WATER QUALITY SURVEY SUMMARY

FOR THE

RIO PUERCO, SAN JUAN, AND LITTLE COLORADO WATERSHEDS

2021-2022

Bluewater Creek near Thoreau, NM

Prepared by
Surface Water Quality Bureau
New Mexico Environment Department

August 2023

Water quality surveys and assessments conducted by the New Mexico Environment Department Surface Water Quality Bureau are completed to fulfill Section 106 of the Clean Water Act [33 USC 1251 et seq.], Work Program for Water Quality Management. This project was funded, in part, by a grant from the U.S. Environmental Protection Agency.

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ACRONYMS

AU	Assessment Unit
BLM	Bureau of Land Management
CALM	Comprehensive Assessment and Listing Methodology
CWA	Clean Water Act
IR	State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report
MASS	Monitoring, Assessment, and Standards Section
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Non-point Source
PCB	Polychlorinated biphenyl
PSRS	Point Source Regulation Section
QAPP	Quality Assurance Project Plan
SLD	Scientific Laboratory Division
SOP	Standard Operating Procedure
SWQB	Surface Water Quality Bureau
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
USEPA	United States Environmental Protection Agency
USFWS	United States Forest Service
WPS	Watershed Protection Section
WQ	Water Quality
WQCC	Water Quality Control Commission
WQS	Water Quality Standards
WTU	Work Time Unit
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

The SWQB conducts concentrated watershed-based water quality surveys to fulfill work plan requirements of the Clean Water Act (CWA) Section 106 grant. This grant provides federal funding to ensure that high quality, defensible data are collected and available to make informed resource management decisions. Data are publicly available to interested parties by making a formal request to the SWQB Monitoring, Assessment, and Standards Section or by downloading from the Environmental Protection Agency's Water Quality Data Portal[1]. The purpose of water quality sampling is to assess the quality of surface waters in the state, determine where water quality standards are not being met (i.e., where water quality is impaired), and to inform development of Total Maximum Daily Loads (TMDLs) for impaired waters, which lay the foundation for restoring these waters. Assessment conclusions are published in the State of New Mexico 303(d)/305(b) Integrated Report, available from the SWQB website[2].

The project area includes the Rio Puerco, San Juan, and Little Colorado watersheds HUCs 15020006, 15020004, 15020003, 15020002, 15020001, 13020207, 13020206, 13020205, and 13020204 (**Figure 1**). Lake sampling was conducted at Quemado Lake and Bluewater reservoir.

Historic and current land uses in the watersheds include agriculture (range, pasture, and croplands), mining, oil and gas, forest, grassland, residential, shrubland, water, and wetlands. Land ownership in the watershed includes tribal lands, Bureau of Land Management (BLM), U.S. Forest Service, Bureau of Reclamation (USFS BOR), National Park Service, New Mexico State Parks, New Mexico Department of Game and Fish, and state and private parcels. The study areas incorporate Rio Puerco, Rio San Jose, and Little Colorado River basins and together encompass approximately 13,789 square miles (35,713 square kilometers) in New Mexico. The watersheds are in Omernik Level III Ecoregions 21 (Southern Rockies), 22 (Arizona/New Mexico Plateau), and 23 (Arizona/New Mexico Mountains) (USEPA 2006).

Rivers are divided into assessment units (AUs) based on differing geological and hydrological properties, and each AU is assessed individually using data from one or more monitoring sites located within the AU. Selected monitoring locations were sampled for water quality constituents 4-8 times over two years. The total number of samples for each location was determined through a priority ranking of Integrated Report (IR) classification, presence of point source discharge, and TMDL status, among other considerations. The framework for monitoring prioritization is discussed in the SWQB 10-Year Monitoring and Assessment Strategy (NMED/SWQB 2016). Monitoring activities conducted at each site are summarized in **Tables 6** and **7**.

1.1 Principal Investigators

Table 1 details the responsibilities for this project. Each team member was responsible for implementing the assigned responsibilities. Questