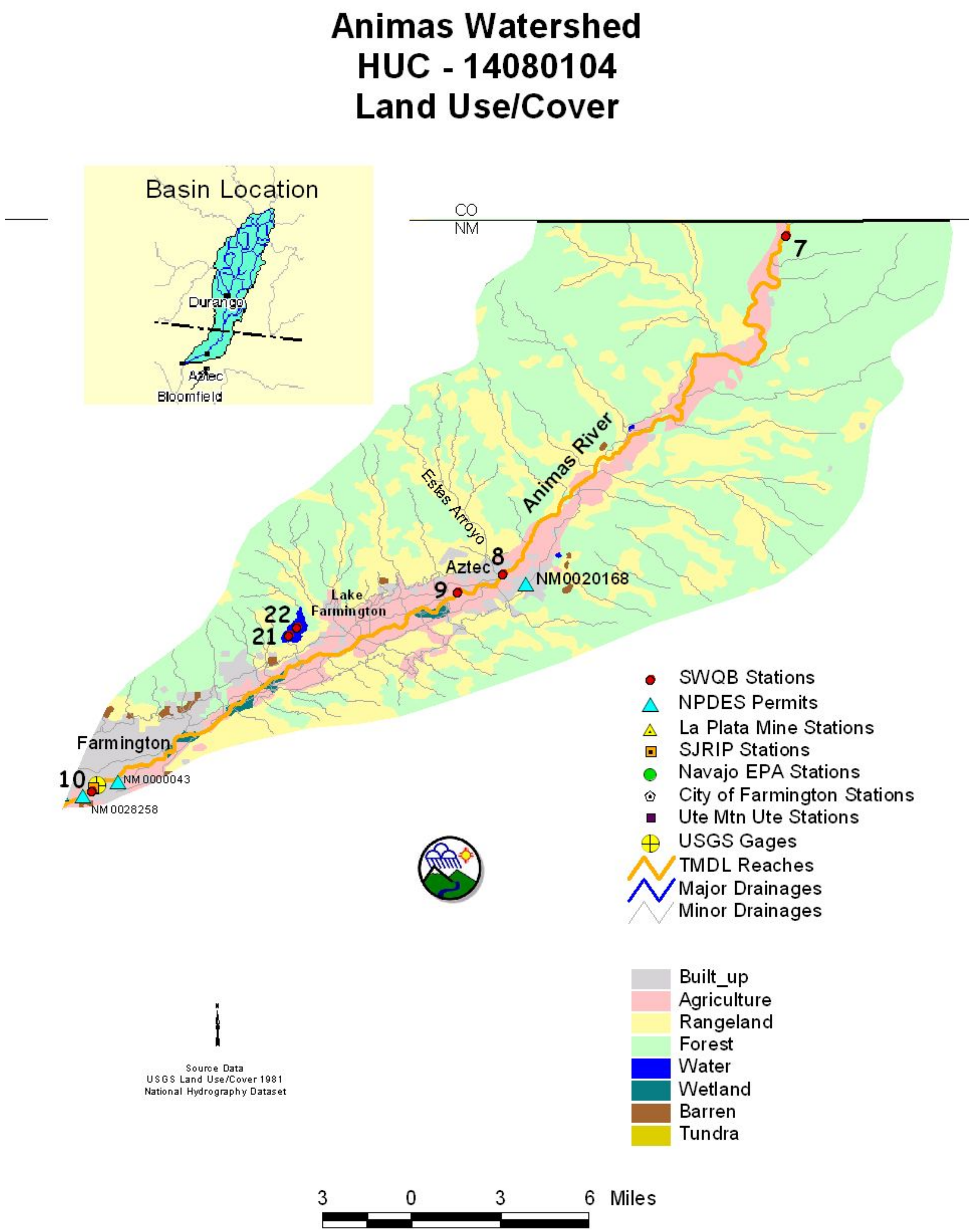


Figure 2.2 Animas River Land Use/Cover and Sampling Stations

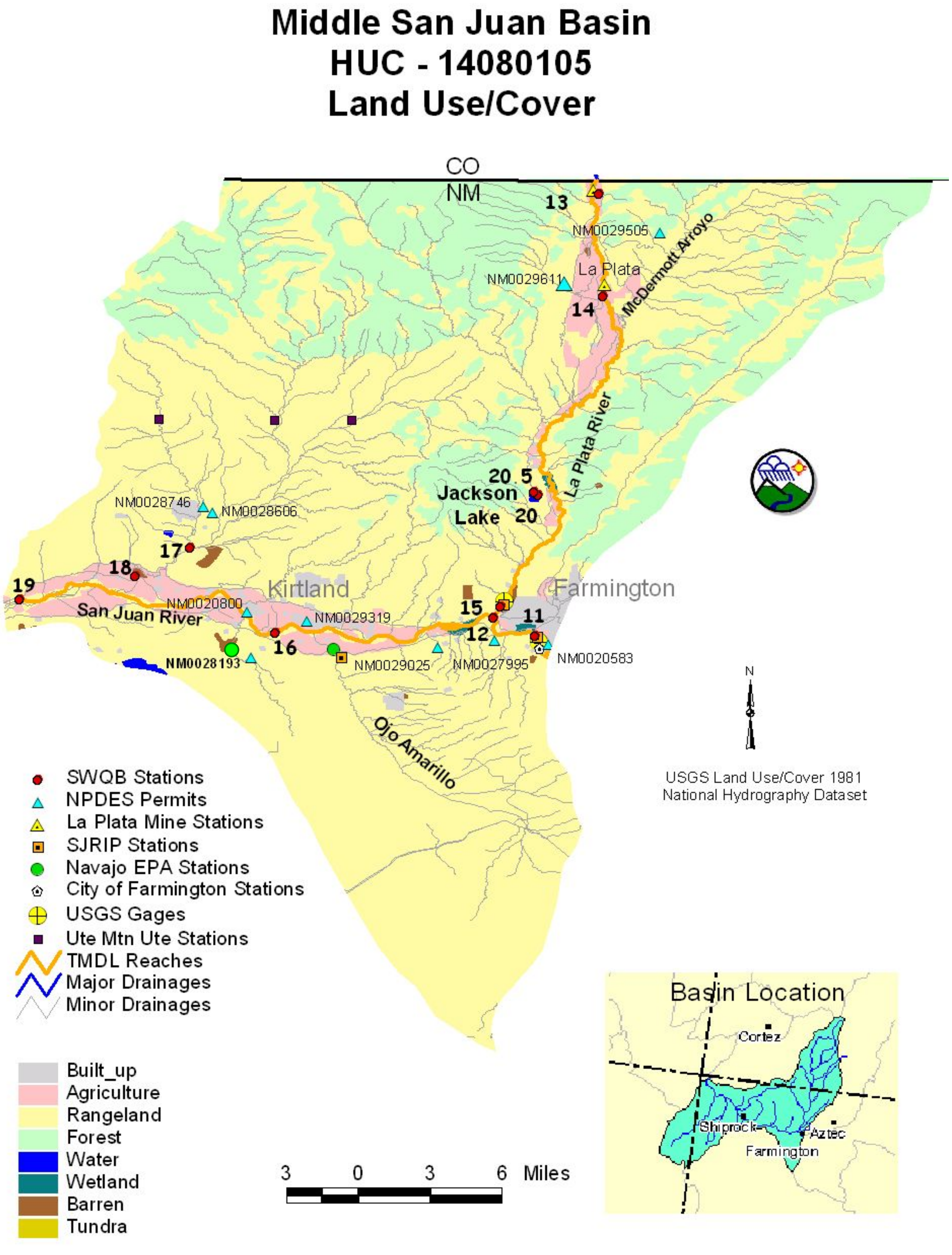


Figure 2.3 Middle San Juan River Land Use/Cover and Sampling Stations

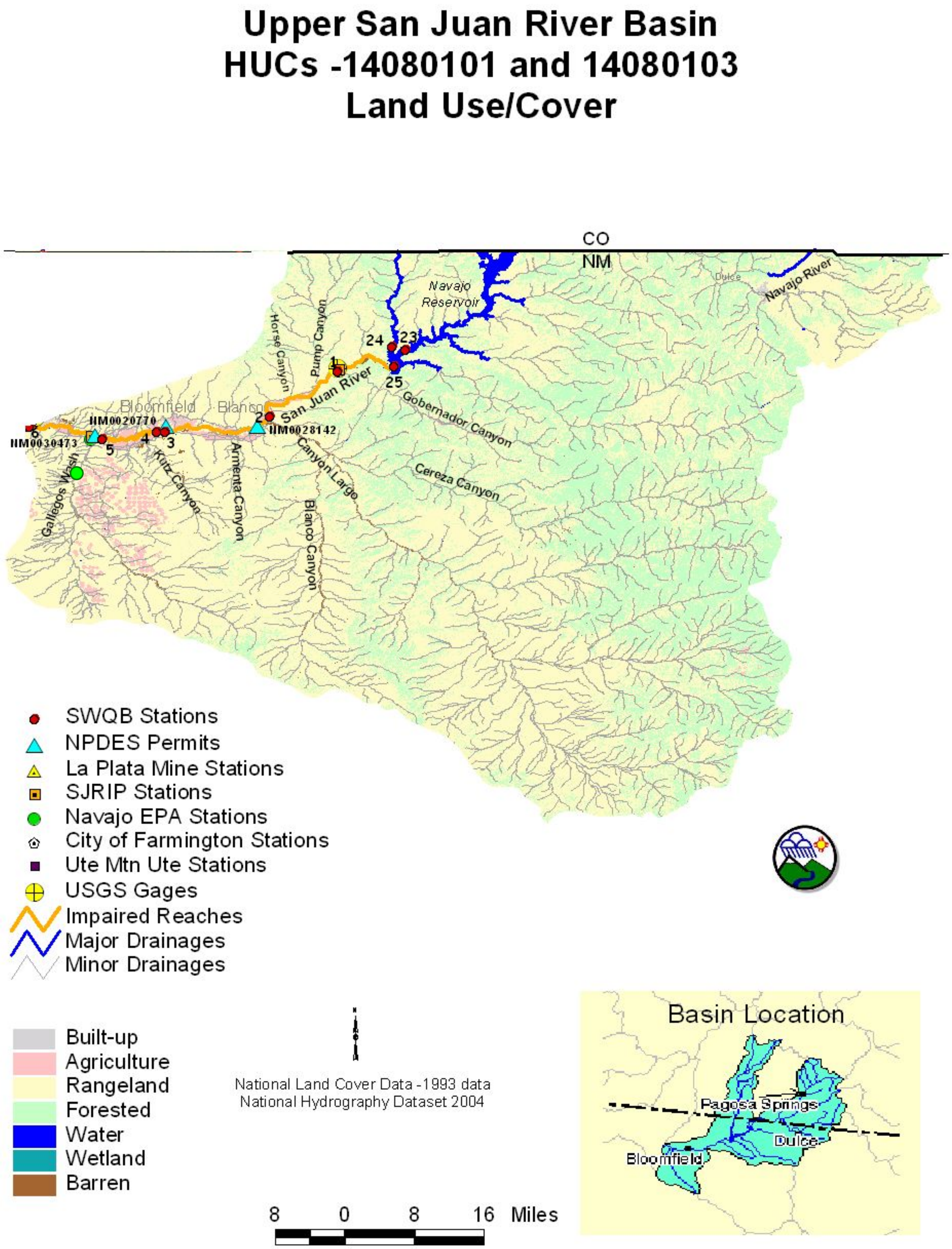


Figure 2.4 Upper San Juan River Land Use/Cover and Sampling Stations

In 2003, Additional nutrient assessment data was collected in the Animas River as part of the Animas River Nutrient Work Group efforts. In 2002, SWQB applied for and received a CWA Section 104(b)(3) grant to develop a protocol for determination of sedimentation/siltation impairment in large southwest rivers. The San Juan and Animas Rivers were chosen as case studies for this protocol. Data collection occurred fall of 2003. Additional information on these two efforts is included in the below sections on nutrients and sedimentation/siltation, respectively.

All sampling and assessment techniques used during the 2002-2003 intensive SWQB survey are detailed in the *Quality Assurance Project Plan* (QAPP) (NMED/SWQB 2001), assessment protocols (NMED/SWQB 2004b), and U.S. Department of Agriculture (USDA) National Sedimentation Lab (NSL) study (Heins *et al.*, 2004). As a result of the 2002 and 2003 monitoring efforts, several surface water impairments were determined. Accordingly, these impairments were added to New Mexico's 2004-2006 CWA Integrated §303 (d)/305(b) list (NMED/SWQB 2004a).

2.4.2 Hydrologic Conditions

There are several active, real-time U.S. Geological Survey (USGS) gaging stations in the San Juan River basin associated with the reaches presented in this document. USGS gage locations are presented in Figures 2.2 through 2.4. Daily stream flow for these USGS gages are presented graphically in Figures 2.5 through 2.9 for the 2002 calendar year.

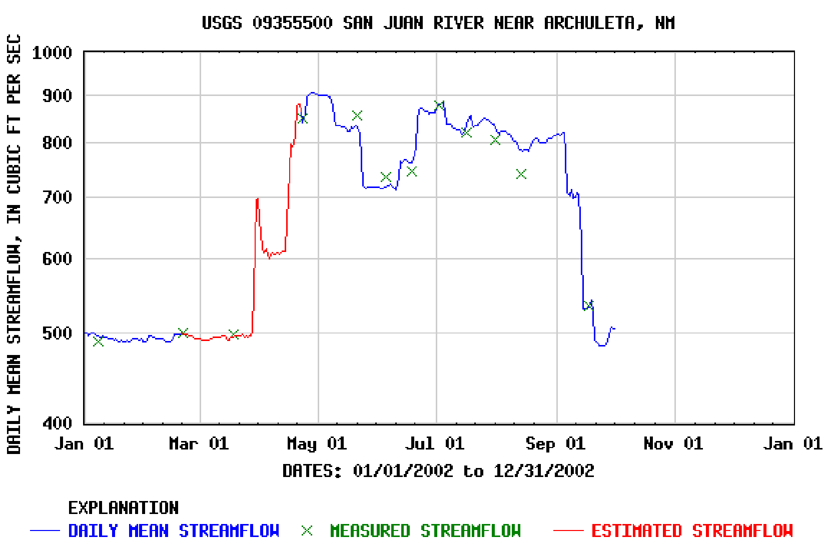


Figure 2.5 2002 USGS Average Daily Flow, San Juan River near Archuleta, NM

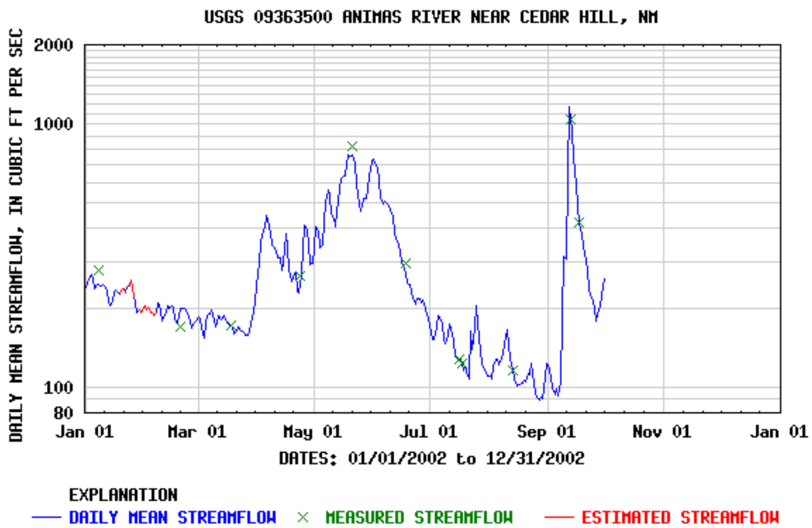


Figure 2.6 2002 USGS Average Daily Streamflow, Animas River near Cedar Hill, NM

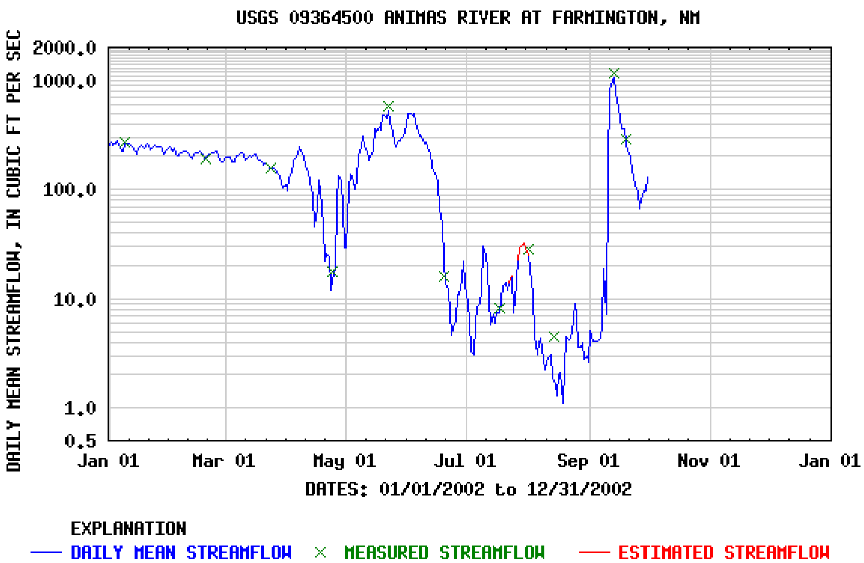


Figure 2.7 2002 USGS Average Daily Streamflow, Animas River at Farmington, NM

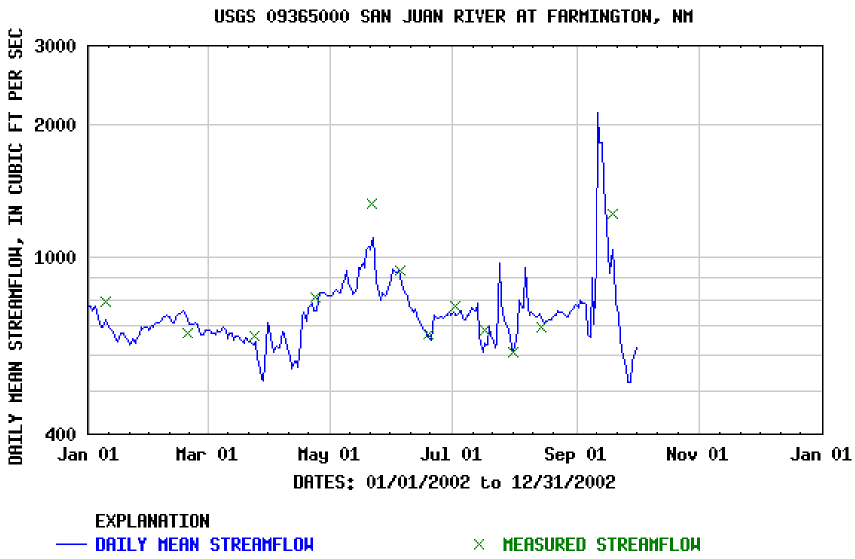


Figure 2.8 2002 USGS Average Daily Streamflow, San Juan River at Farmington, NM

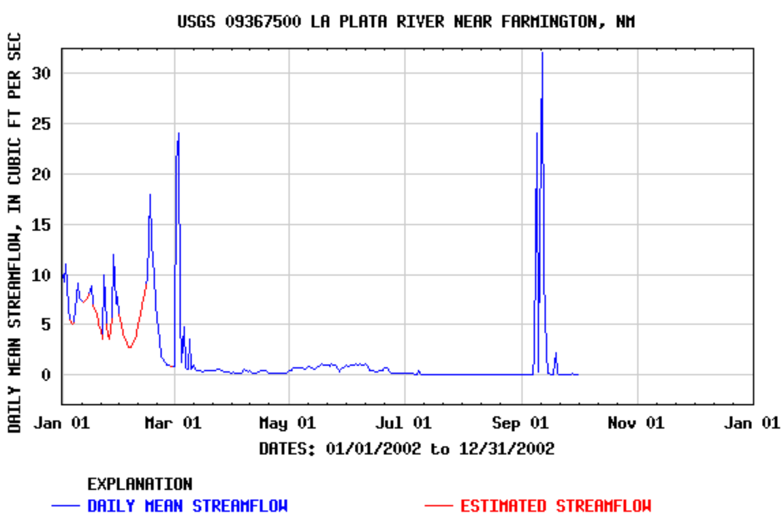


Figure 2.9 2002 USGS Average Daily Streamflow, La Plata River Near Farmington, NM

The San Juan River is a regulated river as a result of the construction of Navajo Dam in 1963. The impacts of this alteration are discussed in the sedimentation/siltation section below. Also, flows during the 2002 survey year were below average based on the period of record. Flows were among the lowest on record. As stated in the Assessment Protocol (NMED/SWQB 2004b), data collected during all flow conditions, including low flow conditions (i.e., flows below the 4Q3), will be used to determine designated use attainment status during the assessment process. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

3.0 INDIVIDUAL WATERSHED DESCRIPTIONS & IMPAIRMENTS

TMDLs were developed for assessment units for which constituent (or pollutant) concentrations measured during the 2002 water quality survey, as combined with quality outside data, indicated impairment. Because characteristics of each watershed, such as geology, land use, and land ownership provide insight into probable sources of impairment, they are presented in this section for the individual 8-digit hydrologic unit code (HUC) watersheds within the San Juan River basin. In addition, the 2004-2006 Integrated §303(d)/§305(b) listings within the San Juan River basin are discussed (NMED/SWQB 2004a).

3.1 Animas River Watershed (HUC 14080104)

The headwaters of the 1,357 square mile (mi^2) Animas River watershed originate in Colorado. According to available Geographic Information System (GIS) coverages, the New Mexico portion of the Animas River watershed (Photo 3.1) is approximately 277 mi^2 and includes several ephemeral tributaries. As presented in Figure 2.1, land ownership is 34% private, 60% BLM, and 6% State. Land use includes 56% forest, 8% agriculture, 29% rangeland, 5% built-up land, 1% water, and less than 1% wetlands and barren land (Figure 2.2). The geology of the Animas watershed is predominantly comprised of the Tertiary Nacimiento Formation with limited areas of the San Jose Formation near the northeast section of the New Mexico portion of the watershed (Figure 3.1).

Photo 3.1 Animas River at Boyd Park, September 2003.

The New Mexico portion of the Animas River was divided into two assessment units (AUs). SWQB established two stations in each AU. Data from these stations were combined with readily available data from other sources that met quality control objectives, and assessed using established assessment protocols to determine whether or not designated uses were being met. As a result, the Animas River (San Juan River to Estes Arroyo) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for nutrients and fecal coliform, and the Animas River (Estes Arroyo to Colorado border) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for temperature (NMED/SWQB 2004a). No TMDLs have previously been established for the Animas River. Therefore, TMDLs were developed for inclusion in this document for the following assessment unit in the Animas River watershed:

- ***Fecal coliform***: Animas River (San Juan River to Estes Arroyo)

TMDLs for nutrients impairment in the Animas River between the San Juan River and Estes Arroyo, and temperature impairment in the Animas River between Estes Arroyo to Colorado border, are under development for inclusion in future TMDL documents.

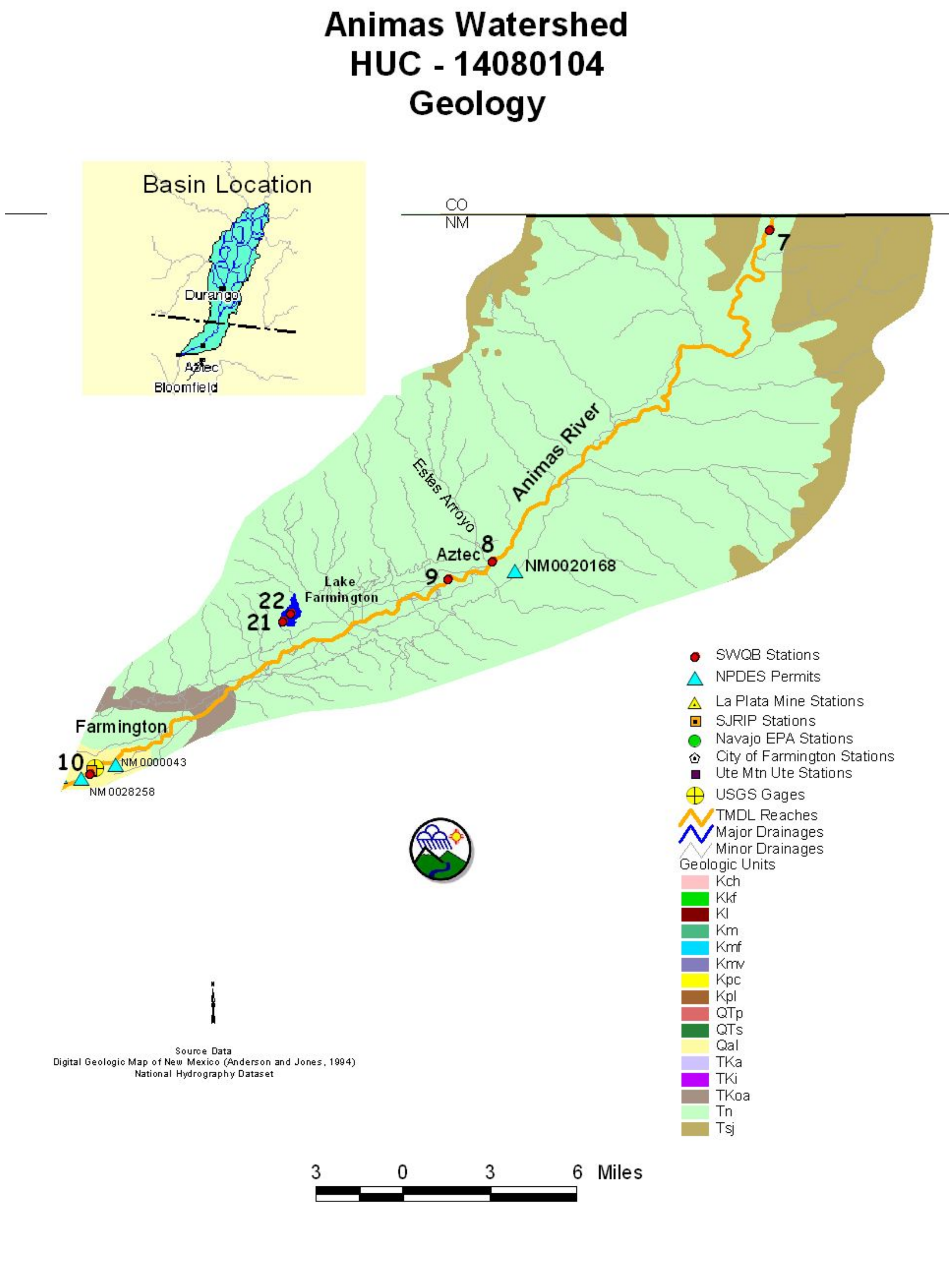


Figure 3.1 Animas River Basin Geology (see Table 2.1 for definitions)

3.2 Middle San Juan River Watershed (HUC 14080105)

The Middle San Juan River watershed includes the La Plata River and San Juan River between the Navajo Nation boundary at the Hogback and the Animas River (Photo 3.2). The headwaters of the 583 mi^2 La Plata River watershed originate in Colorado. According to available GIS coverages, the New Mexico portion of the La Plata River watershed is approximately 162 mi^2 and includes several ephemeral tributaries. As presented in Figure 2.1, land ownership is 29% private, 45% BLM, 20% Native Lands (Ute Mountain Ute) and 6% State. Land use includes 48% forest, 6% agriculture, 45% rangeland, <1% built-up land, <1% water, < 1% wetlands and, <1% barren (Figure 2.3). The overall San Juan River watershed above Hogback is 8,171 mi^2. According to available GIS coverages, the New Mexico portion of this watershed is approximately 4,298 mi^2 and includes several ephemeral tributaries and the La Plata drainages. Overall land ownership statistics for the New Mexico portion of the San Juan River above the Navajo Nation boundary at the Hogback are 6% USFS, 7% private, 37% BLM, 45% Native Lands (Navajo Nation and Ute Mountain Ute) and 5% State. Overall land use includes 52% forest, 1% agriculture, 46% rangeland, <1% built-up land, <1% water, < 1% wetlands and, <1% barren (Figure 2.3). The geology of the Middle San Juan River watershed consists of a complex distribution of Tertiary and Cretaceous formations, with Nacimiento Formation as the most predominant layer (Figure 3.2). The Navajo Nation at the Hogback forms the western border of the study area. The hogback is formed by steeply tilted Cliffhouse sandstone, which is part of the Mesaverde group (Chronic 1987).

Photo 3.2 San Juan River near the Hogback, October 2003

The New Mexico portion of the La Plata River was divided into two AUs (Photo 3.3). SWQB established one station in the lower AU and two stations in the upper AU. Four stations were established in the San Juan River between the Hogback and the Animas River. Data from these stations were combined with readily available data from other sources that met quality control objectives and assessed using established assessment protocols to determine whether or not designated uses were being met. As a result, the San Juan River (Navajo Nation boundary at Hogback to Animas River) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for fecal coliform. The La Plata River (McDermott Arroyo to Colorado border) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for fecal coliform and dissolved oxygen. La Plata River (San Juan River to McDermott Arroyo) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for fecal coliform and sedimentation/siltation (NMED/SWQB 2004a). This lower La Plata River AU was also listed for dissolved oxygen, but the designated use marginal coldwater fishery is not existing or attainable in this stream reach. Accordingly, a change to the water quality standards will be proposed in future triennial reviews.

Photo 3.3 La Plata River near La Plata, NM, November 2003

No TMDLs have previously been established for the any of these AUs. Therefore, TMDLs were developed for this document for the following assessment unit in the Middle San Juan River watershed:

- ***Fecal coliform***: La Plata River (San Juan River to McDermott Arroyo), La Plata River (McDermott Arroyo to Colorado border), San Juan River (Navajo Nation boundary at Hogback to Animas River)
- ***Sedimentation/siltation***: La Plata River (San Juan River to McDermott Arroyo)

A TMDL for dissolved oxygen impairment in the La Plata River between McDermott Arroyo and the Colorado border is under development for inclusion in future TMDL documents.

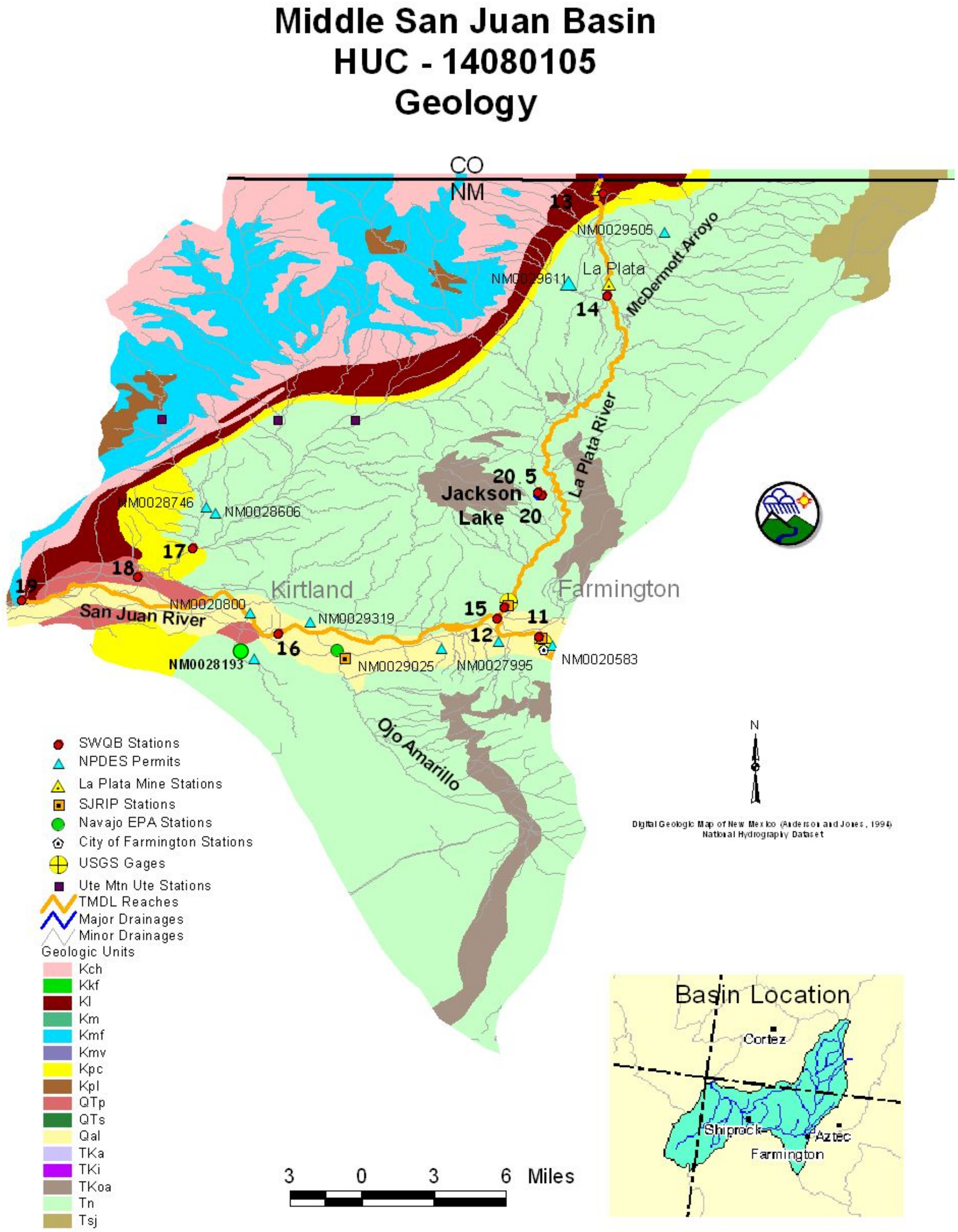


Figure 3.2 Middle San Juan River Basin Geology (see Table 2.1 for definitions)

3.3 Upper San Juan River Watershed (HUC 14080101)

The Upper San Juan River watershed includes the Gallegos Canyon and San Juan River above the Animas River (Photo 3.4 and 3.5). Gallegos Canyon originates on the Navajo Nation. The San Juan River originates in Colorado. Navajo Dam was constructed in 1963 to create Navajo Reservoir. This hydrologic alteration resulted in a world-class trout fishery immediately below the dam. Cañon Largo enters the San Juan River from the southeast near Blanco, New Mexico.

The San Juan River watershed above the confluence with the Animas River is 5,825 mi^2. According to available GIS coverages, the New Mexico portion of this watershed is approximately 3,533 mi^2 and includes several ephemeral tributaries and Cañon Largo. As presented in Figure 2.1, land ownership is 8% US Forest Service, 7% private, 31% Bureau of Land Management (BLM), 49% Native Lands (Navajo Nation) and 5% State. Land use includes 61% forest, 2% agriculture, 36% rangeland, 1% built-up land, <1% water, < 1% wetlands and, <1% barren (Figure 2.4). The geology of the Upper San Juan River watershed consists primarily of the Nacimiento Formation and San Jose Formation (Figure 3.3). The latter is a sandstone/shale conglomerate which erodes easily by wind and wind-driven rains (Chronic 1987).
The specific geology of the Gallegos Wash watershed is discussed in more detail in the Selenium section.

Photo 3.4 San Juan River at Soaring Eagle, October 2003

This portion of the San Juan River was divided into two AUs – San Juan River (Animas River to Cañon Largo) and San Juan River (Cañon Largo to Navajo Dam). SWQB established four stations in the downstream AU and two stations in the upstream AU. Gallegos Canyon (San Juan River to Navajo boundary) was sampled near the confluence with the San Juan River. Data from these stations were combined with any readily available data from other sources that met quality control objectives and assessed using established assessment protocols to determine whether or not designated uses were being met. As a result, Gallegos Canyon was listed for selenium on the Integrated 2004-2006 CWA §303(d)/§305(b) list (NMED/SWQB 2004a). The San Juan River (Animas River to Cañon Largo) was listed for fecal coliform, and remained listed for sedimentation/siltation based on the USDA NSL study (see Section 4.0 for details).

Photo 3.5 Installing thermograph in San Juan River at Bloomfield Bridge, June 2002

No TMDLs have previously been established for the any of these AUs. Therefore, TMDLs were developed for the following assessment units in the Upper San Juan River watershed:

- ***Sedimentation/siltation***: San Juan River (Animas River to Cañon Largo)
- ***Fecal coliform***: San Juan River (Animas River to Cañon Largo)
- ***Selenium***: Gallegos Canyon (San Juan River to Navajo boundary)

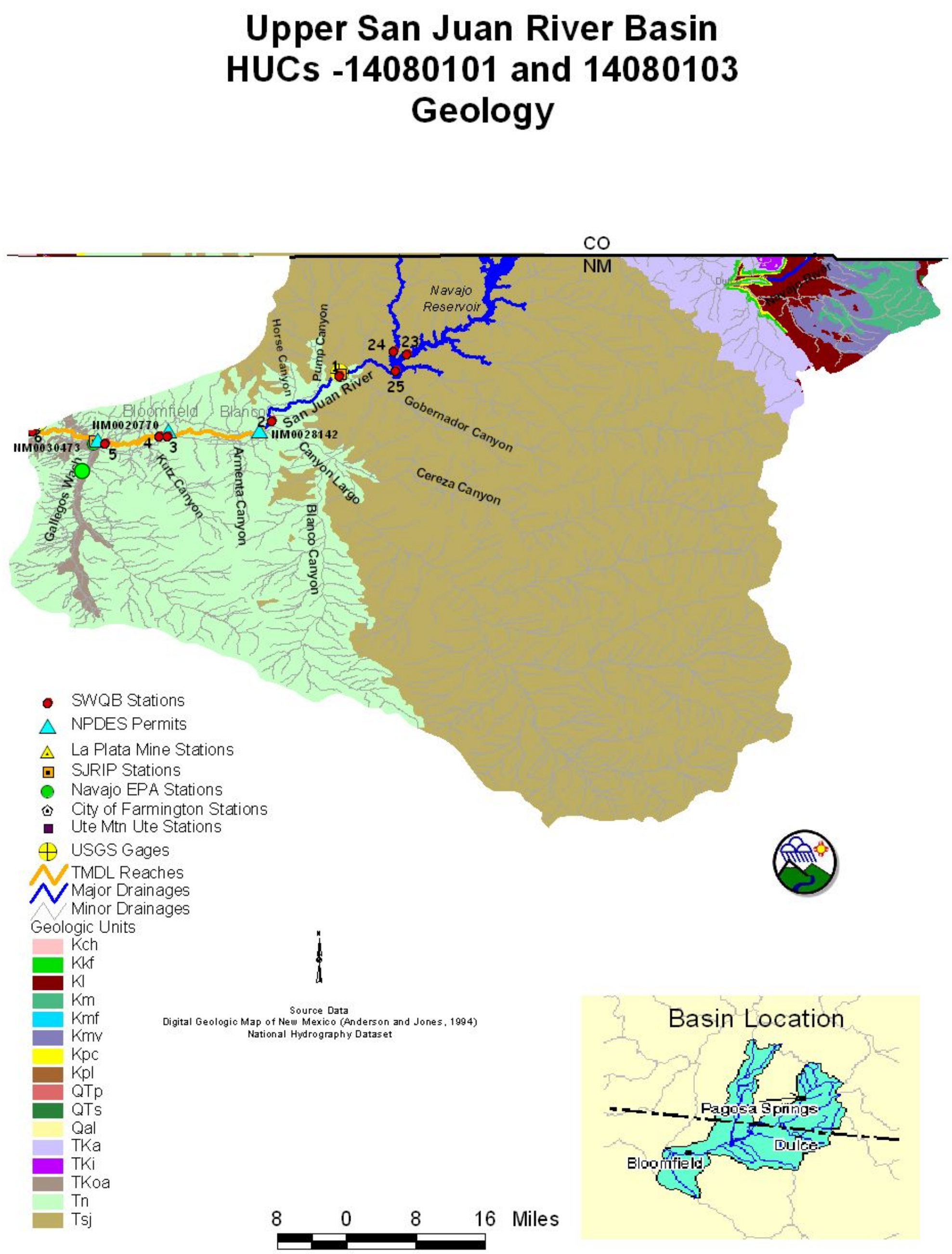


Figure 3.3 Upper San Juan River Basin Geology (see Table 2.1 for definitions)

4.0 SEDIMENTATION/SILTATION (STREAM BOTTOM DEPOSITS)

Impairment due to excessive Sedimentation/Siltation (previously listed as impairment due to Stream Bottom Deposits, [SBD]) was documented for the San Juan River (Animas River to Cañon Largo) and La Plata River (San Juan River to McDermott Arroyo) (NMED/SWQB 2004c). Consequently, these assessment units were listed on the 2004-2006 Integrated CWA §303(d)/§305(b) list for Sedimentation/Siltation (NMED/SWQB 2004a).

4.1 Target Loading Capacity

Target values for this Sedimentation/Siltation TMDL will be determined based on 1) the presence of numeric criteria or appropriate numeric translator to a narrative standard, 2) the degree of experience in applying the indicator, and 3) the ability to easily monitor and produce quantifiable and reproducible results. This TMDL is also consistent with New Mexico's antidegradation policy.

The state of New Mexico has developed and adopted a narrative "bottom deposit" standard. The current general narrative standard for the deposition of material on the bottom of a stream channel is specifically found in Section 20.6.4.12(A) of the State of New Mexico Standards for Interstate and Intrastate Surface Waters (NMAC 2002):

> *Bottom Deposits: Surface waters of the State shall be free of water contaminants from other than natural causes that will settle and damage or impair the normal growth, function, or reproduction of aquatic life or significantly alter the physical or chemical properties of the bottom.*

Clean stream bottom substrates are essential for optimum habitat for many fish and aquatic insect communities. The impact of fine sediment deposits is well documented in the literature. Impairment occurs when critical habitat components, such as spawning gravels and cobble surfaces, are physically covered by fines thereby decreasing intergravel oxygen and reducing or eliminating the quality and quantity of habitat for fish, macroinvertebrates, and algae (Chapman and McLeod 1987, Lisle 1989, Waters 1995). 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. Minshall (1984) cited the importance of substratum size to aquatic insects and found that substratum is a primary factor influencing the abundance and distribution of insects. Aquatic detritivores also can be affected when their food supply either is buried under sediments or diluted by increased inorganic sediment load and by increasing search time for food (Relyea et al., 2000). In addition, sediment loads that exceed a river's sediment transport capacity often trigger changes in stream morphology (Leopold and Wolman 1964). Streams that become overwhelmed with sediment often go through a period of accelerated channel widening and streambank erosion before returning to a stable form (Schumm 1977, Knighton 1984). These morphological changes tend to accelerate erosion, thereby reducing habitat diversity and placing additional stress on designated aquatic life uses.

4.1.1 San Juan River Basin Sedimentation Target Development

The SWQB Sediment Workgroup evaluated a number of methods described in the literature that would provide information allowing a direct assessment of the impacts to the stream bottom substrate. In order to address the narrative criteria for bottom deposits, SWQB compiled techniques to measure the level of sedimentation of a stream bottom. These procedures are presented in Appendix D of the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report* (NMED/SWQB 2004b). The purpose of the protocol is to provide a reproducible quantification of the narrative criteria for bottom deposits in small wadeable streams. A final set of monitoring procedures was implemented at a wide variety of sites during the 2001 monitoring season. These procedures included conducting pebble counts (to determine percent fines), stream bottom cobble embeddedness, geomorphologic measurements, and the collection and enumeration of benthic macroinvertebrates.

The target levels involved the examination of developed relationships between percent fines and biological score as compared to a reference site. Using existing data from NM, a strong relationship (r^2=0.75) was established between embeddedness and the biological scores using data collected in 1998 (NMED/SWQB 2004b). A strong correlation (r^2= 0.719) was also found when relating embeddedness to percent fines. Although these correlations were based on a limited data set, TMDL studies on other reaches, including those in the Cimarron Basin, the Jemez Basin, and the Rio Guadalupe, have shown this relationship to be consistent. These relationships show that at the desired biological score of at least 70, the target embeddedness for fully supporting a designated use would be 45% and the target percent fines would be 20% (NMED/SWQB 2004b). Since this relationship is based on NM streams, 20% was utilized for the target value for percent fines in previous TMDLs for small wadeable streams in New Mexico.

In 2002, SWQB applied for and received a CWA Section 104(b)(3) grant to develop a protocol for determination of sedimentation/siltation impairment in large southwest rivers. The San Juan and Animas Rivers were chosen as case studies for this protocol because these two rivers had historic sedimentation (a.k.a. SBD) listings on previous New Mexico CWA §303(d) Lists. Because these listings were on the 1998 list, they are also considered to be part of the consent decree (Forest Guardians v. Browner CIV. NO. 96-0826 LH).

The USDA NSL was contracted through a Joint Powers Agreement to provide technical support regarding the determination of potential sedimentation impairment in large southwest rivers, as well as a potential target for any subsequent TMDLs. The NSL has provided the research component necessary to develop sedimentation impairment protocols for several states around the country. They have also been working with USEPA to develop suspended sediment and bed material TMDL protocols. The entire study and results are detailed in the NSL report (Heins *et al.* 2004). The overall study approach was to determine bed-material conditions in stable reaches of the region and the local study area to use as a measure of “reference” bed-material condition. The study approach the NSL developed with input from the SWQB relied primarily on a rapid geomorphic assessment (RGA) approach to determine reference condition and concurrent collection of bed material data to determine the amount of embeddedness in terms of percent (%) fines. This expanded geomorphic approach was intended to specifically address the later portion of New Mexico's narrative SBD criteria mentioned above, namely *"…or significantly alter the physical or chemical properties of the bottom"* (NMAC 2002). Through the use of particle counts as a measure of cobble embeddedness, stream bottom characteristics were compared to a reference condition or fine sediment benchmark and then evaluated to determine potential impairment due to sedimentation.

The SWQB impairment determination document (NMED/SWQB 2004c) that evolved from the NSL study represents a repeatable, quantitative assessment procedure for determining whether New Mexico's narrative "bottom deposit" standard is being attained in various river reaches in the San Juan River basin by:

1) determining fine sediment benchmarks for the ecoregion and basin level, and
2) comparing bed material characteristics between the stream reach of concern to these fine sediment benchmarks

The protocol was the basis for bed sediment impairment determinations for AUs in the San Juan River basin, and provides a detailed summary of the NSL project and associated impairment conclusions (NMED/SWQB 2004c). The protocol was not designed to determine exact sources, locations, quantities, or causes of excess stream bottom sediment. The protocol is applicable to coarse-material dominated river beds (in excess of 50% of bed material greater than 2mm) with wadeable, representative riffle areas.

4.1.1.1 Study Design

To determine reference bed sediment values, the NSL sampled several stations throughout Ecoregion 22 with direct funding from the USEPA Office of Water (Figure 4.1). To further define the reference condition for the San Juan basin study, the NSL also determined reference bed sediment values specific to the Animas and San Juan Rivers combined, and both the Animas and San Juan Rivers separately. This was possible in part because there were 92 sampling stations on the San Juan River and 21 stations on the Animas River as part of the CWA Section 104(b)(3) study. This high number of sites allowed statistical confidence in reference condition determination at a basin scale. Stations were originally selected by river mile on the San Juan river (corresponding to study locations in Bliesner and Lamarra [2000]) and every two miles on the Animas River. The nearest representative riffle area was the focus of the sampling station when possible. In reaches that were dominated by sandy bed materials with no riffle areas, sampling was carried out at the mile marker. In addition, two sites were sampled upstream and downstream of twelve tributaries confluences or, if no riffles were present, at 300 and 600 meters (m) away to measure changes in bed material characteristics as a result to tributary input. The tributaries themselves were also sampled at 300 m and 600 m upstream of the confluence with the mainstem. All field sampling occurred in October and November 2003 (Appendix D and G of Heins *et al*. 2004).

Figure 4.1 Ecoregion 22 (Omernik 1987)

RGAs were conducted at all sites to determine relative channel stability, and assess whether sites were stable (stage I or VI) or unstable (stage II, III, IV, or V) (Figure 4.2 and 4.3). Channel stability was assessed through examination of nine process-related geomorphologic indicators including primary bed material, degree of incision, streambank erosion, presence of riparian vegetative cover, and occurrence of bank accretion (Heins *et al*. 2004).

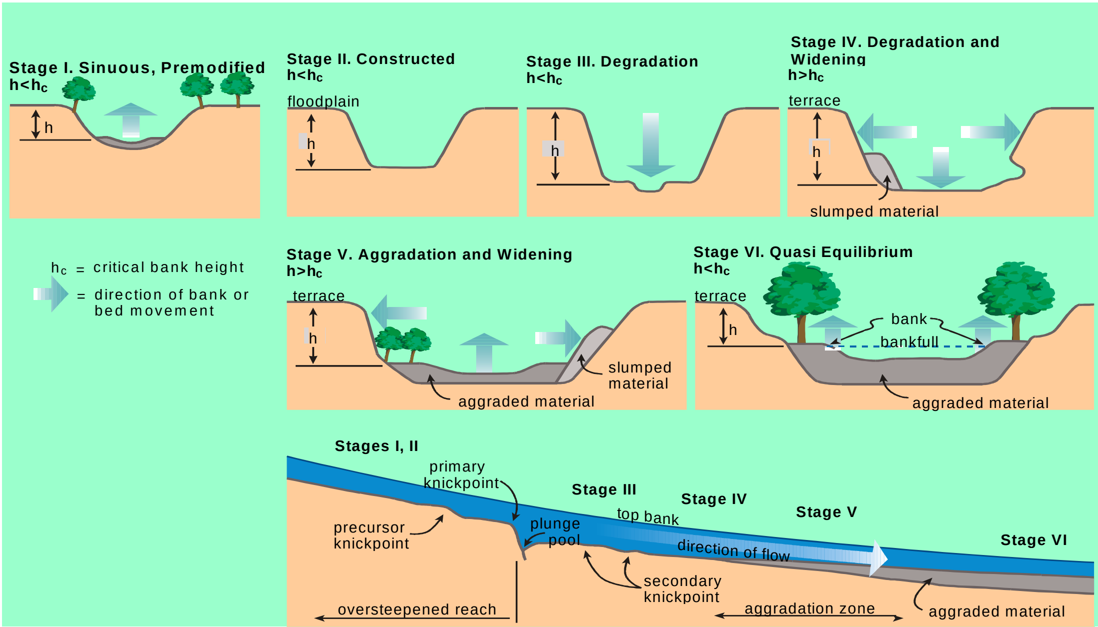


Figure 4.2 Six Stage Channel Evolution Model (Simon and Hupp, 1986)

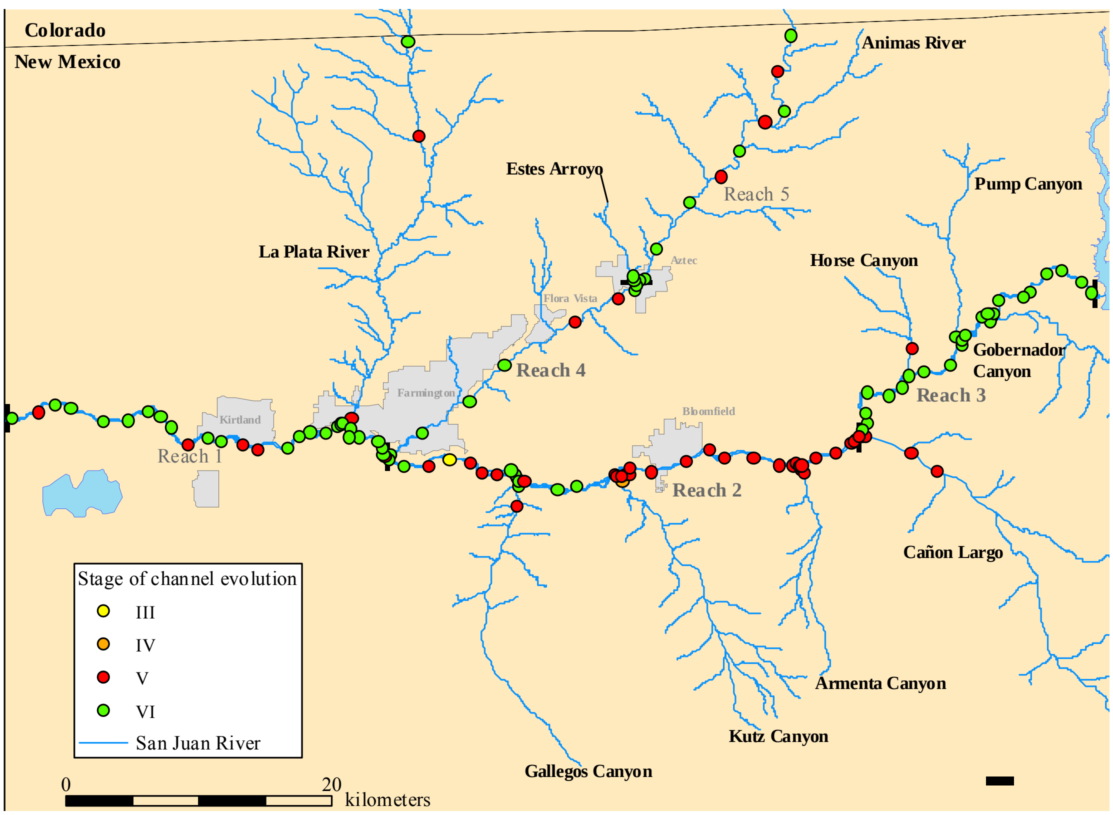


Figure 4.3 Stage of channel evolution for the San Juan River and tributaries

Embeddedness measurements were taken at all sampling stations. The primary tool used to determine the % fines (defined as the percentage of particles with an intermediate axis <2 millimeters [mm]) at each station was a combination of a particle count (PC) (i.e., measuring the intermediate diameter of 100 particles) and bulk sample (BS) at each site were bed material size was mixed, which was the case at most stations. A PC alone was used for purely coarse bed channels, and a BS along was used for 100% fine bed channels. PS/BC bed sediment sample results were plotted over river kilometer to examine any potential longitudinal trends in relationship to tributary confluences and flow diversion structures (Figures 4.4 and 4.5).

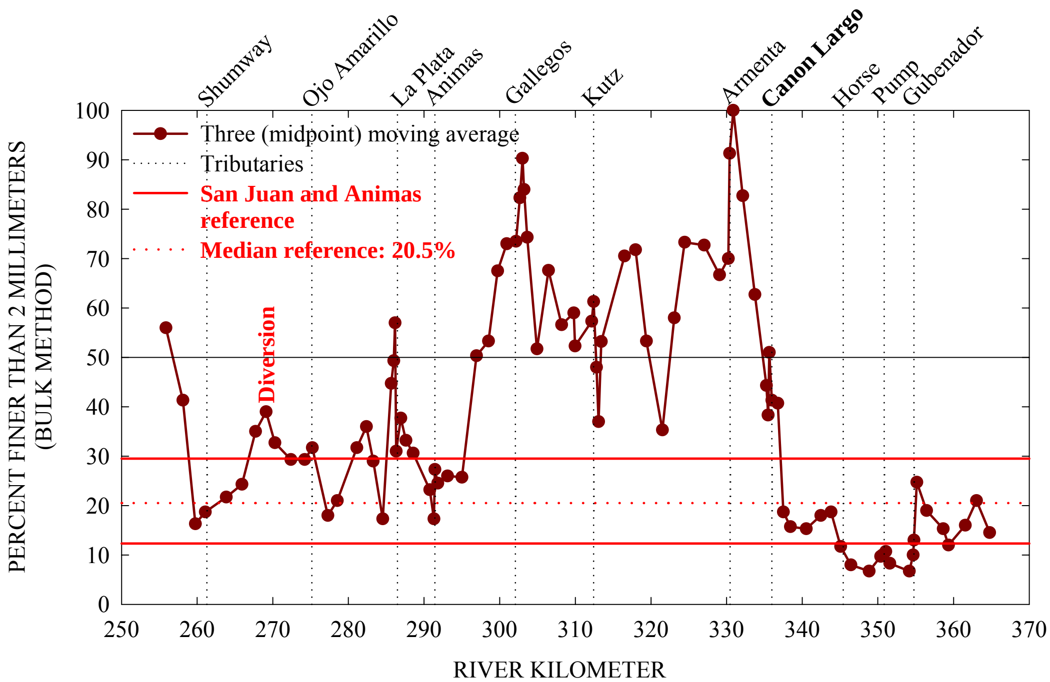


Figure 4.4 Bed material % fines on the San Juan River (adapted from Heins *et al*. 2004)

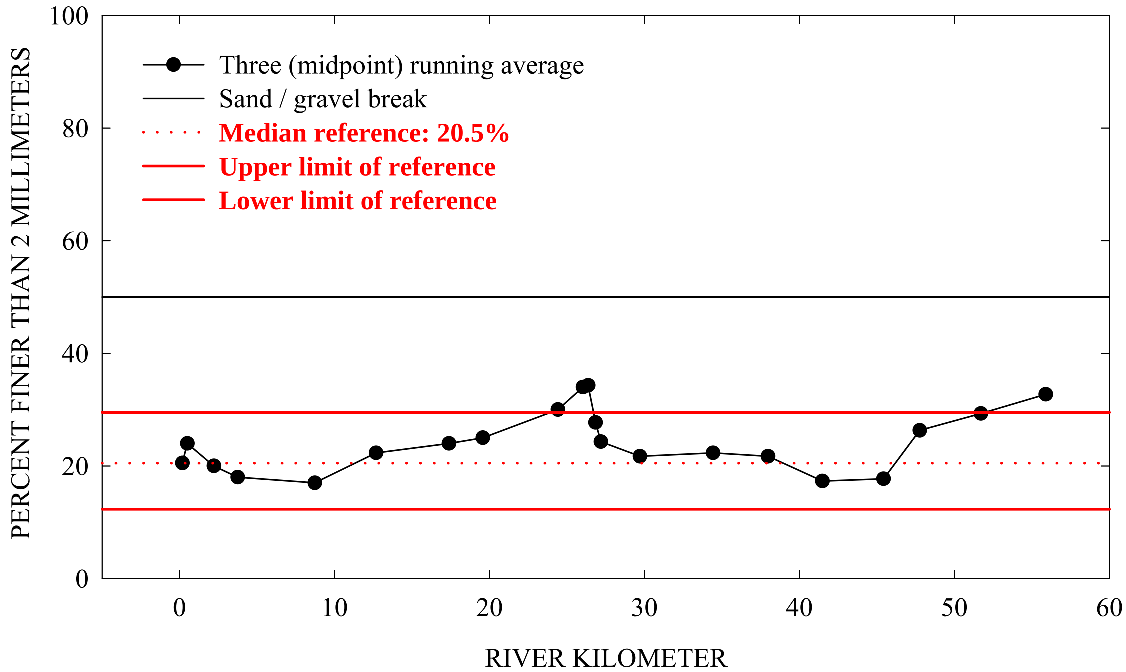


Figure 4.5 Bed material % fines on the Animas River (adapted from Simon presentation to San Juan Watershed Group April 2004)

There were challenges associated with determining and sampling representative riffle areas at sampling stations in the San Juan River. One inaccuracy associated with the sampling technique was averaging across the channel width. At any given station cross section on the San Juan River, the channel bed was often composed purely of sand from the left bank to the midpoint of the channel, and cobbles from the midpoint to the right bank. As stated in the NSL report (Heins *et al.* 2004):

> "…[This site would] appear to have the same bed material as a channel consisting of cobbles across the width of the channel with sand lying in the spaces between the cobbles. However, these two situations present very different environments for habitat and breeding grounds of macro biota. The former ensures 50% of the channel is cobble bed with clean interstitial spaces, whereas the latter is highly embedded and hereby a poor habitat overall. Another accuracy issue was that sampling was biased towards regions of slower, shallower flow, where particle size may be different from the thalweg. This occurred where parts of the channel were too deep and or fast flowing to enter, thus this part of the channel was not sampled.
>
> Initially, the proposed method for acquisition of a PC/BS bed-sediment sample was to stretch a tape across the channel, and collect samples at regular intervals over the cross section using the distance on the table for a reference. However, most of the reaches

visited were too wide for the stretching of a tape across the channel to be practical. In these cases, channel width was estimated, and particles were selected at regular intervals over several transects across the channel perpendicular to the flow direction. For example, if channel width at the site was 25 m, particles would be sampled every meter over 4 transects across the riffle, to provide a fair representation of the bed material size distribution. If greater than 8% of the particles measured were finer than 2 mm in diameter, a bulk sample of the finer material of reasonable weight was collected to obtain a size distribution of this fines fraction."

4.1.1.2 Determination of Bed-Material Reference Values and TMDL target

Reference values for coarse-material dominated sites for Ecoregion 22, the San Juan and Animas Rivers combined, the San Juan and Animas Rivers independently, and the San Juan River only excluding Reach 3 were developed using % fines data determined from the pebble count and bulk sampling data. The NSL defined the reference value as the median percentage of bed sediment finer than 2 mm (i.e., % fines) at stable sites (stage I or VI) which had >50% coarse material (Heins *et al*. 2004). The median was selected instead of the mean because the data was log-normally distributed, so the median more accurately reflects the central tendency of the data. All data from stage I or VI sites within 5 km of dams were removed from the calculations, as was the case in other stations within Ecoregion 22. All values are included in Table 4.1 for comparison. All of these values are consistent with previous research in other parts of the country. In a study of 562 streams located in four northwestern states, Relyea *et al.* (2000) suggested that changes to invertebrate communities as a result of fine sediment (2mm or less) occur between 20-35% fines. Oregon Department of Environmental Quality has drafted a proposed fine sediment impairment benchmark protocol with 75th percentile values ranging between 10.9 and 29.1 % fines, and the 90th percentile values ranging between 14.6 and 32.7 % fines depending on the ecoregion. They are proposing to use the 90th percentile values as their fine sediment benchmark (Douglas Drake, OR DEQ, personal communication). New Mexico's existing protocol for assessing sedimentation in small wadeable streams notes that sites with 20 or less % fines should be noted as non-impaired regardless of the percent increase in % fines from a reference site (NMED/SWQB 2004b). Accordingly, previous TMDL documents prepared by SWQB have utilized a target of 20% fines (see http://www.nmenv.state.nm.us/swqb/library.html for examples).

In the impairment determination protocol, the **fine sediment benchmark** used to determine impairment was defined as the 75th percentile of the %fines measured at reference sites (NMED/SWQB 2004c). This will also be the TMDL target expressed as % fines (Table 4.1).

Table 4.1 Reference bed sediment values and fine sediment benchmarks based on stable coarse-bed sites (adapted from Heins *et al*. 2004)

Dataset	% fines (< 2 mm)		
	Lower quartile (25th percentile)	**Median (reference)**	**Upper quartile (75th percentile)**
San Juan and Animas Rivers (all stage I or VI sites except sites less than 5 km downstream of a dam)	12.8	20.5	**29.5 = fine sediment benchmark** for San Juan and Animas River assessment units
Ecoregion 22	0.25	15.5	**21.5 = fine sediment benchmark** for LaPlata River assessment units

4.2 Flow

No streamflow data are necessary because all loads are specified in %fines.

4.3 Calculations

No calculations were necessary because all loads are specified in %fines. The target loads for sedimentation are shown in Table 4.2.

Table 4.2 Calculation of Target Loads for Sedimentation/Siltation

Location	Sedimentation Standard[(a)] (% fines)	Sedimentation Target Load Capacity (% fines)
San Juan River (Animas River to Cañon Largo)	29.5	29.5
La Plata River (San Juan River to McDermott Arroyo)	21.5	21.5

Notes:
[(a)] This value is based on numeric translators for the narrative bottom deposit standard. The numeric translators (fine sediment benchmark) for sedimentation/siltation in the San Juan River basin were developed from the NSL study (Heins *et al.* 2004) and subsequent impairment determination protocol (NMED/SWQB 2004c).

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning process designed to achieve WQSs. 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.

Measured load was determined by PC/BS analysis as described above in Section 4.1.1.1 and in the NSL study (Heins *et al.* 2004). Fines are defined as particles less than 2 millimeters (mm) in diameter. Results are displayed in Table 4.3. The field data can be found in Appendix D and G of Heins *et al* 2004.

Table 4.3 Calculation of Measured Loads for Sedimentation/Siltation

Location	Embeddedness[(a)] (% fines)	Sedimentation Measured Load (% fines)
San Juan River (Animas River to Cañon Largo)	52[(a)]	52
La Plata River (San Juan River to McDermott Arroyo)	30[(b)]	30

Notes:
[(a)] This value is the median value for % fines from all stations within this assessment unit (Heins *et al.* 2004).
[(b)] This value is % fines measured at the one station in this assessment unit – La Plata River @ gage above San Juan River (NMED/SWQB 2004c).

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

The City of Bloomfield Wastewater Treatment Facility (WWTF) (NM0020770), Blanco School (NM0028142), and McGee Park (NM0030473) facilities are located within the impaired San Juan River AU, and discharge directly to the San Juan River. There is some debate regarding whether or not total suspended solids (TSS) from wastewater facilities has an impact on sedimentation. TSS sampling in ambient streams typically measures suspended sediment from erosional processes. Since TSS sampling in Wastewater Treatment Plant (WWTP) effluent typically measures biosolids, which are less inclined to settle on the stream bottom, USEPA contends that TSS from WWTPs have no impact on sedimentation.

There are no Municipal Separate Storm Sewer System (MS4) storm water permits in these AUs. Sediment may be a component of some industrial and construction storm water discharges covered under General Permits, so these discharges 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 National Pollutant Discharge Elimination System (NPDES) construction general storm water permit (CGP) 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. In addition, the current CGP also includes state specific requirements to implement best management practices (BMPs) that are designed to prevent to the maximum extent practicable, an increase in sediment, or a parameter that addresses sediment (e.g., TSS, turbidity, siltation, SBDs, etc.) 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 Multi Sector General Storm Water Permit (MSGP). This permit also requires preparation of an 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.

Individual wasteload allocations for the General Permits were not possible to calculate at this time in this watershed using available tools. Loads that are in compliance with the General Permits from facilities covered are therefore currently calculated as part of the watershed load allocation.

4.4.2 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity TMDL following **Equation 1**:

$$WLA + LA + MOS = TMDL \qquad \text{(Eq. 1)}$$

The MOS is estimated to be 20 percent of the target load calculated in Table 4.2. Results are presented in Table 4.4. Additional details on the MOS chosen are presented in Section 4.7.

Table 4.4 TMDL for Sedimentation/Siltation

Location	WLA (% fines)	LA (% fines)	MOS (20%) (% fines)	TMDL (% fines)
San Juan River (Animas River to Cañon Largo)	0	23.6	5.9	29.5
La Plata River (San Juan River to McDermott Arroyo)	0	17.2	4.3	21.5

The extensive data collection and analyses necessary to determine background sedimentation loads for these AUs was beyond the resources available for this study. Therefore, it is assumed that a portion of the load allocation is made up of natural background loads. The load reduction necessary to meet the target load (Table 4.6) was estimated as the difference between the target allocation (Table 4.4) and the measured load (Table 4.3).

Table 4.6 Calculation of Load Reduction for Sedimentation/Siltation

Location	TMDL (% fines)	Measured Load (% fines)	Load Reduction (% fines)
San Juan River (Animas River to Cañon Largo)	29.5	52.0	22.5
La Plata River (San Juan River to McDermott Arroyo)	21.5	30.0	8.5

It is important to note that load allocations are estimates based on a specific flow condition (i.e., low flow in this case). Under differing hydrologic conditions, the loads will change. For this reason the load allocations given here are less meaningful than are the relative percent reductions. TMDLs are planning documents that provide a framework for working towards the goal of achieving water quality standards or appropriate numeric translators.

4.5 Identification and Description of Pollutant Source(s)

Probable NPSs that may be contributing to the observed load are displayed in Table 4.7:

Table 4.7 Pollutant source summary for Sedimentation/Siltation

Pollutant Sources	Magnitude[(a)]	Location	Potential Sources[(b)]
Point:			
None	0	--------	0%
Nonpoint:			
Sedimentation[(c)]	52.0	San Juan River (Animas River to Cañon Largo)	100% Crop Production (Crop Land or Dry Land) Drought-related Impacts Flow Alterations from Water Diversions Loss of Riparian Habitat Petroleum/natural Gas Activities (Legacy) Petroleum/natural Gas Production Activities (Permitted) Rangeland Grazing
	30.0	La Plata River (San Juan River to McDermott Arroyo)	100% Animal Feeding Operations (NPS) Drought-related Impacts Flow Alterations from Water Diversions Loss of Riparian Habitat Rangeland Grazing Streambank Modifications/Destabilization

Notes:
NA = Not applicable
[(a)] Measured % fines
[(b)] From the 2004-2006 Integrated 303(d)/305(b) list (NMED/SWQB 2004a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time.
[(c)] Expressed as % fines.

4.6 Linkage of Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the potential sources of impairment (NMED/SWQB 1999). The *Pollutant Source(s) Documentation Protocol* form and summary in Appendix B. provide documentation of a visual analysis of probable sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Staff completing these forms identify and quantify potential sources of NPS impairments along each reach as determined by field reconnaissance and assessment. It is important to consider not only the land directly adjacent to the stream, which is predominantly privately held, but also to consider upland and upstream areas in a more holistic watershed approach to implementing these TMDLs.

New Mexico's existing bottom deposits narrative WQS includes the phrase " …*from other than natural causes*…" Therefore, the degree to which sediment delivery and transport from Cañon Largo and other ephemeral tributary is a natural phenomenon, has been exacerbated by human activities, or is the result of a combination of both should be considered. The dominant source of fine sediment found on the bed of the San Juan in Reach 2 is Cañon Largo (see Figure 2.4 and Photo 4.1). Upstream of the confluence of Cañon Largo and the San Juan River, the % fines on the bed ranged from 6 to 15%. Downstream of the confluence, the % fines steadily increased to 100% within 5 km of the confluence. This pattern is a clear indication of sediment loads from Cañon Largo and the subsequent impact on bed-material conditions in Reach 2 (Heins *et al*. 2004).

Even though Cañon Largo is the primary source of excessive fine sediment loads and storm events during the summer and fall are the primary source of sediment transport from ephemeral tributaries, the anthropogenic influence of the dam and dam operations are contributing to impairment in Reach 2. Therefore, it cannot be stated that sediment impairment in the San Juan River is completely due to natural causes. There is evidence that the San Juan River above Cañon Largo before the installation of the dam in 1962 had a high suspended sediment load (Heins *et al*. 2004). This is not surprising given the geology of the San Juan Basin combined with the high occurrence of intense, convective summer storms. The geology in the watershed contributes to the amount of sediment available for transport. The San Juan River sediment load originates from the highly erodible sedimentary rock and eolian sand deposits (Holden 1999). The primary geologic layer in Cañon Largo in San Jose Formation (Figure 2.7). This sandstone/shall conglomerate erodes easily by wind and wind-driven rains (Chronic 1987). This large, active sediment load in the lower river plays an important role in the formation and maintenance of instream habitat. Intense summer and fall precipitation events contribute to the amount of sediment transported into the mainstem of the San Juan River. Prior to installation of the dam, the San Juan River was characteristic of other large southwest rivers, exhibiting large spring runoff and low base flows (Bliesner and Lamarra 2000). Large, temporary increases in flow and sediment were common during intense, convective summer and fall precipitation events. High sediment input during summer and fall storm events, combined with a loss of sediment transport due to the effects of Navajo Dam, filled low-velocity habitats with sediment. This situation has the potential to adversely impact aquatic species such as the endangered Colorado pikeminnow and razorback sucker by reducing the availability and quality of aquatic habitat during crucial growth periods (Holden 1999). Objective 4.2 of the San Juan River Basin Recovery Implementation Plan (SJRIP) is to identify, protect, and restore habitats for these two fish species (Bliesner and Lamarra 2000).

During the SJRIP study period in the 1990s, various dam release scenarios were tested to determine potential impacts on aquatic habitat and sediment dynamics in the San Juan River. The conclusions of the SJRIP study and other factors led to the development of proposed changes to dam operations (USBOR 2002). In the preferred alternative, the dam operations would be modified to mimic the natural hydrograph (5,000 cubic feet per second (cfs) spring release with 250 cfs baseflow) when anticipated inflow predictions and current reservoir storage allow as determined by the San Juan Model Operating Rule Decision Tree (decision matrix). Among other goals, the peak flow recommendations in the Navajo Reservoir Operations Final Environmental Impact Statement (NROFEIS) were designed to meet the flow recommendations for the endangered fish by providing temporary cleaning of cobbles. Past dam operations did not generate flows sufficient to transport sediment through the system as indicated by measured sediment accumulation between spring runoff events (Holden 1999).

Photo 4.1 Aerial view of confluence of Cañon Largo with the San Juan River, Oct 2003

It should be noted that NROFEIS with the preferred alternative is not yet in place. Also, under the preferred alternative spring releases are only required based on the decision matrix when adequate water is available based on anticipated inflow predictions and current reservoir storage. Spring releases did not occur in 2002, 2003, or 2004 based on the decision matrix.

There are also land use activities that may also be contributing additional amounts of sediment to the river. There is an abundance of unimproved roads in the San Juan River basin associated with oil and gas development. Sediment loads from this potential source may be reduced through improved enforcement of the terms of coal bed methane leases on BLM and Carson National Forest lands, revision of standard conditions of approval language to improve drainage (and reduce erosion) from well access roads, and development of more effective reclamation techniques for well sites, roads, and pipelines (SJWG 2005). The BLM and several oil and gas operators formed the San Juan Basin Public Roads Committee in 2001 to address these issues. The approach is to cost-share road maintenance on BLM lands by dividing the oil and gas field into 14 road maintenance units with each unit having a designated supervisory operator. BLM contributes 10 percent of the total annual costs. The goal is to bring the primary access roads that receive the highest volume of traffic up to proper road standards by 2011 and maintain them to standards for years to come (USBLM 2002 and 2004).

Two area ranchers have developed collaborative relationships with BLM staff and with Burlington Resources and are experimenting with alternative reclamation techniques at their ranch in the Cañon Largo watershed. The method they are testing utilizes confined livestock and straw to introduce organic matter and break up the surface of the ground prior to applying an appropriate seed mix (SJWG 2005).

The area between Blanco and Bloomfield is sparsely populated relative to other parts of the San Juan River valley, but livestock grazing of irrigated pasture and riparian areas does occur. This land use practice can destabilize erodible banks which could deliver additional amounts of fine sediment to the river. Livestock do have access to the river at specific locations, but this access is not common. More commonly, fences, thick woody vegetation, or vertical banks prevent livestock from reaching the river or trampling banks (SJWG 2005). Livestock grazing in upland areas may contribute sediment via tributaries to the San Juan. In both upland and riparian areas, specific improvements in grazing management might be warranted including complete exclusion of cattle from specific riparian areas, limiting grazing to the dormant season, providing sources of water away from the river, or more carefully tracking utilization of plants (and moving cattle when appropriate) to maintain their productivity. The BLM implements or encourages several of these practices, and so the initial focus of improved grazing management may best be directed to private or other lands (SJWG 2005).

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and NPS load estimates, and the modeling analysis. For this TMDL, there will be no MOS for point sources since none that were accounted for in the TMDL calculation. However, the MOS is estimated to be 20% for sedimentation. This MOS is based on the uncertainty in the relationship between embeddedness and percent fines. In this case, the percent fines numeric target was determined to interpret the narrative standard. There are also potential errors in measurement of NPS loads due to sampling technique, time of sampling, and other factors. Accordingly, a conservative MOS for sedimentation increases the TMDL by **20%**.

4.8 Consideration of Seasonal Variation

Data used in the calculation of this TMDL were collected during the fall, which is a biological index period; meaning fall is a critical time in the life cycle stages of aquatic biota. Fall is also generally the low-flow period of the mean annual hydrograph in New Mexico when bottom deposits are most likely to settle and cause impairment, after the summer monsoon season but before annual spring runoff. It is assumed that if critical conditions are met during this time, coverage of any potential seasonal variation will also be met.

4.9 Future Growth

Estimations of future growth are not anticipated to lead to a significant increase for sedimentation that cannot be controlled with BMP implementation in the watershed, continued improvement of road conditions and grazing allotments managed by the BLM, continued adherence to SWPPP requirements related to construction and industrial activities covered under the general permit, and the proposed changes to Navajo Dam operations that will result in an annual spring release (water supply permitting).

5.0 BACTERIA

During the 2002 SWQB sampling monitoring effort in the San Juan River watershed, fecal coliform data showed several exceedences of the New Mexico water quality secondary contact use standard for several assessment units. This data was combined with other sources of data to determine overall impairment for these assessment units. As a result, five assessment units are listed on the 2004-2006 CWA Integrated §303(d)/§305(b) list (NMED/SWQB 2004a) with fecal coliform as a pollutant of concern (see summary in Table 5.1 and data in Appendix C). Presence of fecal coliform bacteria is an indicator of the possible presence of other bacteria that may limit beneficial uses and present human health concerns. There are potential nonpoint and point sources of fecal coliform bacteria throughout the basin that could be contributing to the fecal coliform levels.

Per USEPA guidance, SWQB has proposed changing the contact use criterion from fecal coliform to *E. coli*. In anticipation of this change, *E. coli* concentrations were also measured during the 2002 SWQB and subsequent 2003 and 2004 San Juan Watershed Group (SJWG) surveys (NMED/SWQB 2004d, SJWG 2005). *E. coli* results are therefore also discussed in this TMDL document.

Table 5.1. Summary of Assessment Units Impaired for Bacteria in the San Juan River Basin

Assessment Unit	Fecal coliform: # Exceedences/ Total Samples	Fecal coliform[(a)]: %Exceedence	*E. coli*: # Exceedences/ Total Samples	*E. coli*[(a)]: %Exceedence
Animas River (San Juan River to Estes Arroyo)	2/13	15%	0/14	0%[(b)]
La Plata River (San Juan River to McDermott Arroyo)	2/6	33%	1/6	17%
La Plata River (McDermott Arroyo to CO border)	3/5	60%	3/5	60%
San Juan River (Navajo bnd at Hogback to Animas River)	9/26	35%	13/40	33%
San Juan River (Animas River to Cañon Largo)	11/41	27%	12/54	22%

Notes:
(a) Exceedence rates ≥ 15% result in a determination of Non Support based on the assessment protocol (NMED/SWQB 2004b)
(b) There are no TMDL calculations for *E. coli* in the Animas River in this document because the exceedence rate was < 15%. Thus, the determination would be Full Support.

5.1 Target Loading Capacity

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

The segment-specific criteria leading to an assessment of use impairment for these reaches is the numeric criteria stating that "The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL" for the designated contact use (NMAC 2002). The Navajo Nation Water Quality Standards for the San Juan River between the Hogback and the La Plata River are 100/100 mL geometric mean and 200/100mL single sample (NNEPA 1999). New Mexico has proposed *E. coli* criteria of 126/100 mL geometric mean and 410/100mL single sample for all assessment units discussed in this section. The Navajo Nation has adopted *E. coli* criteria of 126/100 mL geometric mean and 235/100mL the San Juan River between the Hogback and the La Plata River (NNEPA 2004).

5.2 Flow

Bacteria numbers can vary as a function of flow. Exceedences of the criterion occurred at both high and low flows in the impaired assessment units in the San Juan River basin. Therefore, the target flow was set at the critical low flow condition or 4Q3, defined as the minimum average four consecutive day flow which occurs with a frequency of once in three years (4Q3). 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 during both low and high flow conditions.

When available, USGS gage data were used to determine 4Q3s (Table 5.2 and Appendix D). These 4Q3s were estimated through application of USGS gage data to a log Pearson Type III distribution through "*Input and Output for Watershed Data Management*" (IOWDM) software, Version 4.1 (USGS 2002a) and "*Surface-Water Statistics*" (SWSTAT) software, Version 4.1 (USGS 2002b). When necessary, 4Q3s calculated at downstream USGS gaging stations are area weighted according to USGS (1993) to determine 4Q3 values for the upstream ungaged portion (Appendix D).

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

5.3 Calculations

Bacteria standards are expressed as colony forming units (cfu) per unit volume. The fecal coliform criteria and proposed *E. coli* criteria used to calculate the allowable stream flow for the impaired assessment units is listed in Table 5.2.

Table 5.2. Criteria concentrations and flow values for bacteria allowable load calculations

Assessment Unit	Fecal coliform criterion used in target calculation (cfu/100ml)	*E. coli* criterion used in target calculation (cfu/100ml)	Source of selected criterion	4Q3
Animas River (San Juan River to Estes Arroyo)	200	126	NMAC 20.6.4 geometric mean criterion	89 cfs [(a)] 58 mgd
La Plata River (San Juan River to McDermott Arroyo)	200	126	NMAC 20.6.4 geometric mean criterion	0.13 cfs 0.084 mgd
La Plata River (McDermott Arroyo to CO border)	200	126	NMAC 20.6.4 geometric mean criterion	0.11cfs [(b)] 0.068 mgd
San Juan River (Navajo bnd at Hogback to Animas River)	100	126	Navajo Nation Water Quality Standards geometric mean	463 cfs [(d)] 299 mgd
San Juan River (Animas River to Cañon Largo)	200	126	NMAC 20.6.4 geometric mean criterion	374 cfs [(c)] 242 mgd

Notes:
[(a)] Determined from USGS Gage Data from Animas at Farmington, NM. This gage was used because up to 105 cfs (design capacity) is diverted into Farmer's Mutual Ditch above the top of the impaired assessment unit (upstream of Estes Arroyo). The period of record 1967 to 2002 was utilized to take into account the impact of Lemon Dam in Colorado. [(b)] Determined by area-weighting the 4Q3 from USGS Gage La Plata River near Farmington (USGS 1993).
[(c)] Determined by subtracting the 4Q3 for USGS Gage Animas at Farmington, NM, from the 4Q3 for USGS Gage San Juan River at Farmington since this gage is just downstream of the confluence with the Animas River.
[(d)] Determined from USGS Gage Data from San Juan River at Farmington, NM. This gage was used instead of San Juan River at Shiprock due to the substantial withdrawal into the Hogback Canal at the bottom of the assessment unit.

Target loads for bacteria are calculated based on 4Q3 flow values, current and proposed WQS, and conversion factors (Equation 1). The geometric mean criteria are utilized in TMDL calculations to be conservative. In addition, if the single sample criteria were used as targets, the geometric mean criteria may not be reached.

Equation 1

C as cfu/100 mL * 1,000 mL/1 L * 1 L/ 0.264 gallons * Q in 1,000,000 gallons/day = cfu/day

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

The target loads (TMDLs) predicted to attain current and proposed standards were calculated using **Equation 1** and are shown in Tables 5.3 and 5.4.

Table 5.3 Calculation of Target Loads for Fecal Coliform

Assessment Unit	4Q3 Flow (mgd)	Fecal Coliform geometric mean criteria (cfu/100mL)	Conversion Factor[(a)]	Bacteria Target Load Capacity (cfu/day)
Animas River (San Juan River to Estes Arroyo)	58	200	3.79×10^{7}	4.40×10^{11}
La Plata River (San Juan River to McDermott Arroyo)	0.084	200	3.79×10^{7}	6.37×10^{8}
La Plata River (McDermott Arroyo to CO border)	0.068	200	3.79×10^{7}	5.15×10^{8}
San Juan River (Navajo bnd at Hogback to Animas River)	299	100	3.79×10^{7}	1.13×10^{12}
San Juan River (Animas River to Cañon Largo)	242	200	3.79×10^{7}	1.83×10^{12}

Notes:
[(a)] Based on equation 1.

Table 5.4 Calculation of Target Loads for Proposed *E. coli*

Assessment Unit	4Q3 Flow (mgd)	Proposed *E. coli* geometric mean criteria (cfu/100mL)	Conversion Factor[(a)]	Target Load Capacity (cfu/day)
La Plata River (San Juan River to McDermott Arroyo)	0.084	126	3.79×10^{7}	4.01×10^{8}
La Plata River (McDermott Arroyo to CO border)	0.068	126	3.79×10^{7}	3.25×10^{8}
San Juan River (Navajo bnd at Hogback to Animas River)	299	126	3.79×10^{7}	1.43×10^{12}
San Juan River (Animas River to Cañon Largo)	242	126	3.79×10^{7}	1.16×10^{12}

Notes:
[(a)] Based on equation 1.

5.4 Waste Load Allocations and Load Allocations

5.4.1 Waste Load Allocation

There are some potential sources of point source bacteria discharge into three impaired assessment units as shown in Tables 5.5 and 5.6.

Table 5.5 Waste Load Allocations for Fecal Coliform

Assessment Unit	Facility	Design Capacity Flow (mgd)	Proposed or Current Fecal Coliform Effluent limits[(c)] (cfu/100mL)	Conversion Factor[(a)]	Waste Load Allocations (cfu/day)
Animas River (San Juan River to Estes Arroyo)	**NM0020168** City of Aztec WWTP	1.0	200	3.79×10^7	7.58×10^9
San Juan River (Navajo bnd at Hogback to Animas River)	**NM0020583** City of Farmington WWTP	6.67	100	3.79×10^7	2.53×10^{10}
	NM0029319 Kirtland Sewer Treatment Facility	0.05	100	3.79×10^7	1.90×10^8
	NM0020800[(b)] BIA/Nenahnezad Boarding School	0.011	100	3.79×10^7	4.17×10^7
	NM0029025 Harper Valley	0.096	100	3.79×10^7	3.64×10^8
San Juan River (Animas River to Cañon Largo)	**NM0020700** City of Bloomfield WWTP	0.9	200	3.79×10^7	6.82×10^9
	NM0028142 Blanco School	0.0024	200	3.79×10^7	1.82×10^7
	NM0030473 McGee Park	0.05	200	3.79×10^7	3.79×10^8

Notes:
[(a)] Based on equation 1.
[(b)] Permit under USEPA Region 9/ Navajo Nation EPA jurisdiction. This permit is identified for information only as this discharge and its regulation are not under New Mexico's jurisdiction
[(c)] Based on applicable New Mexico and Navajo Nation WQS.

Table 5.6 Waste Load Allocations for *E. coli*

Assessment Unit	Facility	Design Capacity Flow (mgd)	Proposed *E. coli* Effluent limits[(c)] (cfu/100mL)	Conversion Factor[(a)]	Waste Load Allocations (cfu/day)
Animas River (San Juan River to Estes Arroyo)	**NM0020168** City of Aztec WWTP	1.0	126	3.79×10^7	4.78×10^9
San Juan River (Navajo bnd at Hogback to Animas River)	**NM0020583** City of Farmington WWTP	6.67	126	3.79×10^7	3.19×10^{10}
	NM0029319 Kirtland Sewer Treatment Facility	0.05	126	3.79×10^7	2.39×10^8
	NM0020800[(b)] BIA/Nenahnezad Boarding School	0.011	126	3.79×10^7	5.25×10^7
	NM0029025 Harper Valley	0.096	126	3.79×10^7	4.58×10^8
San Juan River (Animas River to Cañon Largo)	**NM0020700** City of Bloomfield WWTP	0.9	126	3.79×10^7	4.30×10^9
	NM0028142 Blanco School	0.0024	126	3.79×10^7	1.15×10^7
	NM0030473 McGee Park	0.05	126	3.79×10^7	2.39×10^8

Notes:
(a) Based on equation 1.
(b) Permit under USEPA Region 9/ Navajo Nation EPA jurisdiction. This permit is identified for information only as this discharge and its regulation are not under New Mexico's jurisdiction
(c) Based on proposed New Mexico and Navajo Nation WQS.

5.4.2 Load Allocation

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

$$WLA + LA + MOS = TMDL \qquad \textbf{Equation 2}$$

Results using a MOS of 5% (as explained in Section 5.7) are presented in Tables 5.7 and 5.8.

Table 5.7 Calculation of TMDLs for Fecal Coliform

Assessment Unit	WLA (cfu/day)	LA (cfu/day)	MOS (5%) (cfu/day)	TMDL (cfu/day)
Animas River (San Juan river to Estes Arroyo)	7.58×10^{9}	4.10×10^{11}	2.20×10^{10}	4.40×10^{11}
La Plata River (San Juan River to McDermott Arroyo)	0	6.05×10^{8}	3.19×10^{7}	6.37×10^{8}
La Plata River (McDermott Arroyo to CO border)	0	4.89×10^{8}	2.58×10^{7}	5.15×10^{8}
San Juan River (Navajo bnd at Hogback to Animas River)	2.59×10^{10}	1.05×10^{12}	5.65×10^{10}	1.13×10^{12}
San Juan River (Animas River to Cañon Largo)	7.22×10^{9}	1.73×10^{12}	9.15×10^{10}	1.83×10^{12}

.

Table 5.8 Calculation of TMDLs for Proposed *E. coli*

Assessment Unit	WLA (cfu/day)	LA (cfu/day)	MOS (5%) (cfu/day)	TMDL (cfu/day)
La Plata River (San Juan River to McDermott Arroyo)	0	3.81×10^{8}	2.00×10^{7}	4.01×10^{8}
La Plata River (McDermott Arroyo to CO border)	0	3.09×10^{8}	1.63×10^{7}	3.25×10^{8}
San Juan River (Navajo bnd at Hogback to Animas River)	3.26×10^{10}	1.33×10^{12}	7.15×10^{10}	1.43×10^{12}
San Juan River (Animas River to Cañon Largo)	4.55×10^{11}	6.47×10^{11}	5.80×10^{10}	1.16×10^{12}

The extensive data collection and analyses necessary to determine background fecal coliform loads for the San Juan River watershed were beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

Measured loads were also calculated using **Equation 1**. In order to achieve comparability between the target capacity (i.e., TMDL values) and measured loads, the same flow rates were used for both calculations. Results are presented in Tables 5.9 and 5.10.

Table 5.9 Calculation of Measured Loads for Fecal Coliform

Assessment Unit	4Q3 Flow (mgd)	Measured Fecal Coliform Concentrations[(b)] (cfu/100mL)	Conversion Factor[(a)]	Measured Load (cfu/day)
Animas River (San Juan River to Estes Arroyo)	58	204	3.79×10^7	4.48×10^{11}
La Plata River (San Juan River to McDermott Arroyo)	0.084	691	3.79×10^7	2.20×10^9
La Plata River (McDermott Arroyo to CO border)	0.068	907	3.79×10^7	2.34×10^9
San Juan River (Navajo bnd at Hogback to Animas River)	299	493	3.79×10^7	5.58×10^{12}
San Juan River (Animas River to Cañon Largo)	242	384	3.79×10^7	3.52×10^{12}

Notes:
[(a)] Based on equation 1.
[(b)] The measured concentration is the arithmetic mean of the measured values used to make the impairment determination (see Appendix C)

Table 5.10 Calculation of Measured Loads for *E. coli*

Assessment Unit	4Q3 Flow (mgd)	Measured *E. coli* Concentration[(b)] (cfu/100mL)	Conversion Factor[(a)]	Measured Load (cfu/day)
La Plata River (San Juan River to McDermott Arroyo)	0.084	216	3.79×10^7	6.88×10^8
La Plata River (McDermott Arroyo to CO border)	0.068	714	3.79×10^7	1.84×10^9
San Juan River (Navajo bnd at Hogback to Animas River)	299	464	3.79×10^7	5.25×10^{12}
San Juan River (Animas River to Cañon Largo)	242	350	3.79×10^7	3.21×10^{12}

Notes:
[(a)] Based on equation 1.
[(b)] The measured concentration is the arithmetic mean of the measured values used to make the impairment determination (see Appendix C).

The load reductions necessary to meet the target loads were calculated to be the difference between the calculated TMDL (Tables 5.7 and 5.8) and the measured loads (Tables 5.9 and 5.10), and are shown in Tables 5.11 and 5.12. These load reduction tables are presented for informational purposes only.

Table 5.11 Calculation of Load Reduction for Fecal Coliform

Assessment Unit	TMDL (cfu/day)	Measured Load (cfu/day)	Load Reduction (cfu/day)	Percent Reduction[(a)]
Animas River (San Juan River to Estes Arroyo)	4.40×10^{11}	4.48×10^{11}	8.00×10^{9}	1.8%
La Plata River (San Juan River to McDermott Arroyo)	6.37×10^{8}	2.20×10^{9}	1.56×10^{9}	71%
La Plata River (McDermott Arroyo to CO border)	5.15×10^{8}	2.34×10^{9}	1.83×10^{9}	78%
San Juan River (Navajo bnd at Hogback to Animas River)	1.13×10^{12}	5.58×10^{12}	4.45×10^{12}	78%
San Juan River (Animas River to Cañon Largo)	1.83×10^{12}	3.52×10^{12}	1.69×10^{12}	48%

Notes:

[(a)] Percent reduction is the percent the existing measured load must be reduced to achieve the TMDL, and is calculated as follows: (Measured Load – TMDL) / Measured Load x 100.

Table 5.12 Calculation of Load Reduction for *E. coli*

Assessment Unit	TMDL (cfu/day)	Measured Load (cfu/day)	Load Reduction (cfu/day)	Percent Reduction[(a)]
La Plata River (San Juan River to McDermott Arroyo)	4.01×10^{8}	6.88×10^{8}	2.87×10^{8}	42%
La Plata River (McDermott Arroyo to CO border)	3.25×10^{8}	1.84×10^{9}	1.52×10^{9}	82%
San Juan River (Navajo bnd at Hogback to Animas River)	1.43×10^{12}	5.25×10^{12}	3.82×10^{12}	73%
San Juan River (Animas River to Cañon Largo)	1.16×10^{12}	3.21×10^{12}	2.05×10^{12}	64%

Notes:
[(a)] Percent reduction is the percent the existing measured load must be reduced to achieve the TMDL, and is calculated as follows: (Measured Load – TMDL) / Measured Load x 100.

It is important to note that load allocations are estimates based on a specific flow condition (i.e., low flow in this case). Under differing hydrologic conditions, the loads will change. For this reason the load allocations given here are less meaningful than are the relative percent reductions.   Successful implementation of this TMDL will be determined based on achieving the current fecal coliform and proposed E. coli water quality standards.

5.5 Identification and Description of Pollutant Sources

Based on measured loads and potential contributions from existing point sources, probable point and nonpoint pollutant sources that may be contributing to observed fecal coliform loads are displayed in Table 5.13. Probable source lists for *E. coli* would be similar.

Table 5.13 Pollutant Source Summary for Fecal Coliform

Pollutant Sources	Magnitude (cfu/day)	Assessment Unit	Potential Sources[a]
Point: [b]			
Fecal coliform	7.58×10^{9}	Animas River (San Juan River to Estes Arroyo)	0.8% Municipal Point Source Discharges
	None	La Plata River (San Juan River to McDermott Arroyo)	0%
	None	La Plata River (McDermott Arroyo to CO border)	0%
	2.26×10^{10}	San Juan River (Navajo bnd at Hogback to Animas River)	0.7% Municipal Point Source Discharges
	7.22×10^{9}	San Juan River (Animas River to Cañon Largo)	0.2% Municipal Point Source Discharges
Nonpoint: [c]			
Fecal coliform	4.40×10^{11}	Animas River (San Juan River to Estes Arroyo)	99.2% Drought-related Impacts, Flow Alterations from Water Diversions, Municipal (Urbanized High Density Area), On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Source Unknown, Streambank Modifications/destabilization
	2.20×10^{9}	La Plata River (San Juan River to McDermott Arroyo)	100% Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/destabilization
	2.34×10^{9}	La Plata River (McDermott Arroyo to CO border)	100% Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/destabilization
	5.55×10^{12}	San Juan River (Navajo bnd at Hogback to Animas River)	99.3% Drought-related Impacts, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing
	3.07×10^{12}	San Juan River (Animas River to Cañon Largo)	99.8% Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing

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

5.6 Linkage Between Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the potential sources of impairment (SWQB/NMED 1999). The Pollutant Source(s) Documentation Protocol form and Potential Sources Summary Table in Appendix B provides 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 potential sources of impairment in this watershed. Table 5.13 (Pollutant Source Summary) identifies and quantifies potential sources of nonpoint source impairments along the reach as determined by field reconnaissance and assessment.

Additional bacteria sampling would need to be conducted to more fully characterize probable sources of bacteria in the San Juan River watershed. However, sufficient data exist to support development of a fecal coliform TMDL to address the stream standards violations.

Among the potential sources of bacteria are poorly maintained or improperly installed (or missing) septic tanks, livestock grazing of valley pastures and riparian areas, upland livestock grazing, and wildlife (such as geese, which are numerous in some areas). Very high fecal coliform concentrations have been measured in water sampled from ephemeral drainages flowing south to the San Juan River west of the La Plata River (such as Shumway Arroyo), which drain a sparsely vegetated area with little permanent settlement and some livestock grazing (SJWG 2005). The September 2004 SJWG sampling effort demonstrated that ephemeral flow from sparsely populated watersheds can increase bacteria levels in the San Juan River. The effect of Cañon Largo was very dramatic, and Kutz Canyon also seemed to increase *E. coli* levels in the San Juan as well. Other tributaries and inflows had relatively low levels of *E. coli* (NMED/SWQB 2004d). The area between Blanco and Bloomfield is sparsely populated relative to other parts of the San Juan River valley, but livestock grazing of irrigated pasture and riparian areas does occur. The bacteria loading from Cañon Largo and other ephemeral drainages probably originate almost entirely from a combination of livestock and wildlife transported downstream during runoff events. Directly on the La Plata River between La Plata and the state line, a livestock feeding and holding area exists which, though small enough to not be recognized as a concentrated animal feeding operation requiring a discharge permit, probably contributes significant bacteria loading to the La Plata River (SJWG 2005) (Photo 5.1).

Between the bridge on the Bollack Ranch and the Bisti Bridge, where relatively high loading also is evident, lie several potential sources of bacteria including portions of Farmington that are not connected to municipal sewer lines, urban runoff, irrigated pasture, and wildlife (especially geese). These potential sources are also found between the Bisti and Fruitland Bridges, which also bracket the communities of Kirtland and most of Fruitland, where the majority of households utilize septic tanks (SJWG 2005).

Photo 5.1 Livestock feeding/holding area on the La Plata River north of La Plata, NM

In order to determine exact sources and relative contributions, further study is needed. SWQB and the San Juan Watershed Group have been discussing the development of a Bacterial Source Tracking (BST) study to identify all sources of bacteria loading to help develop the most efficient implementation plan to address the impairment.

5.7 Margin of Safety (MOS)

TMDLs should reflect a margin of safety 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 margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors in flow calculations. Therefore, this margin of safety is the sum of the following two elements:

- *Conservative Assumptions*

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

  A more conservative limit of the geometric mean value, rather than the current and proposed standards which allow for higher concentrations in individual grab samples, was to calculate loading values.

- *Errors in calculating flow*

  4Q3s low flow values were determined based on USGS gaging data. There is inherent error in all flow measurements. A conservative MOS for this element is therefore 5 percent.

5.8 Consideration of Seasonal Variability

During the 2002 water quality survey, bacteria exceedences occurred during both high and low flow events. Based on this data, there is no single critical condition for bacteria. Higher flows may flush more nonpoint source runoff containing fecal coliform. It is possible the criterion may be exceeded under a low flow condition when there is insufficient dilution of the point source. Evaluation of seasonal variability for potential nonpoint sources is difficult due to limited available data. Because of the uncertainty involved, there will be no seasonal allocations for fecal coliform in these TMDLs.

5.9 Future Growth

According to the calculations, the overwhelming source of bacteria loading is from nonpoint sources. Estimates of future growth are not anticipated to lead to a significant increase in bacteria concentrations that cannot be controlled with BMP implementation in this watershed.

6.0 SELENIUM

During the 2002 SWQB intensive water quality survey in the San Juan River basin, there was one exceedence of the New Mexico water quality standard for total recoverable selenium documented at the sampling station on Gallegos Canyon near the confluence with the San Juan River. SJRIP also provided data from 1994-2003. In total, there were 23 of 30 exceedences of the total recoverable selenium wildlife habitat chronic screening criteria of 0.0075 mg/L (0.005 mg/L x 1.5). Consequently, Gallegos Canyon (San Juan River to Navajo boundary) was listed on the 2004-2006 Clean Water Act Integrated §303(d)/§305(b) list for selenium.

6.1 Target Loading Capacity

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

According to the New Mexico water quality standards (20.6.4.900.M NMAC), the total recoverable selenium criterion is 0.005 mg/L for wildlife habitat uses. According to the SWQB assessment protocol, impairment is determined by comparing measured concentrations to the chronic screening criteria of 0.0075 mg/L (0.005 mg/L x 1.5) (NMED/SWQB 2004b). This screening criteria was exceeded 23 of 30 times during the 2002 survey and in the 1994-2003 data set from SJRIP (Table 6.1). Concurrently collected TSS and turbidity data reported in Table 6.1 will be discussed in the Linkage(s) section below.

The large majority of the Gallegos watershed (99%) is under the jurisdiction of the Navajo Nation. The Navajo Nation water quality criteria for dissolved and total selenium are 0.05 mg/L and 0.002 mg/L, respectively, for Livestock and Wildlife Watering uses (NNEPA 2004).

Selenium is both an essential and detrimental naturally occurring trace element, predominantly found in black shale derived soils and landscapes. Selenium becomes bioavailable to aquatic biota through surface and groundwater interactions with surrounding geology. Selenium is also hypothesized as contributing to the decline of endangered fishes of the Colorado River Basin because it may inhibit recovery by adversely affecting reproduction and recruitment (see USGS 2004 for full references). Due to the bioaccumulative properties of selenium, USEPA is currently proposing that one component of selenium criteria be expressed as a concentration of the pollutant in fish tissue rather than a concentration in the water (USEPA 2004).

Table 6.1 Total recoverable selenium, TSS, and turbidity concentrations in Gallegos Canyon

Sample Date	Total Recoverable Selenium (mg/L)	TSS (mg/L)	Turbidity (NTU)	Source
2/17/1998	0.015*	3160	2660	SJRIP
3/16/1998	0.017*	340	31	SJRIP
4/20/1998	0.007	756	510	SJRIP
5/12/1998	0.013*	168	93	SJRIP
6/22/1998	0.025*	168	81	SJRIP
8/19/1998	0.010*	2150	1170	SJRIP
9/21/1998	0.013*	1210	585	SJRIP
11/18/1998	0.018*	2220	950	SJRIP
3/7/1999	0.016*	372	240	SJRIP
5/13/1999	0.018*	780	480	SJRIP
8/26/1999	0.010*	3380	1650	SJRIP
11/30/1999	0.017*	362	NA	SJRIP
2/7/2000	0.014*	196	38	SJRIP
5/25/2000	0.007	714	140	SJRIP
8/22/2000	0.007	6260	314000	SJRIP
11/18/2000	0.015*	114	45.4	SJRIP
2/27/2001	0.008*	5810	5920	SJRIP
5/21/2001	0.013*	250	167	SJRIP
8/21/2001	0.013*	1870	1030	SJRIP
2/13/2002	0.016*	56	43.4	SJRIP
3/27/2002	0.014*	560	338	SJRIP
5/7/2002	0.012*	142	25.7	SJRIP
8/21/2002	0.007	4670	3970	SJRIP
10/24/2002	0.008*	1340	1100	SWQB
11/19/2002	0.009*	1210	770	SJRIP
2/19/2003	0.012*	38	47.2	SJRIP
5/27/2003	0.005	118	71	SJRIP
8/28/2003	0.007	4390	4300	SJRIP
11/18/2003	0.008*	1690	1420	SJRIP

NOTES: * Exceedence of chronic screening criterion of 0.0075 mg/L total recoverable selenium.
NTU = Nephelometric turbidity units

6.2 Flow

TMDLs are calculated for the Gallegos Canyon at a specific flow. When available, USGS gages are used to estimate flow. Where gages are absent, geomorphologic cross section field data are collected at each site and flows are modeled or actual flow measurements are taken.

Gallegos Canyon is an ephemeral system. However, there appears to be perennial flow in the lower portion of Gallegos Canyon due to seepage from return flow from irrigated Navajo Agricultural Products Industry (NAPI) fields in the watershed (Photo 6.0). The flow in this portion is braided and shallow with sandy substrate. It is therefore often not possible to take an accurate flow measurement using standard USGS protocol. Flow at the Gallegos Canyon station during the October 2002 SWQB sampling event was estimated to be 2 cfs at this sampling event based on SWQB staff field notes. In the absence of any other flow information, this value is used in the TMDL calculation.

This flow value for Gallegos Canyon was converted from cfs to units of million gallons per day (mgd) as follows:

$$2\,\frac{ft^3}{\sec}\times 1{,}728\,\frac{in^3}{ft^3}\times 0.004329\,\frac{gal}{in^3}\times 86{,}400\,\frac{\sec}{day}\times 10^{-6} = 1.29\,mgd$$

It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in all natural surface water systems, the target load 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 target load may be a difficult objective.

Photo 6.0 Gallegos Canyon at confluence with the San Juan River, Oct 2003

6.3 Calculations

A target load for total recoverable selenium is calculated based on a flow, the current water quality criterion, and a conversion factor (8.34) that is a used to convert milligrams per liter (mg/L) units to pounds per day (lbs/day) (see Appendix A for Conversion Factor Derivation). The target loading capacity is calculated using **Equation 1**. The results are shown in Table 6.2.

Critical Flow (mgd) x Standard (mg/L) x 8.34 = Target Loading Capacity (Eq. 1)

Table 6.2 Calculation of target loads for total recoverable selenium

Location	**Flow+ (mgd)**	**Total recoverable selenium (mg/L)**	**Conversion Factor**	**Target Load Capacity (lbs/day)**
Gallegos Canyon	1.29	0.005	8.34	0.054

NOTES: + Since USGS gages were unavailable and direct measurement was not possible, flow was estimated during the 2002 October sampling event.

The measured loads for total recoverable selenium were similarly calculated. The arithmetic mean of the data used to determine the impairment was substituted for the standard in **Equation 1**. The same conversion factor of 8.34 was used. Results are presented in Table 6.3.

Table 6.3 Calculation of measured loads for total recoverable selenium

Pollutant sources	**Flow (mgd)**	**Dissolved Selenium Arithmetic Mean* (mg/L)**	**Conversion Factor**	**Measured Load Capacity (lbs/day)**
Gallegos Canyon	1.29	0.012	8.34	0.129

Notes: * Arithmetic mean of total recoverable selenium concentrations (see Table 6.1).

6.4 Waste Load Allocations and Load Allocations

6.4.1 Waste Load Allocation

There are no point source contributions associated with this TMDL. The WLA is zero.

6.4.2 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity (TMDL) following **Equation 2**.

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

The MOS is estimated to be 25% of the target load calculated in Table 6.2. Results are presented in Table 6.4. Additional details on the MOS chosen are presented in Section 6.7 below.

Table 6.4 Calculation of TMDL for total recoverable selenium

Location	**WLA (lbs/day)**	**LA (lbs/day)**	**MOS (25%) (lbs/day)**	**TMDL (lbs/day)**
Gallegos Canyon	0	0.040	0.014	0.054

The extensive data collection and analyses necessary to determine background total recoverable selenium for the Gallegos Canyon watershed was beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

The NPS and background load reductions that would be necessary to meet the target loads were calculated to be the difference between the calculated TMDL (Tables 6.4) and the measured load (Table 6.3), and are shown in Table 6.5. These load reduction tables are presented for informational purposes only.

Table 6.5 Calculation of load reduction for total recoverable selenium

Location	**TMDL (lbs/day)**	**Measured Load (lbs/day)**	**Load Reduction (lbs/day)**	**Percent Reduction**[(a)]
Gallegos Canyon	0.054	0.129	0.075	58%

Notes:
[(a)] Percent reduction is the percent the existing measured load must be reduced to achieve the TMDL, and is calculated as follows: (Measured Load – TMDL) / Measured Load x 100.

6.5 Identification and Description of Pollutant Source(s)

Probable nonpoint pollutant sources that may be contributing to observed total recoverable selenium loads are displayed in Table 6.6.

Table 6.6 Pollutant Source Summary for Total Recoverable Selenium

Pollutant Sources	Magnitude (lbs/day)	Assessment Unit	Potential Sources[(a)]
Point: [(b)]			
Selenium	NA	Gallegos Canyon (San Juan River to Navajo Nation bnd)	0%
Nonpoint: [(c)]			
Selenium	0.129	Gallegos Canyon (San Juan River to Navajo Nation bnd)	100% Irrigated crop production, natural sources

Notes: NA – not applicable
[(a)] From the 2004-2006 Integrated 303(d)/305(b) list. This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time.
[(b)] There are no point sources of selenium in the watershed.
[(c)] Measured load.

6.6 Link Between Water Quality and Pollutant Sources

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.

SWQB fieldwork includes an assessment of the potential sources of impairment (SWQB/NMED 1999). The Pollutant Source(s) Documentation Protocol form and Potential Sources Summary Table in Appendix B provide documentation of a visual analysis of probable sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Table 6.6 (Pollutant Source Summary) identifies and quantifies potential sources of nonpoint source impairments along each reach as determined by field reconnaissance and assessment. It is important to consider not only the land directly adjacent to the impaired assessment unit, but also on the upland and upstream areas in a more holistic watershed approach to implementing this TMDL.

In general, increased metals in the water column can commonly be linked to sediment transport and accumulation, where the metals are a constituent part of the sediment. This does not appear to be the case in the Gallegos Canyon as evidenced by the fact that there is not a relationship between total recoverable selenium and TSS concentrations according to the data used to determine the impairment (Table 6.1, Figure 6.1).

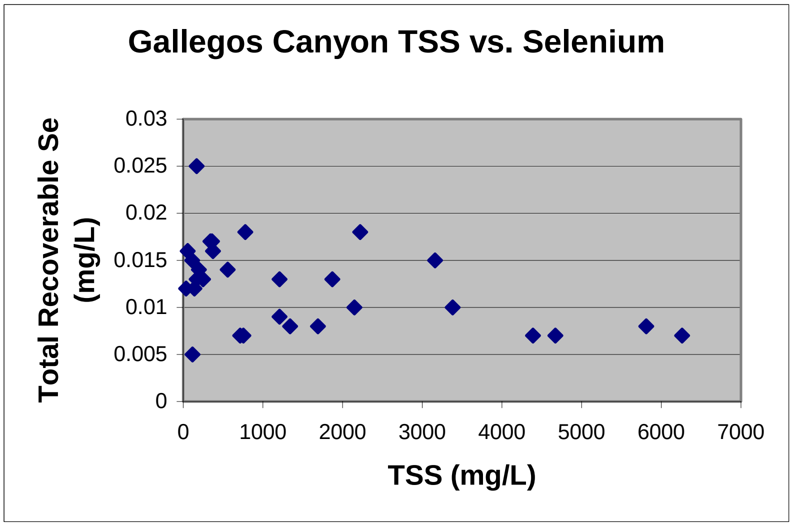


Figure 6.1 Relationship between Total Recoverable Selenium and TSS in Gallegos Canyon

The high sandstone bluffs that parallel the flood plain on the south side of the San Juan River east of Gallegos canyon are often referred to as the Bluffs. The Bluffs are characterized geologically as sedimentary sandstone of the Ojo Alamo Formation, and clays and shales of the Kirtland and Fruitland Formations (Dane and Bachman 1965). The Nacimiento Formation and the Kirtland Shale/Fruitland Formation underlie tile soils and compose the outcrop in most of the upland area south of the San Juan River (Blanchard *et al*. 1993). These deep layers are cut by drainages creating dissected colluvial mesa tops that drop off into narrow steep-walled canyons (Wheelbarger 2000).

All of the shales of Cretaceous age consist at least in part of gray arid black shale and are potential sources of selenium (Blanchard *et al.* 1993). Black shale is comprised of organic-rich, generally dark-colored, fine-grained, sedimentary rock deposited in very low oxygen conditions. Oil and gas are valued resources that originate in black shale, thus explaining the large amount of oil and gas exploration in the San Juan River basin. This type of shale is also the probable source of metals found in some mineral deposits. As such, many black shale sequences are non-point sources for potentially toxic elements such as arsenic, selenium, chromium, and mercury (USGS 2004). Normal aqueous chemical processes, enhanced by seepage from irrigated agriculture in the watershed, are capable of rendering some of the naturally-occurring selenium in the Cretaceous age layers in the watershed available to the stream system.

These landscapes, which occur in the San Juan River basin, are recognized by several federal, tribal, and state land management agencies as a focal point for the need for science information supporting sound land-use policies. This need has risen in prominence due to increased and changing land use demands, and bioavailability issues involving both selenium concentrations and salinity levels in surface and ground water (USGS 2004). Specifically, ground-water return flow from irrigated areas contributes substantially to surface water flow in Gallegos Canyon (Blanchard *et al*. 1993). Seepage of irrigation water from fields in the upland areas east of Gallegos Canyon appears to be the cause of the perennial flow in lower Gallegos Canyon. This seepage is also likely leaching out and mobilizing the selenium, thus leading to elevated concentrations. Concern for selenium concentrations in water and sediment prompted a USGS 1990-1991 study of Gallegos Canyon, Ojo Amarillo Canyon, and the Hogback Project (Blanchard *et al.* 1993) and a 1993-1995 follow up study (Thomas *et al.*, 1998). Concentrations of selenium larger than established standards and criteria were present in water, bottom sediment, and biota in four areas on these three irrigation projects, including the middle and north ponds in Gallegos Canyon on the Navajo Indian Irrigation Project (NIIP) (Blanchard *et al.* 1993). Soils in the upland area where the NIIP is located typically are derived from eolian and alluvial material, are deep and are well- to excessively- drained. Permeability ranges from moderately rapid to rapid (Blanchard *et al.* 1993). Thomas *et al*. (1998) found that water samples from seeps and tributaries to the San Juan River draining irrigated land developed on Cretaceous soils contained about 10 times more selenium than samples from sites draining irrigated land developed on non-Cretaceous soils.

These finding have helped prioritize locations for proposing and implementing BMPs to address excessive selenium in the San Juan River basin. NIIP as well as the Hogback Irrigation Project have been identified as irrigation sources of salt in the San Juan River Basin, which may in turn contribute to excessive salinity in the Colorado River basin. This concern, and potential solutions that are already being implemented, are being addressed through the Colorado River Basin Salinity Control Program for the San Juan Unit. Additional information can be found at web site http://www.usbr.gov/dataweb/html/san_juan.html.

6.7 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and NPS load estimates, and the modeling analysis. For this TMDL, there will be no MOS for point sources, since there are none. However, for NPSs the MOS is estimated to be an addition of **25%** for total recoverable selenium in this case. This MOS incorporates several factors:

- Errors in calculating NPS loads

  A level of uncertainty exists in sampling NPSs of pollution. Techniques used for measuring metals concentrations in stream water can lead to inaccuracies in the data. Therefore, a conservative MOS for metals increases the TMDL by **15%.**

- Errors in calculating flow

  Flow estimate was based on one visual estimation October 2002. Accordingly, a conservative MOS increases the TMDL by an additional **10%.**

6.8 Consideration of Seasonal Variation

Data used in the calculation of this TMDL were collected during the spring, summer, fall, and winter between 1998 and 2003 in order to ensure coverage of any potential seasonal variation in the system. Critical condition was set to the flow estimate determined during the October 2002 SWQB sampling visit.

6.9 Future Growth

Estimations of future growth are not anticipated to lead to a significant increase for total recoverable selenium that cannot be controlled with BMP implementation in this watershed.

7.0 MONITORING PLAN

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

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

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every eight years. The next scheduled monitoring date for the San Juan River watershed is 2010. The SWQB maintains current quality assurance and quality control plans for the respective sample year to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6 (NMED/SWQB 2001). In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program. Current priorities for monitoring in the SWQB are driven by the CWA Section 303(d) list of streams requiring TMDLs. Short-term efforts will be directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997).

Once assessment monitoring is completed, those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority assessment units (including biological assessments), and compliance monitoring of industrial, federal, and municipal dischargers, as specified in the SWQB assessment protocols (NMED/SWQB 2004b).

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

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

SWQB recently developed a 10-year monitoring strategy submitted to USEPA on September 30, 2004. Once the 10-year monitoring plan is reviewed and approved by the USEPA, it will be available at the SWQB website: http://www.nmenv.state.nm.us/swqb/swqb.html. The strategy will detail both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. According to the draft proposed 8-year rotational cycle, which assumes the existing level of resources, the next time SWQB will intensively sample the San Juan River watershed is during 2010.

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

8.0 IMPLEMENTATION OF TMDLS

8.1 Coordination

In this watershed public awareness and involvement will be crucial to the successful implementation of these plans and improved water quality. Staff from SWQB and the Meridian Institute have worked with stakeholders to develop a draft Watershed Restoration Action Strategy (WRAS) for the San Juan River Basin (SJWG 2005). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It details opportunities for private landowners and public agencies to reduce and prevent impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving constituent levels consistent with New Mexico's WQS, and will be used to prevent water quality impacts in the watershed. The WRAS is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WRAS leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

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

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

8.2 Time Line

The San Juan Basin is atypical in that a watershed group was formed in 2002 during the planning stage for the 2002 intensive survey, and thus prior to any impairment determinations/verifications or TMDL development. As a result, the WRAS and TMDLs will be final at essentially the same time. The modified general implementation timeline is detailed below (Table 8.1).

8.3 Clean Water Act §319(h) Funding Opportunities

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

Table 8.1 Proposed Implementation Timeline

Implementation Actions	Year 1 (2002)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Public Outreach and Involvement	X	X	X	X	X	X	X
Form watershed groups	X	X					
TMDL Development			X				
WRAS Development		X	X	X			
Revise any NPDES permits as necessary (currently EPA Region 6)			X				
Establish Performance Targets				X			
Secure Funding			X	X			
Implement Management Measures (BMPs)			X	X	X		
Monitor BMPs			X	X	X		
Determine BMP Effectiveness					X	X	
Re-evaluate Performance Targets						X	X

8.4 Other Funding Opportunities and Restoration Efforts in the San Juan River Basin

Several other sources of funding existing to address impairments discussed in this TMDL document. NMED's Construction Programs Bureau assists communities in need of funding for WWTP upgrades and improvements to septic tank configurations (such as the design of cluster systems). They can also provide matching funds for appropriate CWA §319(h) projects using state revolving fund monies. The USDA Environmental Quality Incentive Program (EQIP) program can provide assistance to private land owners in the basin. The USDA Forest Service aligns their mission to protect lands they manage with the TMDL process, and are another source of assistance. The Colorado River Basin Salinity Control Program may provide matching funds to address selenium issues in Gallegos Canyon (contact NM Interstate Stream Commission 827-6165). The BLM has several programs in place to provide assistance to improve unpaved roads and grazing allotments (see section 4.6).

9.0 ASSURANCES

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

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

In addition, the State of New Mexico Surface Water Quality Standards (see NMAC 20.6.4.10.C) (NMAC 2002) states:

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

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

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

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

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

Group applied for and was awarded a §319 grant in 2005 to begin development of projects to addressing bacteria impairments noted in this TMDL document.

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

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

10.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL (see Appendix E). The draft TMDL was made available for a 30-day comment period on March 15, 2005. Response to comments is attached as Appendix F of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers.

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APPENDIX A
CONVERSION FACTOR DERIVATION

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:

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

APPENDIX B
SOURCE DOCUMENTATION SHEET AND SOURCES SUMMARY TABLE

Source Documentation Sheet

CODES FOR USES NOT FULLY SUPPORTED

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

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

REACH NAME:

SEGMENT NUMBER:
BASIN:
PARAMETER:

STAFF MAKING ASSESSMENT:
DATE:

CODES FOR SOURCES OF NONSUPPORT (CHECK ALL THAT APPLY)

☐ 0100 INDUSTRIAL POINT SOURCES

☐ 0200 MUNICIPAL POINT SOURCES
☐ 0201 DOMESTIC POINT SOURCES

☐ 0400 COMBINED SEWER OVERFLOWS

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

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

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

☐ 4000 URBAN RUNOFF/STORM SEWERS

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

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

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

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

☐ 9000 SOURCE UNKNOWN

San Juan River (Part One) TMDL Probable Sources Summary

Reach	Parameter	Probable Sources (ADB v.2 terminology)
ANIMAS RIVER (SAN JUAN RIVER TO ESTES ARROYO)	Fecal coliform (bacteria)	Drought-related Impacts, Flow Alterations from Water Diversions, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Source Unknown, Streambank Modifications/destabilization
GALLEGOS CANYON (SAN JUAN RIVER TO NAVAJO BOUNDARY)	Selenium	Irrigated crop production, Natural sources
LA PLATA RIVER (SAN JUAN RIVER TO MCDERMOTT ARROYO)	Fecal Coliform	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing
	Sedimentation/ Siltation	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, Rangeland Grazing, Streambank Modifications/Destabilization
LA PLATA RIVER (MCDERMOTT ARROYO TO COLORADO BORDER)	Fecal Coliform	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/Destabilization
SAN JUAN RIVER (NAVAJO BOUNDARY AT HOGBACK TO ANIMAS RIVER)	Fecal Coliform	Drought-related Impacts, Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing

Reach	Parameter	Probable Sources (ADB v.2 terminology)
SAN JUAN RIVER (ANIMAS RIVER TO CAÑON LARGO)	Fecal Coliform	Drought-related Impacts, Flow Alterations from Water Diversions, Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing
	Sedimentation/ Siltation	Crop Production (Crop Land or Dry Land), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, Petroleum/natural Gas Activities (Legacy), Petroleum/natural Gas Production Activities (Permitted), Rangeland Grazing

APPENDIX C
SAN JUAN RIVER BACTERIA DATA

Data source	Station	DateTime	Fecals (cfu/100ml)	E. Coli (cfu/100ml)
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	4/17/02 13:30	43	33
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	5/22/02 12:40	75	111
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	5/28/02 14:40	23	38
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	6/17/02 12:00	23	13
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	7/16/02 9:40	150	110
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	8/12/02 14:25	240	31
SWQB	ANIMAS R @ AZTEC @ HWY 550 BRIDGE	10/22/02 10:30	200	57
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	4/17/02 10:45	93	30
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	5/22/02 14:00	75	51
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	5/28/02 12:30	23	23
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	6/17/02 15:15	23	10
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	7/16/02 12:40	23	11
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	8/12/02 14:50	75	13
SWQB	ANIMAS RIVER @ COLORADO STATE LINE	10/21/02 15:00	9	5
		Total count	14	14
		# exceed	0	0
		% exceed	0	0
		Average conc	77	38
SWQB	Animas River near Flora Vista	4/17/02 13:45	23	37
SWQB	Animas River near Flora Vista	5/20/02 14:40	460	261
SWQB	Animas River near Flora Vista	5/29/02 13:30	210	86
SWQB	Animas River near Flora Vista	6/17/02 12:20	93	13
SWQB	Animas River near Flora Vista	7/16/02 9:55	240	173
SWQB	Animas River near Flora Vista	8/21/02 7:40	460	172
SWQB	Animas River near Flora Vista	10/22/02 12:00	150	96
USGS	Animas River at Farmington	11/15/2001		110
USGS	Animas River at Farmington	3/19/2002	210	240
USGS	Animas River at Farmington	5/14/2002	190	280
USGS	Animas River at Farmington	1/29/2003	100	260
USGS	Animas River at Farmington	5/21/2003	10	17
USGS	Animas River at Farmington	7/9/2003	260	80
SWQB	ANIMAS R AT FARMINGTON	6/17/02 12:55	240	4
		Total count	13	14
		# exceed	2	0
		% exceed	15	0
		Average conc	204	131
SWQB	LA PLATA R NR FARMINGTON	4/17/02 14:30	240	397
SWQB	LA PLATA R NR FARMINGTON	5/22/02 11:55	1100	192
SWQB	LA PLATA R NR FARMINGTON	5/29/02 8:20	93	117
SWQB	LA PLATA R NR FARMINGTON	6/17/02 13:15	75	55
SWQB	LA PLATA R NR FARMINGTON	7/16/02 7:10	2400	488
SWQB	LA PLATA R NR FARMINGTON	10/22/02 14:00	240	47
		Total count	6	6
		# exceed	2	1
		% exceed	33	17
		Average conc	691	216
SWQB	LA PLATA RIVER @ NM-COLORDO STATE LINE	8/20/02 12:25	93	19
SWQB	LA PLATA RIVER AT LA PLATA, NM	4/17/02 14:55	240	770
SWQB	LA PLATA RIVER AT LA PLATA, NM	5/22/02 12:15	1100	980
SWQB	LA PLATA RIVER AT LA PLATA, NM	5/29/02 10:15	1500	387
SWQB	LA PLATA RIVER AT LA PLATA, NM	7/16/02 9:20	1600	1414
		Total count	5	5
		# exceed	3	3
		% exceed	60	60
		Average conc	907	714

Data source	Station	DateTime	Fecals (cfu/100ml)	E. Coli (cfu/100ml)
SWQB	SAN JUAN R AT HOGBACK	5/20/02 13:30	240	126
SWQB	SAN JUAN R AT HOGBACK	5/29/02 9:10	240	166
SWQB	SAN JUAN R AT HOGBACK	6/17/02 13:45	93	10
SWQB	SAN JUAN R AT HOGBACK	6/17/02 14:45	1100	461
SWQB	SAN JUAN R AT HOGBACK	7/16/02 7:35	2400	198
SWQB	SAN JUAN R AT HOGBACK	8/13/02 8:50	460	184
SWQB	SAN JUAN R AT HOGBACK	9/16/02 13:10	1100	579
SWQB	SAN JUAN R AT HOGBACK	10/23/02 11:45	240	28
SJWG	SAN JUAN R AT HOGBACK	9/29/03; 13:15		548
SJWG	SAN JUAN R AT HOGBACK	9/30/03; 13:00		218
SJWG	SAN JUAN R AT HOGBACK	10/1/03; 13:30		343
SJWG	SAN JUAN R AT HOGBACK	10/3/03; 13:30		1860
SWQB	SAN JUAN RIVER NEAR KIRTLAND	5/20/02 14:00	150	240
SWQB	SAN JUAN RIVER NEAR KIRTLAND	5/29/02 9:30	240	157
SWQB	SAN JUAN RIVER NEAR KIRTLAND	6/17/02 13:30	93	57
SWQB	SAN JUAN RIVER NEAR KIRTLAND	7/16/02 8:15	1500	214
SWQB	SAN JUAN RIVER NEAR KIRTLAND	8/13/02 9:10	240	167
SWQB	SAN JUAN RIVER NEAR KIRTLAND	9/16/02 13:30	1100	461
SWQB	SAN JUAN RIVER NEAR KIRTLAND	10/23/02 12:15	43	27
SJWQ	SJR at Fruitland Bridge	9/29/03; 12:30		1308
SJWQ	SJR at Fruitland Bridge	9/30/03; 12:30		650
SJWQ	SJR at Fruitland Bridge	10/1/03; 13:00		417
SJWQ	SJR at Fruitland Bridge	10/2/03; 12:00		1553
SJWQ	SJR at Fruitland Bridge	10/3/03; 12:30		1986
SWQB	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	5/29/02 9:50	43	91
SWQB	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	8/20/02 11:10	93	308
SWQB	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	9/16/02 12:40	1100	204
SWQB	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	10/22/02 13:30	93	51
SJWG	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	9/29/03; 12:00		310
SJWG	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	9/30/03; 11:00		153
SJWG	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	10/1/03; 12:30		524
SJWG	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	10/2/03; 11:30		1129
SJWG	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	10/3/03; 12:00		2031
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	11/15/01 0:00		320
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	3/19/02 0:00	170	310
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	5/14/02 0:00	62	120
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	1/29/03 0:00	150	290
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	5/21/03 0:00	71	400
USGS	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	7/9/03 0:00	230	130
USBOR	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	7/6/00 13:00	1100	
USBOR	SAN JUAN RIVER AT BISTI BRIDGE - USGS gage	8/13/01 8:35	460	214
		Total count	26	40
		# exceed	9	13
		% exceed	35	33
		Average conc	493	464

Data source	Station	DateTime	Fecals (cfu/100ml)	E. Coli (cfu/100ml)
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	5/20/02 14:20	240	248
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	5/21/02 15:25	43	27
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	5/22/02 13:00	93	18
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	5/28/02 13:30	93	10
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	5/29/02 14:10	93	25
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	8/12/02 14:05	150	86
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	8/13/02 12:30	150	122
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	8/14/02 8:30	240	137
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	8/19/02 11:20	93	146
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	8/21/02 8:45	460	128
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/21/02 12:15	43	27
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/22/02 12:30	43	41
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/23/02 13:30	75	48
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/28/02 14:55	150	78
SWQB	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/29/02 10:10	4600	2419
SJWG	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	9/29/03; 10:00		191
SJWG	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	9/30/03; 9:30		204
SJWG	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/1/03; 10:30		378
SJWG	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/2/03; 10:00		433
SJWG	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	10/3/03; 9:30		2419
USBOR	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	7/6/00 11:30	240	
USBOR	SAN JUAN RIVER AT BLOOMFIELD BRIDGE	7/13/01 10:20	1100	291
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	5/21/02 14:30	43	70
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	5/29/02 7:40	93	157
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	6/17/02 12:40	93	46
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	7/16/02 10:40	1100	201
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	8/13/02 10:00	150	124
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	9/16/02 12:20	460	276
SWQB	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	10/29/02 9:25	1100	488
SJWG	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	9/29/03; 11:30		561
SJWG	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	9/30/03; 10:30		209
SJWG	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	10/1/03; 11:30		429
SJWG	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	10/2/03; 11:00		719
SJWG	SAN JUAN RIVER AT BOLACK BRIDGE NEAR FARMINGTON	10/3/03; 11:30		2419
SWQB	San Juan River at Jeff Blagg property	5/20/02 14:40	93	52
SWQB	San Juan River at Jeff Blagg property	5/21/02 15:15	93	34
SWQB	San Juan River at Jeff Blagg property	5/22/02 13:10	93	14
SWQB	San Juan River at Jeff Blagg property	5/28/02 13:50	23	18
SWQB	San Juan River at Jeff Blagg property	5/29/02 14:00	23	29
SWQB	San Juan River at Jeff Blagg property	8/12/02 13:45	460	74
SWQB	San Juan River at Jeff Blagg property	8/13/02 10:30	460	461
SWQB	San Juan River at Jeff Blagg property	8/14/02 8:00	93	145
SWQB	San Juan River at Jeff Blagg property	8/19/02 11:00	240	150
SWQB	San Juan River at Jeff Blagg property	8/21/02 8:15	460	173
SWQB	San Juan River at Jeff Blagg property	10/21/02 12:45	93	40
SWQB	San Juan River at Jeff Blagg property	10/22/02 12:50	75	52
SWQB	San Juan River at Jeff Blagg property	10/23/02 13:10	43	37
SWQB	San Juan River at Jeff Blagg property	10/28/02 14:45	1100	517
SWQB	San Juan River at Jeff Blagg property	10/29/02 9:15	1100	687
SJWQ	San Juan River at Jeff Blagg property	9/29/03; 11:00		345
SJWQ	San Juan River at Jeff Blagg property	9/30/03; 10:00		190
SJWQ	San Juan River at Jeff Blagg property	10/1/03; 11:00		300
SJWQ	San Juan River at Jeff Blagg property	10/2/03; 10:30		247
SJWQ	San Juan River at Jeff Blagg property	10/3/03; 10:30		1770
USBOR	SJR at Lee Acrres bridge CR 5500	7/6/00 12:00	240	
USBOR	SJR at Lee Acrres bridge CR 5500	7/13/01 9:20	93	365
		Total count	41	54
		# exceed	11	12
		% exceed	27	22
		Average conc	384	350

Data source	Station	DateTime	Fecals (cfu/100ml)	E. Coli (cfu/100ml)
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	5/20/02 14:00	23	18
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	5/28/02 14:20	43	10
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	6/17/02 11:45	43	26
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	7/16/02 11:20	93	70
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	8/13/02 12:55	240	115
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	8/21/02 9:10	15	50
SWQB	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	10/21/02 13:30	15	12
SJWG	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	9/29/03; 9:30		82
SJWG	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	9/30/03; 9:00		66
SJWG	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	10/1/03; 9:30		128
SJWG	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	10/2/03; 8:30		236
SJWG	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	10/3/03; 8:30		125
USBOR	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	7/13/01 9:20	240	38
USBOR	SAN JUAN RIVER AT BRIDGE NEAR BLANCO	7/6/00 10:30	43	
USBOR	SAN JUAN RIVER AT ARCHULETA	7/6/00 9:30	3	
USGS	SAN JUAN RIVER AT ARCHULETA	11/13/2001	1	1
USGS	SAN JUAN RIVER AT ARCHULETA	3/18/2002	12	3
USGS	SAN JUAN RIVER AT ARCHULETA	5/13/2002	3	3
USGS	SAN JUAN RIVER AT ARCHULETA	1/28/2003	1	11
USGS	SAN JUAN RIVER AT ARCHULETA	3/18/2003	1	1
USGS	SAN JUAN RIVER AT ARCHULETA	5/20/2003	2	20
USGS	SAN JUAN RIVER AT ARCHULETA	7/8/2003	19	5
USBOR	SAN JUAN RIVER AT ARCHULETA	7/13/01 9:20	4	1
		Total count	18	21
		# exceed	2	1
		% exceed	11	5
		Average conc	45	49
SWQB	LAKE FARMINGTON SHALLOW	7/16/02 10:15	3	1
SWQB	NAVAJO RESERVOIR AT PINE SITE MARINA	4/17/02 12:15	3	1
SWQB	NAVAJO RESERVOIR AT PINE SITE MARINA	7/16/02 11:50	93	29
SWQB	NAVAJO RESERVOIR AT PINE SITE MARINA	10/29/02 10:55	23	5
SWQB	JACKSON LAKE SHALLOW	7/16/02 9:00	23	11

APPENDIX D
4Q3 CALCULATIONS AND
LAPLATA RIVER AREA-WEIGHTING

Log-Pearson Type III Statistics
SWSTAT 4.1
(based on USGS Program A193)

Notice -- Use of Log-Pearson Type III or Pearson-Type III distributions are for preliminary computations. User is responsible for assessment and interpretation.

09365000 San Juan River at Farmington
April 1 - start of season
March 31 - end of season
1966 - 2002 - time period
4-day low - parameter
37 - non-zero values
0 - zero values
0 - negative values (ignored)

1132.500	390.750	289.750	452.500	914.750
458.000	422.500	349.500	1250.000	361.500
732.000	278.500	308.750	298.000	422.250
525.000	458.750	967.500	834.500	1165.000
826.750	1317.500	747.500	635.250	549.250
332.250	481.750	613.250	711.250	608.750
582.750	421.250	1030.750	433.750	735.750
515.250	551.500			

The following 7 statistics are based on non-zero values:

Mean (logs)	2.754
Variance (logs)	0.036
Standard Deviation (logs)	0.190
Skewness (logs)	0.255
Standard Error of Skewness (logs)	0.388
Serial Correlation Coefficient (logs)	0.161
Coefficient of Variation (logs)	0.069

Non-exceedance Probability	Recurrence Interval	Parameter Value
0.0100	100.00	222.761
0.0200	50.00	245.596
0.0500	20.00	285.684
0.1000	10.00	328.368
0.2000	5.00	391.133
0.3333	3.00	462.937
0.5000	2.00	557.387
0.8000	1.25	815.506
0.9000	1.11	1005.725
0.9600	1.04	1268.131
0.9800	1.02	1479.788
0.9900	1.01	1705.470

Calculated 4Q3

7 statistics were added as attributes to data set 101:

MEANND SDND SKWND NUMZRO NONZRO LDIST
L04003

```
                 Log-Pearson Type III Statistics
                            SWSTAT 4.1
                   (based on USGS Program A193)

Notice -- Use of Log-Pearson Type III or Pearson-Type III
          distributions are for preliminary computations.
          User is responsible for assessment and
          interpretation.


                09368000 San Juan River at Shiprock
                    April  1 - start of season
                    March 31 - end of season
                 1966 - 2002 - time period
                   4-day low - parameter
                          37 - non-zero values
                           0 - zero values
                           0 - negative values (ignored)

       1035.000     239.500     110.250     479.500     928.250
        298.000     313.500      78.500    1225.000     142.250
        645.250     254.500      79.000     118.250     279.500
        586.250     340.250    1010.000     739.500     909.250
        923.750    1452.500     761.250     573.750     257.750
        124.250     270.250     341.250     475.750     292.500
        515.000     146.250     716.750     376.250     739.750
        246.750     362.250

The following 7 statistics are based on non-zero values:

Mean (logs)                                      2.580
Variance (logs)                                  0.116
Standard Deviation (logs)                        0.341
Skewness (logs)                                 -0.328
Standard Error of Skewness (logs)                0.388
Serial Correlation Coefficient (logs)            0.126
Coefficient of Variation (logs)                  0.132


     Non-exceedance     Recurrence       Parameter
      Probability        Interval          Value
      -----------       ----------       ---------
           0.0100           100.00          50.838
           0.0200            50.00          66.345
           0.0500            20.00          97.642
           0.1000            10.00         135.891
           0.2000             5.00         199.575
           0.3333             3.00         280.382       Calculated
           0.5000             2.00         396.974       4Q3
           0.8000             1.25         743.066
           0.9000             1.11        1007.322
           0.9600             1.04        1369.594
           0.9800             1.02        1654.857
           0.9900             1.01        1949.938

  7 statistics were added as attributes to data set   101:

        MEANND SDND   SKWND  NUMZRO NONZRO LDIST
        L04003
```

Log-Pearson Type III Statistics
SWSTAT 4.1
(based on USGS Program A193)

Notice -- Use of Log-Pearson Type III or Pearson-Type III distributions are for preliminary computations. User is responsible for assessment and interpretation.

09367500 LaPlata near Farmington
April 1 - start of season
March 31 - end of season
1939 - 2002 - time period
4-day low - parameter
30 - non-zero values
34 - zero values
0 - negative values (ignored)

0.500	2.000	0.075	0.100	0.143
0.725	0.100	0.025	0.100	0.010
0.425	0.010	0.070	0.188	0.278
0.458	1.475	0.115	1.565	1.075
1.375	0.153	0.558	0.042	0.275
1.250	0.370	0.418	0.095	0.160

The following 7 statistics are based on non-zero values:

Mean (logs)	-0.660
Variance (logs)	0.380
Standard Deviation (logs)	0.616
Skewness (logs)	-0.430
Standard Error of Skewness (logs)	0.427
Serial Correlation Coefficient (logs)	0.141
Coefficient of Variation (logs)	-0.934

Non-Exceedance Probability	Recurrence Interval	Parameter Value	Adjusted Non-Exceedance Probability	Adjusted Parameter Value
0.0100	100.00	0.005	0.5359	0.000
0.0200	50.00	0.009	0.5406	0.000
0.0500	20.00	0.018	0.5547	0.000
0.1000	10.00	0.034	0.5781	0.000
0.2000	5.00	0.069	0.6250	0.000
0.3333	3.00	0.129	0.6875	0.000
0.5000	2.00	0.242	0.7656	0.000
0.8000	1.25	0.736	0.9063	0.313
0.9000	1.11	1.247	0.9531	0.698
0.9600	1.04	2.101	0.9812	1.405
0.9800	1.02	2.880	0.9906	2.038
0.9900	1.01	3.773	0.9953	2.808

Calculated 4Q3

Note -- Adjusted parameter values include zero values and correspond with non-exceedance probabilities in column 1 and recurrence interval in column 2. Parameter values in column 3 are based on non-zero values.

Log-Pearson Type III Statistics
SWSTAT 4.1
(based on USGS Program A193)

Notice -- Use of Log-Pearson Type III or Pearson-Type III distributions are for preliminary computations. User is responsible for assessment and interpretation.

09364500 Animas River at Farmington, NM
April 1 - start of season
March 31 - end of season
1967 - 2002 - time period
4-day low - parameter
35 - non-zero values
1 - zero values
0 - negative values (ignored)

111.500	111.250	95.000	156.500	190.250
92.750	6.000	201.250	7.850	189.000
94.000	10.900	20.750	132.750	162.500
147.000	303.250	272.750	258.500	231.500
379.250	226.000	261.250	99.250	82.500
169.750	187.250	241.250	122.000	142.250
211.250	225.500	202.250	14.375	84.750

The following 7 statistics are based on non-zero values:

Mean (logs)	2.050
Variance (logs)	0.209
Standard Deviation (logs)	0.457
Skewness (logs)	-1.675
Standard Error of Skewness (logs)	0.398
Serial Correlation Coefficient (logs)	0.153
Coefficient of Variation (logs)	0.223

Non-Exceedance Probability	Recurrence Interval	Parameter Value	Adjusted Non-Exceedance Probability	Adjusted Parameter Value
0.0100	100.00	3.030	0.0375	0.000
0.0200	50.00	5.846	0.0472	0.000
0.0500	20.00	14.101	0.0764	6.603
0.1000	10.00	27.798	0.1250	19.607
0.2000	5.00	55.783	0.2222	47.573
0.3333	3.00	94.163	0.3518	88.790
0.5000	2.00	148.212	0.5139	143.054
0.8000	1.25	263.334	0.8056	260.709
0.9000	1.11	313.387	0.9028	311.832
0.9600	1.04	351.634	0.9611	350.803
0.9800	1.02	368.074	0.9806	367.562
0.9900	1.01	378.225	0.9903	377.931

Calculated 4Q3

Note -- Adjusted parameter values include zero values and correspond with non-exceedance probabilities in column 1 and recurrence interval in column 2. Parameter values in column 3 are based on non-zero values.

4Q3 derivations for portions of gaged SJR Basin streams

4Q3 ungaged = Qt(u) = Qt(g) X (Au/Ag)^0.566 Reference: USGS 1993

where

4Q3 = 4-day, 3-year, low flow frequency (cfs)

Qt(g) = 4Q3 at the gaged site (cfs)

Au = drainage area at the ungaged site (mi2)

Ag = drainage area at the gaged site (mi2)

Qt(u) = area weighted 4Q3 at the ungaged site (cfs)

Parameter	**La Plata River (gaged portion)**	**La Plata River (ungaged portion)**
Ag (mi2)	583	
Au (mi2)		434
Qt(g) (cfs)	0.13	
Qt(u) = 4Q3 ungaged (cfs)		0.11
4Q3 ungaged (mgd)		**0.071**

APPENDIX E
PUBLIC PARTICIPATION PROCESS FLOWCHART

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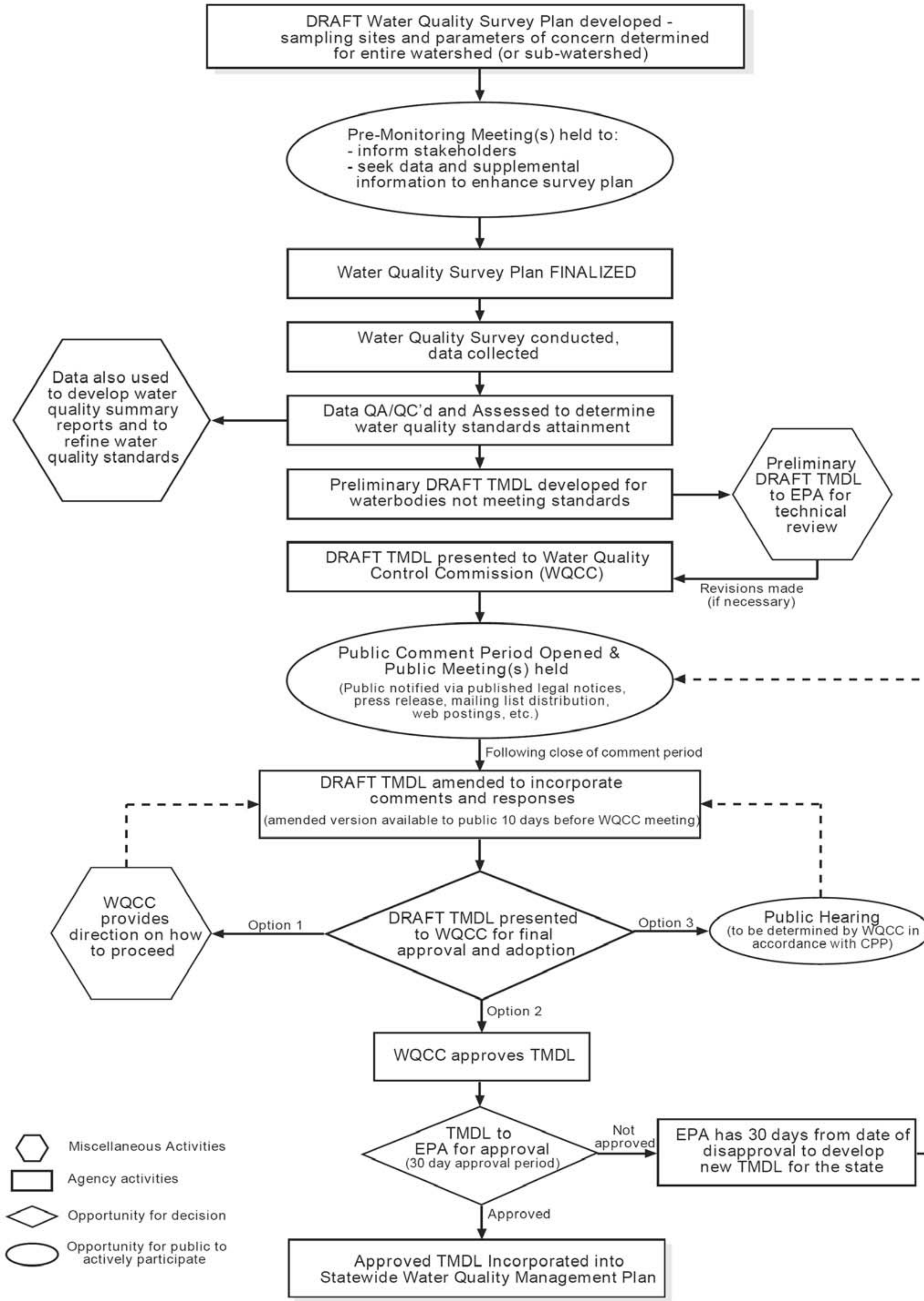
DRAFT Water Quality Survey Plan developed - sampling sites and parameters of concern determined for entire watershed (or sub-watershed)
Pre-Monitoring Meeting(s) held to:
- inform stakeholders
- seek data and supplemental information to enhance survey plan
Water Quality Survey Plan FINALIZED
Water Quality Survey conducted, data collected
Data also used to develop water quality summary reports and to refine water quality standards
Data QA/QC'd and Assessed to determine water quality standards attainment
Preliminary DRAFT TMDL developed for waterbodies not meeting standards
Preliminary DRAFT TMDL to EPA for technical review
DRAFT TMDL presented to Water Quality Control Commission (WQCC)
Revisions made (if necessary)
Public Comment Period Opened & Public Meeting(s) held
(Public notified via published legal notices, press release, mailing list distribution, web postings, etc.)
Following close of comment period
DRAFT TMDL amended to incorporate comments and responses
(amended version available to public 10 days before WQCC meeting)
WQCC provides direction on how to proceed
Option 1
DRAFT TMDL presented to WQCC for final approval and adoption
Option 3
Public Hearing
(to be determined by WQCC in accordance with CPP)
Option 2
WQCC approves TMDL
TMDL to EPA for approval
(30 day approval period)
Not approved
EPA has 30 days from date of disapproval to develop new TMDL for the state
Approved
Approved TMDL Incorporated into Statewide Water Quality Management Plan
Miscellaneous Activities
Agency activities
Opportunity for decision
Opportunity for public to actively participate

APPENDIX F
RESPONSES TO COMMENTS

Comment Set A:
Navajo Nation Environmental Protection Agency

April 11, 2005

Lynette Guevara, Monitoring and Assessment Program Manager
New Mexico Environment Department
Surface Water Quality Bureau
Room N2056
P.O. Box 26110
Santa Fe, NM 87502

RE: TMDL for the San Juan River Watershed (Part One)

Ms. Guevara,

Thank you for the opportunity to comment on the proposed total maximum daily loads (TMDLs) for the San Juan River Watershed. As both an upstream and downstream water user within the basin, we have a vested interest in maintaining high water quality on the San Juan River. We commend NMED for proposing a fecal coliform TMDL on the lower San Juan River that meets the Navajo Nation water quality standard for that reach. We look forward to working closely with NMED to address water quality concerns there and elsewhere within the basin. Below are the comments that the Navajo EPA Water Quality/NPDES Program has on the draft TMDL:

1) Page 4: The watershed of interest and waterbody of interest should be identified in the map instead of the HUC. Also, it is unclear if the information presented in the table is limited to the area under NMED jurisdiction or if the entire watershed of interest is covered. If the latter is the case, than the percent of land in agriculture is significantly underestimated given the presence of the Navajo Indian Irrigation Project (NIIP). This also applies to the table on p. 7.

***RESPONSE**: The small maps at the top of the summary pages are imported from USEPA's Surf Your Watershed and are intended only to orient the reader to the USGS 8-digit HUC location. There are SWQB-generated maps in the main body of the TMDL that detail the waterbodies of interest. The Land Use/Cover statistics in the review draft were for the entire Gallegos Canyon basin, based on a USGS Land Use/Cover GIS coverage dated 1981. SWQB has since acquired a land use coverage dated 2000. The percentages on page 4 and associated map in Figure 2.4 were updated. Please note that the % agriculture was only increased from 1% to 9% because some of the NIIP irrigation plots are outside of the Gallegos watershed on the available GIS coverage, and the pixels in between the circular plots are classified as "rangeland."*

2) Section 2.2, p. 10: The Mancos Shale outcrops west of the Hogback, not between Farmington and the Hogback. Also, a better reference for this section would be “Hydrogeology and water resources of San Juan Basin, New Mexico”—New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 6 by W. J. Stone et al.

***RESPONSE**: The reference to Mancos shale was corrected.*

3) On p. 13, the designated uses for the San Juan River and perennial tributaries should also include Fish Consumption.

***RESPONSE**: Fish Consumption was added as a designated use.*

4) In Figures 2.3 and 3.2, another Navajo EPA sample site is located on the unnamed tributary to the San Juan River west of Ojo Amarillo, downstream from NPDES permit NM0028193.

***RESPONSE**: A symbol was added to both figures to note the additional sample site.*

5) Figures 2.3 and 2.4 need to be updated to reflect the large area under irrigation on the NIIP. These figures currently show the NIIP as all rangeland. The land use statistics in sections 3.2 and 3.3 should also be adjusted where appropriate.

***RESPONSE**: The Land Use/Cover statistics were for the entire Gallegos basin, based on a USGS Land Use/Cover GIS coverage dated 1981. SWQB has since acquired a land use coverage dated 2000. The percentages on page 4, associated map in Figure 2.4, and statistics in section 3.3 were updated.*

6) In Figures 2.4 and 3.3, The Navajo EPA sample site on Gallegos Canyon should be located about four miles upstream from the junction with the San Juan River.

***RESPONSE**: A symbol was added to correct the location.*

7) Section 3.2 (mid-paragraph), p. 26: The Animas drainage is not part of the Middle San Juan River Watershed.

***RESPONSE**: The reference to the Animas was removed.*

8) Section 3.3, p. 29, 2nd paragraph: The reference to Figure 2.7 near the end of the paragraph should be Figure 3.3.

***RESPONSE**: The reference was changed to 3.3.*

9) Section 5.1, p. 50: The E. coli standard has already replaced the total coliform standard on the Navajo Nation portions of the San Juan River, which are between the Colorado border upstream to the La Plata River (not Animas) in New Mexico.

***RESPONSE**: The sentence was corrected.*

10) Table 5.2, p. 51: It looks like the Shiprock gage was used to calculate the 4Q3 for the San Juan River between the Hogback and the Animas River. This may underestimate the discharge in this reach because 100-200 cfs bypass the gage via the Hogback canal during the time of year when these low flows occur. It may be better to use the Farmington gage for this reach. Also, the 4Q3 calculation for the San Juan River between the Animas River and Cañon Largo assumes that both the San Juan and Animas have low flows at exactly the same time. This may not necessarily be the case because the San Juan is artificially elevated during the driest months to ensure that downstream water users are not shorted. It may be better to use the San Juan River gage at Archuleta.

***RESPONSE**: Calculating 4Q3s for the San Juan River basin is very challenging due to the large number of ungaged diversions and returns flows throughout the basin. SWQB concurs that the SJR USGS Gage at Farmington may be the better choice to calculate 4Q3s for the assessment unit between the Hogback and Animas River due to the large impact the Hogback Canal has on flow between the Hogback and the Shiprock gage, although the use of this gage may slightly overestimate flow due to withdrawals for the Fruitland Irrigation Canal, Jewitt Valley Canal, and San Juan Power Plant. Table 5.2 and the subsequent TMDL calculations were changed accordingly.*

SWQB does not believe the SJR USGS Gage at Archuleta should be used to calculate the 4Q3 for the San Juan River between the Animas River and Cañon Largo. The USGS program SWSTAT 4.1 is used to calculate 4Q3s from daily flow values. The program does not assume any particular time of year is low flow. It determines the 4-day low flow period of each individual year of record (April 1- March 31), wherever it may fall, to calculate the 4Q3.

11) Table 5.8, p. 55: The WLA for San Juan River (Navajo bnd at Hogback to Animas River) should be 2.84×10^{10}.

***RESPONSE**: The exponent was corrected.*

12) Section 6.1, p. 62, 3rd paragraph: The 2004 NNWQS should be cited instead of the 1999 version.

***RESPONSE**: The reference was corrected.*

13) Section 6.2: There are about 13 months worth of mean daily flow data from a USGS gage located near the mouth of Gallegos Canyon. The gage is number 09357255 and was in place between September of 1993 and October of 1994. This may have been when the NIIP was regularly releasing water into Gallegos in an attempt to dilute flows. If not, these data would provide a better estimate of critical flows than the one-time estimate by NMED staff. Also, given the lack of flow data and the difficulty in measuring flow for this waterbody, it may be more useful to set the TMDL as a target concentration instead of a load.

***RESPONSE**: SWQB disagrees that the one year of gage data from 1993 to 1994 would provide a more accurate flow estimate for calculations of current target loads and measured loads. SWQB has no information on whether NIIP was releasing during that time period. If they were releasing during this time, this gage record would not provide a good estimate of critical flow because the flow values would be much higher than normal. The nature of this channel would also make it difficult to generate a reliable rating curve, which would lead to a high number of estimated values in the USGS gage record. Also, it would not be possible to generate a reliable 4Q3 value using SWQSTAT with only one year of data. Although limited, SWQB believes the estimated flow value during the October 2002 sampling event is "best available" and sufficient for calculation of this 100% nonpoint source TMDL.*

14) Table 6.3, p. 65: The third column heading should have "Total recoverable selenium" instead of "Dissolved Al".

***RESPONSE**: The column heading was changed.*

15) Section 6.4 and Table 6.5, p. 66: There seems to be an inconsistency between load reduction calculations for the fecal coliform TMDLs and the selenium TMDL. For fecal coliforms, the TMDL was subtracted from the measured load to obtain the load reduction. For selenium, the load allocation was used instead of the TMDL in this equation. Please explain why the reductions on the San Juan River are only designed to meet the TMDL whereas the reductions on Gallegos Canyon are designed to meet a level 25% below the TMDL.

***RESPONSE**: Table 6.5 was corrected.*

I hope that these comments are helpful. Please contact me at 505-368-1037 if you have any questions. Thank you.

Sincerely,

Stephen A. Austin, Senior Hydrologist
Navajo Nation EPA Water Quality/NPDES Program

Comment Set B:
USEPA Region 9 – San Francisco, CA

April 13, 2005

Ms. Lynette Guevara
Monitoring and Assessment Section
Surface Water Quality Bureau
1190 S. St. Francis Drive (N2050)
Santa Fe, NM 87502

RE: EPA Region 9 Comments on San Juan River Watershed TMDLs

Dear Ms. Guevara:

Thank you for the opportunity to review and comment on the draft San Juan River Watershed TMDLs. EPA Region 9 appreciates that that you have worked with EPA Region 6 and Navajo EPA in the development of these TMDLs. EPA Region 9 limited our review to the TMDL's method of addressing discharges in and from the Navajo Nation. As you know, EPA Region 9 is the lead EPA Region working with the Navajo Nation EPA on water quality management issues and EPA Region 6 asked us to review the TMDL's treatment of discharges from the Navajo Nation.

In general, we were impressed by the TMDLs and the straightforward manner in which they addressed TMDL development for a large watershed despite significant data limitations in some areas. We offer a few specific comments concerning the bacteria and selenium TMDLs, principally with the intent of ensuring that the TMDLs reflect the appropriate distinction between State and tribal jurisdiction regarding different discharge sources in the watershed. We also have a few suggestions concerning the manner in which the TMDLs and allocations are expressed (mass vs. concentration based) and the margin of safety considerations for the selenium TMDL.

Comments Concerning Bacteria TMDL

The draft bacteria TMDL for the San Juan River (Navajo Boundary to Animas River) is designed in part to ensure attainment of the applicable Navajo Nation water quality standards for bacterial indicators. We commend the State's recognition of the importance of setting TMDLs that will result in attainment of the neighboring tribal jurisdiction's applicable water quality standards, that are, for fecal coliform, more stringent that New Mexico's standards.

We recommend that you revise the wasteload and load allocations for the bacteria TMDLs for San Juan River (Navajo Boundary to Animas River) to more accurately reflect the limits to the State's jurisdiction over bacteria sources in the Navajo portion of the watershed.

The draft TMDL establishes a separate wasteload allocation (WLA) for the BIA/Nenahnezad Boarding School, which is located in the Navajo Nation and discharges to a tributary to the San Juan River. The TMDL also establishes a general load allocation applicable to all nonpoint sources in the watershed. It is appropriate for the New Mexico TMDL to consider and account for all point and nonpoint sources of bacteria discharge in the San Juan watershed in this TMDL. In cases where a TMDL accounts for discharges from a neighboring jurisdiction located upstream from the TMDL assessment unit, we generally recommend setting a load allocation at the border location where the water body in question flows into the downstream state or tribal water. The downstream state TMDL should not set specific wasteload allocations for the point sources located in the upstream jurisdiction. In the case of the San Juan, the situation is more complex as the Navajo Nation and New Mexico lie on opposites sides of the San Juan River in this area; thereby making it more difficult to distinguish allocations among jurisdictions. In this case, we recommend that you add text clarifying that the WLA for the BIA/Nenahnezad Boarding school is identified for information only as this discharge and its regulation are beyond the State's jurisdiction. We recommend that you set a single load allocation at the state-tribal "border" that accounts for all loads from sources in the Navajo Nation. When the Navajo school's NPDES permit is up for renewal, this allocation will be considered in setting the appropriate effluent limitations for bacteria.

RESPONSE: *Footnote "(b)" on Tables 5.5 and 5.6 acknowledged that the BIA/Nenahnezad Boarding school is under USEPA Region 9/Navajo Nation jurisdiction. An additional note was added to both footnotes to clarify that inclusion of these permits in the table is for information only.*

SWQB does not believe it is possible to set a single load allocation at the state-tribal "border" because the Navajo Nation and New Mexico share jurisdiction of the San Juan River between the Hogback and the La Plata River. There is not a identifiable point in the river where the jurisdiction changes from New Mexico to the Navajo Nation through this assessment unit. Additionally, we do not have adequate data to discern what portion of the load allocation is coming from Navajo Nation sources vs. state sources. Data is limited because New Mexico currently does not perform specific TMDL studies for all individual impairments identified on our Clean Water Act 303(d) list due to staff and financial limitations. Instead, we generally use the same data collected during our intensive surveys 1) to determine impairment for development of the 303(d) list, and 2) to develop any subsequent TMDLs. In the case of the San Juan River basin, we were able to collate some additional surface water quality data for other agencies, but not enough to determine which portion of the load allocations are coming from various probable sources.

As a practical matter, we recommend that you consider setting a "concentration" based load allocation applicable to loads from the Navajo Nation into San Juan River set equal to the applicable water quality standards for e. coli and fecal coliform. This would provide useful guidance for identifying appropriate point and nonpoint source controls in the future. Moreover, setting concentration-based bacteria TMDLs may also provide an implicit margin of safety to account for uncertainties in the analysis concerning critical flows and attainment of applicable standards under different flow conditions.

***RESPONSE**: SWQB appreciates the suggestion to set concentration based load allocations. We will look into this approach, utilized by several USEPA Region 9 states based on research performed to respond to this request, for future TMDLs. New Mexico has not used this approach in the past, and has not discussed the merits of this approach with our USEPA Region 6 counterparts, SWQB Point Source Regulation Section, or the New Mexico Water Quality Control Commission (our governing body that approves TMDLs for inclusion into the state's water quality management plan).*

The target loads in the draft TMDL are calculated with the applicable Navajo Nation and New Mexico fecal coliform and E. coli standards, so the current approach seems to meet the same end as proposed. We also include the following statement in the TMDL regarding the use of TMDL targets as goals to achieve water quality standards:

> "*It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning 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 may be a difficult objective.*"

For the above reasons, SWQB believes a change in TMDL methodology is not warranted at this stage in the development of the San Juan River TMDLs.

Finallly, we note that the bacteria TMDLs include information on loading reductions needed to attain the TMDLs. We recommend that the state clarfiy that the load reduction amounts in tables 5.11 and 5.12 are provided for information only and are not part of the TMDL/load allocation itself. Setting TMDLs and/or allocations in terms of needed reductions needlessly multiplies the analytical uncertainty underlying the TMDL. We recommend that you retain the reduction information for information purposes but express load reductions needed in terms of percent reductions compared with current estimated loads in order to more clearly communicate the level of control or reduction needed in different parts of the watershed.

***RESPONSE**: A sentence was added to the load reduction tables to clarify that these tables are for informational purposes only. Since the inception of our TMDL program, SWQB has always included load reduction tables to indicate the magnitude of impairment to the reader. These tables are not a required element, and are not identified as part of the TMDL calculation. SWQB concurs that expressing the load reductions needed in terms of percent reduction further clarifies the magnitude of the impairment, and has added this information to the load reduction tables.*

Comments Concerning Selenium TMDL

We also reviewed the selenium TMDL proposed for Gallegos Canyon. We recommend that a single load allocation applicable to discharges from the Navajo Nation be set to apply at the "border" where the Canyon flows enter state waters. We also recommend setting this allocation (and possibly the TMDL as a whole) on a concentration basis as this approach may be more defensible and sensitive to varying flow regimes than the proposed approach of setting a mass based TMDL based on a single, potentially unreliable, flow estimate. In flowing systems of this type it may not be necessary to set mass-based TMDLs in order to effectively protect uses threatened by selenium exposures. Moreover, if the load allocation is set on a concentration basis, the proposed numeric margin of safety to account for flow uncertainty would be unnecessary. By establishing concentration-based TMDLs, a lower margin of safety would be warranted.

***RESPONSE**: SWQB appreciates the suggestion to set concentration based load allocations. We will look into this approach, utilized by several USEPA Region 9 states based on research performed to respond to this request, for future TMDLs. New Mexico has not used this approach in the past, and has not discussed the merits of this approach with our USEPA Region 6 counterparts, Point Source Regulation Section, or the New Mexico Water Quality Control Commission (our governing body that approves TMDLs for inclusion into the state's water quality management plan).*

The target loads in the draft TMDL are calculated with the applicable New Mexico selenium standard, so the current approach seems to meet the same end as proposed. We also include the following statement in the TMDL regarding the use of TMDL targets as goals to achieve water quality standards:

> "*It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in all natural surface water systems, the target load 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 target load may be a difficult objective.*"

For the above reasons, SWQB believes a change in TMDL methodology is not warranted at this stage in the development of the San Juan River TMDLs.

If a mass-based TMDL and load allocation is retained, we recommend that the State clarify that the load reduction amount estimated to be needed in table 6.5 is not part of the TMDL/load allocation itself and is presented for information only. By clarifying that the TMDL and load allocations themselves are not a function of the loading estimate, it becomes unnecessary to include the extra margin of safety proposed in Section 6.7 to account for uncertainty in the loading estimate. In other words, setting the TMDL and allocations in terms of reductions required unnecessarily multiplies the uncertainty in the TMDL calculations. We do recommend that you retain the information concerning loading reductions needed (and express it in terms of estimate percentage reductions needed) as that approach provides useful information in targeting irrigated agriculture controls or practices to implement the TMDL and load allocation.

***RESPONSE**: A sentence was added to the load reduction tables to clarify that these tables are for informational purposes only. Since the inception of our TMDL program, SWQB has always included load reduction tables to indicate the magnitude of impairment to the reader. These tables are not a required element, and are not identified as part of the TMDL calculation. SWQB concurs that expressing the load reductions needed in terms of percent reduction further clarifies the magnitude of the impairment, and has added this information to the load reduction tables.*

We would be happy to discuss these comments, and appreciate the opportunity to comment. Please don't hesitate to call me at (415) 972-3416 if you have any questions.

Sincerely,

/original signed by/

David Smith
TMDL Team Leader
EPA Region 9 (WTR-2)

Comment Set C:
City of Farmington

Lynette Guevara
New Mexico Environment Department
Surface Water Quality Bureau
Room N2056
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Guevara:

Thank you for allowing the City of Farmington to comment on the proposed Total Maximum Daily Load (TMDL) for the San Juan Watershed (Part One). As you are aware, the City of Farmington is an active participant in the activities of the San Juan Watershed Group (SJWG), including the SJWG's evaluation and identification of potential impairments to the watershed. Farmington is very aware of the quality of water of the Animas and San Juan Rivers.

After careful review of the proposed TMDL document, the City appreciates the importance placed by the New Mexico Environment Department (NMED) in developing the proposed TMDLs and recognizes the investment of NMED resources in developing the document for comment. The City offers NMED the following comments for consideration in completing their work.

1. The City of Farmington is pleased that the drought-related impacts to water quality in the watershed are recognized in this document because of the timing of the testing.

2. Table 13 also suggests that point source fecal coliform pollutants are only a small percentage of potential sources of pollutants and their volume may only marginally impacting surface waters within the basin. The City of Farmington recently completed a $13 million upgrade to their wastewater treatment plant to implement point source management techniques so as to minimize bacterial source loadings to surface waters.

   Water analysis completed by NMED and the SJWG have not identified the sources of these loadings as from point or non-point sources. The City agrees that a more detailed bacteria source tracking analysis is needed to identify bacterial source loading.
   The best approach to improving water quality from non-point sources is Best Management Practice (BMP) programs that are implemented by local stakeholders with the collaboration of state and federal agencies.

3. Farmington's wastewater treatment plant (Facility 0020583) design capacity is 6.67 million gallons per day (mgd) after the plant expansion was completed in 2004. The

facility's design capacity on page 54 of the document is listed as 5.8 mgd.

***RESPONSE**: The design capacity change had not yet been entered into SWQB's NPDES tracking database at the time the bacteria TMDLs were drafted. Based on your comment, the design capacity in tables 5.5 and 5.6, as well as all subsequent calculations utilizing this value, were changed to reflect the plant expansion to 6.67 mgd.*

4. The City is very concerned with the proposed fecal coliform and/or *E. Coli* point source impairment levels in the San Juan River (Navajo bnd at Hogback to Animas River) reach as described in the document. If the proposed TMDL standards are implemented the City is concerned that it will be required to meet more stringent standards than the adjacent reaches since its wastewater treatment plant's point of discharge into the San Juan River is only 990 feet below the confluence with the Animas River and 770 feet from the San Juan River (Animas River to Canon Largo) reach.

Although the City's NPDES permit has been submitted for renewal, the existing permit allows a fecal coliform count of 200 cfu/100 mL (30-day geometric mean) and 400 cfu/100 mL (7-day geometric mean). After reviewing the Calculation of Load Reduction for fecal coliform and *E.* Coli (page 57) and Pollutant Source Summary for Fecal Coliform (page 58), the City is apprehensive about point source changes to fecal coliform standards found on page 53. The proposed San Juan River (Navajo bnd at Hogback to Animas River) reach 30-day geometric mean standard for fecal coliform of 100 cfu/100 mL 30-day geometric mean and a 200 cfu/100 mL maximum single fecal coliform sample or *E. coli* of 126 cfu/100 mL 30 day geometric mean and 235 cfu/100 mL maximum single *E. coli* sample are extremely stringent.

The proposed standards for the lowest San Juan River reach will be challenging and, under certain circumstances, may be difficult during certain time periods. Moreover, to meet the more stringent standards, there is, in the City's opinion, little question that there will be an additional expense to the City's ratepayers for infrastructure development and treatment costs.

Because point source dischargers appear to have minimal contribution to fecal coliform/E. Coli impairment found in the San Juan River System and considering a San Juan and Animas River dilution factor, it seems reasonable for the Surface Water Quality Board to implement an upgradient waiver policy for those point sources in the upper reaches of the San Juan River (Navajo bnd at Hogback to Animas River) Assessment Unit. The City's vision is the waiver would allow a fecal coliform 30-day geometric mean of 200 cfu/100 mL and a single sample requirement of 400 cfu/100 mL similar to other point source dischargers in other nearby reaches.

Another consideration for the Surface Water Quality Bureau is to reduce in size the length of the reach. For example, the San Juan River (Navajo bnd at Hogback to Animas River) reach would be shortened to include only the San Juan River (Navajo bnd at Hogback to the Bisti Bridge) allowing the City the benefits of a San Juan and Animas River mixing zone.

Again, the City of Farmington appreciates the opportunity to provide input and comment on the proposed TMDL regulations.

***RESPONSE**: The bacteria limits in the current NPDES permit for the City of Farmington WWTP are water quality-based limits, based on the existing New Mexico water quality standards for the receiving water. When the permit was issued on 7/1/1999, the Navajo Nation had not yet established surface water quality standards. The Navajo Nation now has standards in place. Since the Navajo Nation is the downstream user on the San Juan River, and the state of New Mexico and the Navajo Nation share jurisdiction between the Hogback and the La Plata River, the Navajo Nation's water quality standards must be considered during NPDES permit development and/or renewal to be protective of their designated uses. The TMDL document is not driving the proposed change in the City of Farmington WWTP bacteria limits. This reduction to meet Navajo Nation water quality standards would be implemented even in the absence of a TMDL or impairment listing. In addition, DMR data received from the City of Farmington (01/2003 through 2/2005) indicate that the 2004 plant improvements have been successful in reducing the concentration of fecal coliform in the effluent to well below both the existing permit limits and proposed permit limits in the draft TMDL.*

Both the Navajo Nation and the state of New Mexico have proposed replacing their respective current fecal coliform water quality standards with E. coli standards. Both entities have proposed 126 cfu/100 mL 30 day geometric mean and 235 cfu/100 mL maximum single E. coli criteria for this portion of the San Juan River. These changes were approved by the Navajo Nation Council and the New Mexico Water Quality Control Commission, respectively. These E. coli limits should eventually be used to replace the existing fecal coliform limits in all WWTP permits once the USEPA approves these changes and the permits come up for renewal. Again it is important to note that this process is being driven by changes to the water quality standards, not the existence of the TMDL document or the impairment. Both the fecal coliform and E. coli scenarios were included in the document to stress the point that the standards change, and subsequent change to WWTP permit limits, are forthcoming.

Sincerely,

Jeffrey Smaka, P.E.
Water/Wastewater Administrator

CC:
Bob Hudson, City Manager
Mike Sullivan, Acting Community Development Director
Ruben Salicido, O & M Contracts Manager

Paul A. Montoia, Water Resources
Ron Rosen, OMI

Comment Set D:
San Juan Water Commission

(PDF of letter received inserted)

San Juan Water Commission
7450 East Main Street, Suite B • Farmington • New Mexico • 87402
Office: 505-564-8969 • Fax 505-564-3322 • Email: sjwcoffice@sjwc.org

MEMBERS:
City of Aztec
City of Bloomfield
City of Farmington
San Juan County
S.J. County Rural Water Users Assoc.

April 13, 2005

Ms. Lynette Guevara
Surface Water Quality Bureau
New Mexico Environment Department
Room N2056
P.O. Box 26110
Santa Fe, NM 87502

Via e-mail (Lynette_Guevara@nmenv.state.nm.us) and U.S. mail

Re: Comments of San Juan Water Commission on the Draft Total Maximum Daily Load ("TMDL") for the San Juan River Watershed (Part One)

Dear Ms. Guevara:

Pursuant to the public notice of a 30-day comment period on the New Mexico Environment Department's ("NMED") draft Total Maximum Daily Load ("TMDL") for the San Juan River Watershed (Part One), I hereby submit the following comments to NMED on behalf of the San Juan Water Commission ("SJWC").

General Considerations

On July 22, 2003, SJWC submitted comments on the draft Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report: Assessment Protocol that has been used as a basis for the draft San Juan River TMDLs. In addition, on October 14, 2004, SJWC commented on proposed changes to the sediment/siltation listings in the San Juan River Basin. In those comments, SJWC objected to the use of certain methodologies, including the use of drought data. Specifically, with regard to the sediment/siltation listing, SJWC questioned the application of the chosen methodology (Heinz, *et al.*, 2004) to the San Juan River Basin, noted the fact that biological data did not support the sediment/siltation (bottom deposit) impairment designation of the San Juan, and pointed out the misinterpretation of the impact of dam operations on the lower San Juan. Although the proposed TMDLs will have no immediate impact on current point source discharges, SJWC reiterates the concerns it previously expressed with NMED's methodology. Should EPA or the state begin regulating nonpoint sources in the future, the proposed sediment/siltation and bacteria TMDLs could have an adverse and unnecessary impact on land and water use activities in the San Juan Basin. Thus, it is imperative that impairment determinations be made, and TMDL calculations be developed, applying appropriate assumptions and using a valid data set.

Specific Comments

2.0 San Juan River Basin Background

2.4.1—Survey Design: "Surface water quality samples were collected monthly between March and October for the 2002 intensive SWQB study."

2.4.2—Hydrologic Conditions (p. 22): "Also, flows during the 2002 survey year were below average based on the period of record."

Comment: 2002 was one of the driest years on record in the San Juan Basin, if not the driest. Data collected during this period is not representative of conditions in the San Juan River from a quantity or quality standpoint. Nor is the data likely representative of even typical low flow conditions in the San Juan River. Conducting an assessment and using results under these conditions for establishment of TMDLs is not appropriate.

SJWC proposes that, rather than simply stating that "flows during the 2002 survey year were below average based on the period of record," NMED should state that the flows were among the lowest on record and cite statistical determination of the exceedence for 2002 for each of the rivers in the San Juan Basin that are addressed in this document. The statement that these flows were "below average" is misleading.

4.0 Sediment/Siltation (Stream Bottom Deposits)

Comment: On October 14, 2004, SJWC submitted comments regarding the lack of validity of the stream bottom deposit impairment determinations for the 2004-2006 Clean Water Act Integrated §303(d)/§305(b) List of Assessed Surface Waters. [*See* letter from Jolene McCaleb to Ms. Lynette Guevara, Surface Water Quality Bureau, attached and adopted by reference.] Those comments addressed SJWC's concerns that (1) the non-supporting use determinations were not valid and are contradicted by biological data, (2) the determination failed to recognize historic conditions in the San Juan Basin, and (3) statements regarding the impacts of Navajo Dam were inaccurate and misinterpreted the influence of Navajo Dam on sedimentation. The stream bottom deposit standard is designed to protect aquatic life uses. Aquatic life data shows that the San Juan River has an abundant fish population. The impairment determination and the resulting TMDL are, therefore, both inappropriate.

5.0 Bacteria

5.2 Flow

Comment: This discussion is confusing. A statement is made (p.50) that "[c]ritical low flow is defined on an annual basis for these TMDLs because exceedences occurred during both low and high flow conditions." However, in the preceding sentence the statement is made that "the target flow was set at the critical low flow condition or 4Q3, defined as the minimum average four consecutive day flow which occurs with a frequency of once in three years (4Q3)." If the 4Q3 is based on a frequency of once in three years, why is NMED defining this critical low flow on an annual basis for these TMDLs?

In the third paragraph it is stated: "It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of [the] planning process designed to achieve water quality standards." If the target flow is set at 4Q3, *i.e.*, "defined critical condition" for bacteria, why is this not applied to sediment loading? In the sediment discussion (Section 4.8 Consideration of Seasonal Variation (p.47)), the statement is made:

> Data used in the calculation of this TMDL was collected during the fall, which is a biological index period. . . . Fall is also generally the low-flow period of the mean annual hydrograph in New Mexico when stream bottom deposits are most likely to settle and cause impairment. . . .

There is no reference to the 4Q3 in Section 4. Section 4 uses the *lowest* flow period to define impairment.

5.4 WLAs and LAs

Comment: Table 5.5 includes waste load allocations for fecal coliform, including allocations to the City of Aztec, City of Farmington, Kirkland Sewer Treatment Facility, BIA/Nenahnezad Boarding School, Harper Valley, City of Bloomfield, Blanco School, and McGee Park. It appears that the current permit conditions are factored into the TMDLs for fecal coliform (Table 5.7), and that no additional treatment by these entities will be required to achieve the TMDLs. If this is the case, it needs to be clearly stated in the document.

Tables 5.7 and 5.8 regarding the calculations for fecal coliform and E.coli include numbers in exponential form (5.1.5 x 10^8; 1.83 x 10^{12}). Given that these numbers are additive across the rows, they should also be expressed in a common exponent, such as 10^8.

Margin of Safety

Comment: The margin of safety varies for constituents discussed in this report as follows:

Constituent	***MOS (%)***
Sediment	20
Bacteria	15
Selenium	25

What is the basis for the margin of safety for each constituent? How is the margin of safety determined for each constituent?

Conclusion

In conclusion, SJWC appreciates the hard work NMED does to protect and improve the water quality of the surface waters of this state. Developing TMDLs for impaired streams is one part of that effort. However, SJWC urges NMED to carefully review its methods for determining stream impairment in general to ensure that no impairment decision is based on inadequate data. If a stream is impaired, appropriate actions need to be taken to improve its quality under both state and federal law. However, if a stream is not truly impaired, an improper impairment designation may have unintended and long-term adverse consequences for the citizens of San Juan County. Further, SJWC requests that NMED consider revising its draft TMDLs with regard to the specific concerns raised above.

Thank you very much for your time and consideration of these comments. If you have any questions, please do not hesitate to call me.

Sincerely,

L. Randy Kirkpatrick, Executive Director
San Juan Water Commission

Enclosure

RESPONSE TO SECTION 2.0: *The statement "Flows were among the lowest on record" was added to the text. It is unclear what is meant by "…cite statistical determination of the exceedence for 2002 for each of the rivers in the San Juan Basin…" Impairment determinations are based on application of the Assessment Protocols (NMED/SWQB 2004a). Information regarding the original impairment listings that led to development of these TMDLs can be found in the Integrated Clean Water Act 303(d)/305(b) List (NMED/SWQB 2004b), associated Record of Decision (ROD) (NMED/SWQB 2004c), and San Juan River Basin Sedimentation/Siltation Impairment Determinations document (NMED/SWQB 2004d).*

As stated in the Assessment Protocol, data collected during all flow conditions, including low flow conditions (i.e., flows below the 4Q3), will be used to determine designated use attainment status during the assessment process. Impairments due to pollutants as identified during the assessment process led to TMDL development as required by the Clean Water Act. 4Q3 values are to be utilized as minimum dilution assumptions for developing discharge permit effluent limitations. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions. SWQB contends that it is the intent of the Clean Water Act to consider all available data from any flow conditions when determining designated use attainment status and has stated so in the Assessment Protocols. USEPA Region 6 has reviewed and provided comment on the Assessment Protocols and did not express any concerns with this understanding.

References:

NMED/SWQB. 2004a. State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report. Santa Fe, NM.

———. 2004b. State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

———. 2004c. Record of Decision for the State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

———. 2004d. San Juan River Basin Sedimentation/Siltation Impairment Determinations for the for the 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters September.

RESPONSE TO SECTION 4.0: *SWQB believes the Sedimentation/Siltation impairment determinations are appropriate. The New Mexico Water Quality Control Commission*

(WQCC) and USEPA Region 6 agree with SWQB as indicated by their approval of the impairment listings. See attachment A for previously prepared responses to SJWC concerns detailed in the October 14, 2004 letter to SWQB. These comments and SWQB responses were considered by the WQCC and USEPA during their decision-making process.

RESPONSE TO SECTION 5.2: *SWQB has clarified the statement in the text. The reference to "annual basis" was added to note that for each available year of record, all USGS daily values for the entire year vs. values for any one particular season were used to determine the 4Q3 value for the TMDL calculations. Some of our previous bacteria TMDLs, such as the one prepared for the Middle Rio Grande, utilized daily values from the summer "monsoon" season only because all exceedences of the standards occurred during this season. In the San Juan Basin, there was no discernible pattern of exceedences, so a 4Q3 was generated from all daily flows.*

The 4Q3 was not applied to the Sedimentation/Siltation TMDL because the load was expressed in terms of percent fines instead of a concentration multiplied by a flow value. USEPA Region 6 supports this approach to Sedimentation/Siltation TMDLs.

RESPONSE TO SECTION 5.4: *The proposed or current fecal coliform, and proposed E. coli effluent used to determine the Waste Load Allocations in Tables 5.5 and 5.6 are set at the applicable Navajo Nation and New Mexico current and proposed fecal coliform and E. coli standards, respectively. This is stated in the second paragraph of section 5.3. It would be inappropriate for SWQB to include a statement that "no additional treatment by these entities will be required to achieve the TMDLs" in the TMDL document because this is an issue to be decided by the USEPA Region 6 Permits Branch in consultation with the SWQB Point Source Regulatory Section and the permittees based on discharge monitoring reports and compliance monitoring activities at the individual plants. Also, the City of Farmington's WWTP permit is up for renewal. The city's current permit does not take into account the Navajo Nation's water quality standards while their new permit must (see Comment Set C for details).*

There are separate sections in the TMDL document for each of the pollutants of concern. Under each of these sections, there is a Margin of Safety subsection that explains how the margin of safety was determined for that particular parameter (see subsections 4.7, 5.7, and 6.7).

ATTACHMENT A:

RESPONSE TO COMMENTS
ON PROPOSED CHANGES TO SAN JUAN RIVER BASIN
SEDIMENTATION/SILTATION (STREAM BOTTOM DEPOSIT)
IMPAIRMENT DETERMINATIONS FOR THE
2004-2006 STATE OF NEW MEXICO
INTEGRATED §303(d)/ §305(b)
LIST OF ASSESSED WATERS

October 14, 2004

Ms. Lynette Guevara
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Via e-mail(lynette_guevara@nmenv.state.nm.us) and U.S. mail

Re: Comments of San Juan Water Commission on Proposed Changes to the Sedimentation/Siltation Listings in the San Juan River Basin on the Approved 2004-2006 State of New Mexico Clean Water Act Integrated §303(d)/§305(b) List of Assessed Surface Waters

Dear Ms. Guevara:

Pursuant to the public notice of a 30-day comment period on the New Mexico Environment Department's ("NMED") proposed changes to the sedimentation/siltation listings in the San Juan River Basin on the approved 2004-2006 State of New Mexico Clean Water Act Integrated §303(d)/§305(b) List of Assessed Surface Waters ("Section 303(d) List"), I hereby submit the following comments to NMED on behalf of the San Juan Water Commission ("SJWC").

SJWC's General Comments

First, let me note that SJWC commends NMED's efforts to safeguard water quality throughout the state. SJWC particularly appreciates all of the hard work NMED has put into developing a protocol for determining sedimentation/siltation, or stream bottom deposit, impairment in the State's large rivers and reassessing certain waters in the San Juan River Basin under the new protocol. As you know from previous written comments and testimony submitted by SJWC in various proceedings, SJWC has been concerned that several stream segments in the San Juan River Basin have been improperly listed as impaired because of stream bottom deposits. Specifically, SJWC has been concerned that, in the past, NMED failed to adequately consider natural sediment contributions when determining impairment. SJWC is therefore pleased to see that NMED is now recommending the de-listing of four stream segments in the San Juan River Basin: (i) the San Juan River from the Navajo Nation boundary at Hogback to the Animas River; (ii) the San Juan River from Cañon Largo to Navajo Dam; (iii) the Animas River from the San Juan River to Estes Arroyo; and (iv) the Animas River from Estes Arroyo to the Colorado border. SJWC fully supports NMED's proposal to de-list these stream segments.

That said, SJWC is concerned that NMED's recent stream bottom deposit analysis of the San Juan River was based on some invalid assumptions and, as a result, NMED improperly has proposed retaining the impairment listing for the San Juan River from the Animas River to Cañon Largo. Based on the following considerations, SJWC requests that NMED modify its new stream bottom deposit protocol, as appropriate, and determine that the San Juan River from the Animas River to Cañon Largo (Reach 2) is fully supporting its designated uses in terms of stream bottom deposits.

SJWC's Specific Comments on NMED's September 14, 2004
San Juan River Basin Sedimentation/Siltation (Stream Bottom Deposit)
Impairment Determinations for the 2004-2006 Clean Water Act
Integrated §303(D)/§305(B) List of Assessed Waters

Both SJWC and its technical expert, Tom Pitts, P.E., have reviewed the two documents underlying NMED's proposed changes to the Section 303(d) List for the San Juan River Basin: (i) NMED's September 14, 2004 San Juan River Basin Sedimentation/ Siltation (Stream Bottom Deposit) Impairment Determinations for the 2004-2006 Clean Water Act Integrated §303(D)/§305(B) List of Assessed Waters (NMED's "Report"); and (ii) the National Sedimentation Laboratory's ("NSL") August 2004 Research Report Number 47—Bed-Material Characteristics of the San Juan River and Selected Tributaries, New Mexico: Developing Protocols for Stream-Bottom Deposits. Based on that review, SJWC has the following specific comments on NMED's Report and NMED's recommendation to keep the impairment designation for Reach 2 of the San Juan River.

1. Section 2.2 Ecoregion and Basin Study Design

On pages 3-4 of its Report, NMED states that all sampling to determine ecoregion bed sediment values occurred in October and November 2003. SJWC believes, however, that long-term sampling of the San Juan River and its tributaries is necessary to determine ecoregion characteristics. Sampling during two months of a drought year does not provide representative data. Also, the procedure followed by the NSL did not take into account antecedent hydrology, which is a determining factor in sedimentation/siltation during the brief sampling period. Thus, basing the impairment determination for Reach 2 of the San Juan River on such an extremely limited data set for the highly complex sedimentation phenomena is not technically valid.

***RESPONSE**: NMED believes the National Sedimentation Lab study, the associated NMED impairment determination document, and information from previous studies such as the San Juan River Basin Implementation Recovery Program (SJRIP) provides sufficient information to make these sedimentation/siltation impairment determinations. The study was spatially extensive -- 92 San Juan River sites, 21 Animas River sites, and 23 tributary sites. This is the most extensive effort NMED has taken to date to determine potential Sedimentation/Siltation impairment. Our wadeable stream protocol which has been in place for several years, is deemed acceptable by USEPA Region 6, and has been referenced as a model for several other states, only requires one sample at one station per assessment unit and reference reach to make Sedimentation/Siltation determinations. NMED believes the approach used in the San Juan Basin is technically valid to* *determine Sedimentation/Siltation impairment in the context of the Clean Water Act and associated USEPA guidance.*

2. Section 2.4 Embeddedness Measurements

NMED assumed in this section, and throughout the Report, that the normal condition of the entire San Juan River is "substrate that is plentiful, sufficiently large and varied, and [] not surrounded or buried by fines . . ." on a year-round basis. However, given both the geology and the climate of the San Juan Basin, Reach 2 historically has experienced sediment deposition during much of the year from post-runoff storm events. This is a normal and natural characteristic of Reach 2 rather than an impairment.

***RESPONSE**: SJWC is misinterpreting and representing this comment in Section 2.4. This is general comment that "substrate that is plentiful, sufficiently large and varied, and is not surrounded or buried by fines appears to offer the best attributes for habitat suitability for many aquatic organisms adapted to such conditions." This comment is simply describing the general relationship between substrate and aquatic organisms. This quote is not stated as a characterization of the entire San Juan River.*

Further, on page 5 of the Report, NMED states: "Therefore, this approach that utilizes embeddedness measures applies to streambeds composed of 50% or more coarse materials (i.e., gravel and cobbles)." Based on this statement, it appears that NMED assumes impairment is defined by stream beds composed of *less than* 50% or more coarse materials. SJWC questions whether the lower San Juan River is routinely composed of "50% or more coarse materials." SJWC further questions the validity of this assumption as it applies to Reach 2 of the San Juan, particularly on a seasonal basis.

***RESPONSE**: SJWC is misinterpreting this comment in Section 2.4. Nowhere does it state or imply that NMED assumes impairment is defined by streambeds composed on less than 50% or more coarse material. The embeddedness approach utilized in this study quantifies the extent to which coarse-material dominated river beds (in excess of 50% of bed material greater than 2 mm) are covered by fine sediments (Heins et al. 2004). Sampling occurred in representative riffle areas. Figure 2.4 displays how the percent fines were generally much higher in these representative riffle areas in Reach 2 because these areas were buried with fine sediment, primarily from Cañon Largo. Regarding the general substrate characteristic of the San Juan River between the Hogback and Navajo Dam, Holden (1999) states "Reach 6 (RM 155 to 180, below Hogback Diversion to the confluence with the Animas River)…Cobble and gravel substrates dominate, and cobble bars with clean interstitial space are more abundant in this reach than in any other." Also, "Reach 7 (RM 181 to 213, Animas River confluence to between Blanco and Archuleta, New Mexico) is similar to Reach 6 in terms of channel morphology…dominant substrate is cobble…"*

3. Section 2.5 Results

A. Section 2.5.1 Rapid Geomorphic Assessments

On page 6 of its Report, NMED states: "Stable (stage I or VI), gravel dominated (i.e., >50% cobble/boulder) sites were identified as candidate reference sites for the determination of reference condition." Once again, NMED assumes that ">50% cobble/boulder" sites are representative reference sites for the San Juan River and are typical conditions for the Basin. Put another way, NMED assumes impairment is occurring if conditions are less than 50% cobble/boulder.

This inherent bias is built into the definition of impairment—any site with less than 50% cobble/boulder is not representative of the San Juan River Basin or certain river reaches, seasonally, and such sites are therefore impaired. However, no data from sources other than the NSL study is provided to support this position. Furthermore, the NSL's very limited sampling period, which occurred during a drought year, provides only a snapshot of conditions—it cannot form the basis of a valid definition of an impaired site. Given this fundamental problem with the definition of impairment, use of the NSL methodology and data set to define Reach 2 of the San Juan River as impaired is not valid.

***RESPONSE**: Again, SJWC is misinterpreting this comment in Section 2.4. Nowhere does it state or imply that NMED assumes impairment is defined by streambeds composed of less than 50% or more coarse material. Stable, gravel dominated sites (>50% cobble/boulder) represent the best available, riffle habitat in the ecoregion. Sites that were <50% cobble/boulder were not used to determine a reference condition or benchmark because they do not represent best available riffle habitat, which was the focus of this study.*

NMED believes the National Sedimentation Lab study, the associated NMED impairment determination document, and information from previous studies such as the San Juan River Basin Implementation Recovery Program (SJRIP) provides sufficient information to make these sedimentation/siltation impairment determinations. The study was spatially extensive -- 92 San Juan River sites, 21 Animas River sites, and 23 tributary sites. This is the most extensive effort NMED has taken to date to determine potential Sedimentation/Siltation impairment. Our wadeable stream protocol which has been in place for several years, is deemed acceptable by USEPA Region 6, and has been referenced as a model for several other states, only requires one sample at one station per assessment unit and reference reach to make Sedimentation/Siltation determinations. NMED believes the approach used in the San Juan Basin is technically valid to determine Sedimentation/Siltation impairment in the context of the Clean Water Act and associated USEPA guidance.

B. Section 2.5.3 Determination of Bed-Material Reference Values

On page 9 of its Report, NMED states that the Oregon Department of Environmental Quality is considering using the "90th percentile values as their fine sediment benchmark . . . ." It therefore appears that NMED's selection of the 75th percentile benchmark is somewhat arbitrary. What is the basis for selecting the 75th percentile?

***RESPONSE**: Oregon's choice of the 90th percentile was somewhat arbitrary and based on their desire to balance Type I and Type II errors associated with making impairment decisions (Doug Drake, OR DEQ, personal communication). While the National Sedimentation Lab provides no official opinion on which percentage to use, they have worked with some states who have chosen the 50th percentile (median) while other states have chosen the 75th percentile. NMED believes the 75th percentile is protective of the environment, acknowledges inherent sources of error in the data due to the challenges associated with measuring substrate characteristics, and balances the costs associated with Type I and Type II errors.*

4. Section 3.2 San Juan and Animas River Assessments

In this section, NMED concludes that Reach 2 of the San Juan River is "Non-Supporting" of aquatic life use because of sedimentation. For all of the reasons discussed below, SJWC does not believe this conclusion is valid for Reach 2.

A. Section 3.2.1 Biological Data and Biorelevance

In this section, NMED states that available biological data does *not* confirm the non-supporting aquatic life use impairment determination for Reach 2 of the San Juan River. However, NMED dismisses the need for biological proof of impairment by stating that "it is not necessary to prove biorelevance because the latter part of the narrative [stream bottom deposit water quality] standard states: '. . . *or significantly alter the physical or chemical properties of the bottom.*' Therefore, this expanded geomorphic approach is adequate to determine impairment status." (Emphasis in original.) SJWC rejects this conclusion because it is supported only by NMED's interpretation of the narrative standard. NMED's conclusion is *not* supported by the facts.[1]

SJWC believes that, for a stream segment to be designated as impaired, there must be corresponding biological data to support the impairment designation. This clearly is not the case in Reach 2. As discussed on page 12 of NMED's report, biological data do *not* support NMED's proposed impairment designation: "Benthic macroinvertebrate assessment of the San Juan sites indicates no or slight impairment as compared to the selected reference site." Because available biological data indicates that Reach 2 of the San Juan River is not impaired, it should not be listed as impaired on the Section 303(d) List.

RESPONSE*: NMED believes our interpretation of the narrative standard is accurate, as the language in the Water Quality Standards clearly states* "*. . . or significantly alter the physical or chemical properties of the bottom*" (NMAC 20.6.4). *Section 3.2.1 discusses the challenges associated with identifying a benthic macroinvertebrate reference condition in the San Juan Basin due to the effects of the dam and lack of comprehensive benthic macroinvertebrate sampling protocols for large rivers. The section notes that a benthic macroinvertebrate reference site or condition for the San Juan River could not be defined within the scope of this project due to the above-mentioned issues. SJWC's footnote acknowledges that they don't believe the benthic macroinvertebrate conditions below the dam represent reference conditions for the San Juan River Basin. The available benthic macroinvertebrate data and interpretation by Dr. Jacobi (Appendix A) defines a station from Reach 3 below the dam ("San Juan River below Soaring Eagle Lodge HWY 173") as the "selected reference site" to conclude that the three San Juan sites in Reach 2 are slightly or not impaired. If SJWC does not believe the station in Reach 3 is a valid reference site, they cannot possibly support the conclusions in Appendix A or the sentence quoted from page 12 regarding biological impairment. NMED shares the same option -- "San Juan River below Soaring*

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1 SJWC concurs with NMED's statement on page 11 that the benthic macroinvertebrate conditions of the stream segment below Navajo Dam do not represent a reference condition for the San Juan River Basin.

Eagle Lodge HWY 173" in not a valid reference site to determine biological condition due to the effects of the dam on the benthic macroinvertebrate community at this site.

B. 3.2.2 Discussion of Cañon Largo and Navajo Reservoir Operations

As noted on page 12 of NMED's report, high suspended sediment loads from Cañon Largo have occurred historically. SJWC agrees that these loads result from the geology of the San Juan Basin, particularly Cañon Largo, and the occurrence of intense summer storms. As recognized by NMED, "[i]ntense summer and fall precipitation events contribute to the amount of sediment transported into the mainstem of the San Juan River," and "[l]arge, temporary increases in flow and sediment [are] common during intense, convective summer and fall precipitation events."

Nevertheless, SJWC disagrees with NMED's statement on page 12 that "[h]igh sediment input during summer and fall storm events, combined with a loss of sediment transport due to the effects of Navajo Dam, filled low-velocity habitats with sediment." It is true that the primary sediment-moving event in the San Juan River, both before and after the construction of Navajo Dam, was/is spring runoff. Spring runoff events scour sediment to a large degree and reshape habitat for endangered fish. However, such runoff has no effect on the removal of sediment resulting from intense summer precipitation events that occur after spring runoff. Any sediment deposited by these events can be moved only by base flows in the San Juan River.

***RESPONSE**: NMED believes this statement on page 12 is accurate and is supported by documents produced during the San Juan River Basin Recovery Implementation Program, including Holden 1999. The point of the statement on page 12 is that the loss of annual high spring runoff below the dam, as a result of Navajo Dam operations, resulted in the loss of this annual source of sediment transport. Spring runoff is no longer an annual occurrence due to past reservoir operations. Holden states "Prior to Navajo Dam's regulation of the San Juan River in 1962, flows were highly variable and dominated by the spring snowmelt runoff…Since the closure of Navajo Dam, flows in the San Juan River have been significantly altered by operations that typically store water during spring runoff and release storage during summer, fall, and winter months." Spring runoff is an important component of a natural hydrograph in the San Juan basin, which is in part why the preferred alternative in the Navajo Reservoir Operations EIS includes spring releases whenever predicted hydrologic conditions allow. NMED disagrees with SJWC's statement that spring flows have no effect on the removal of sediment from intense summer precipitation events and that this sediment can only be moved by baseflows. Adequate spring flows the following spring would likely have an effect, which again is one of the reasons behind the preferred alternative in the Navajo Reservoir Operations EIS. Regarding the SJRIP test period when they tested various spring release scenarios, Holden (1999) states "These studies showed that relatively high flows were needed to build and clean these habitats [cobble bars and backwaters], but that lower flows were needed to make them more abundant at the proper time of year...The change to the more-natural hydrograph during the research period resulted in more cobble and less sand habitats in the river…"*

Further, Navajo Dam releases have *increased* San Juan River base flows throughout the year to well above historic levels:

> Base flows were substantially elevated in the post-dam compared

> with the pre-dam period. The median monthly flow for the base-flow months of August through February averaged 168% of the pre-dam period. Minimum flows were also elevated. The near-zero flow periods were eliminated, with a minimum monthly flow during base-flow periods of 250 cfs compared with 65 cfs for the pre-dam period. Summer storm runoff was not directly affected by the dam, especially in terms of high sediment input, because these events can be generated below the influence of the dam."

(Holden, 1999) Even with these increased base flows, however, removal of sediments from summer thunderstorms does not occur below Cañon Largo due to high sediment loads from that source.

The fact that base flows increased after the construction of Navajo Dam contradicts NMED's statement on page 13 that "[p]ast dam operations did not generate flows sufficient to transport sediment through the system as indicated by measured sediment accumulation between spring runoff events (Holden 1999)." NMED has taken this statement from Holden out of context and misapplied it. Historically, sediment undoubtedly built up in the San Juan River as a result of intense summer storms throughout the year, and this is still a common condition of the River. Base flows were incapable of moving the storm-driven sediment even prior to the construction of Navajo Dam.

In the same vein, NMED also states, on page 13 of its Report, that "[e]ven though Cañon Largo is the primary source of excessive fine sediment loads and storm events during the summer and fall are the primary source of sediment transport from ephemeral tributaries, the anthropogenic influence of the dam and dam operations are contributing to impairment in Reach 2." However, as evidenced by the discussion above, it is clear that NMED's statements concerning the Dam's influence on sediment transport in Reach 2 of the San Juan River are incorrect. The Dam did reduce spring peak flows, which resulted in a narrowing of the channel of the San Juan River below Navajo Dam. However, spring peak flows are adequate to transport sediment under that narrowed condition. There is no evidence that the channel is continuing to narrow as a result of sediment deposition in the channel in Reach 2. The sediment deposition that is occurring results from seasonal events, and that sediment is removed by the spring flows resulting from post-Dam hydrology. NMED's statement that continuing sediment deposition is the result of Dam operations is erroneous. If anything, higher post-Dam base flows have enhanced conditions in Reach 2.

RESPONSE*: NMED's statements concerning the influence of reservoir operations on sediment transport in Reach 2 are correct. SJWC's comments create the false impression that spring runoff is still an annual event in the San Juan River post-dam. SJWC is also contradicting earlier statements by now stating the spring flows can remove sediment occurring from seasonal events. In earlier statements, SJWC contends "Any sediment deposited by these events can be moved only by base flows in the San Juan River."*

NMED is not taking Holden's statements out of context and does not believe the above quote from Holden contradicts the statement in the protocol regarding the loss of sediment transport due to the loss of spring runoff. The above quote from Holden is simply stating the fact that baseflows have been elevated post dam. Regarding the SJRIP test period, Holden (1999) states "These studies showed that relatively high flows were needed to build and clean these habitats [cobble bars and *backwaters], but that lower flows were needed to make them more abundant at the proper time of year...The change to the more-natural hydrograph during the research period resulted in more cobble and less sand habitats in the river…" NMED's statements are supported by Holden (1999).*

NMED goes on to state on page 13 that "it cannot be stated that sediment impairment in the San Juan River is completely due to natural causes" and cites cattle grazing and unimproved roads associated with oil and gas development. However, no specific citations of such cattle grazing or unimproved roads are made with respect to Reach 2. Post-spring runoff sediment deposition in Reach 2 is a common event that has occurred historically, as indicated in the 2004 report of Heins, *et al.* Such sediment deposition would be occurring with or without anthropogenic influences. It would also be occurring with or without the presence of Navajo Dam.

***RESPONSE**: NMED clearly acknowledges that Cañon Largo "…is the primary source of excessive fine sediment loads…", as stated in the first half the quote on page 13 listed above. NMED is acknowledging that land management practices, such as grazing and road development associated with oil and gas, do occur in the watershed that could be contributing to sediment impairment. The National Sedimentation Lab report (Heins et al 2004) also mentions anthropogenic changes in the watershed.*

Finally, NMED states that

> USEPA Region 6 has determined that Reach 2 of the San Juan River does not fall under Category 4B because the Navajo Reservoir Operations Final Environmental Impact Statement with the preferred alternative is not yet in place. Spring releases are only required when adequate water is available based on anticipated inflow predictions and current reservoir storage. Spring releases did not occur in 2002, 2003, or 2004 based on the decision matrix. Therefore, Reach 2 will be categorized as Category 5A and scheduled for TMDL development.

For all of the reasons outlined above, SJWC disagrees with this position, and with the impairment designation for Reach 2 of the San Juan River. To summarize:

1. The definition of sedimentation/siltation impairment is arbitrary based on the methodology used.

2. Two months' of sampling during a drought is inadequate to characterize Reach 2 as impaired.

3. Sediment accumulation in Reach 2 has occurred historically and would occur with or without anthropogenic influences.

4. NMED has misinterpreted the influence of Navajo Dam on sedimentation.

5. Biological data contradicts the impairment designation.

Thus, SJWC requests that NMED (i) re-evaluate its position with respect to Reach 2 and (ii) recommend to the WQCC that Reach 2 be de-listed as impaired for stream bottom deposits.

***RESPONSE**: Thank you for your comments. NMED's hopes our responses have increased SJWC's understanding of the National Sedimentation Lab study, SWQB protocol, and impairment determinations. NMED believes the study and protocol are technically-sound and adequate to make the proposed Sedimentation/Siltation impairment determination.*

Thank you for your consideration of these comments. If further discussion would be helpful, please do not hesitate to contact me or the Executive Director of SJWC, Mr. Randy Kirkpatrick.

Sincerely,

Jolene L. McCaleb

JLM:ma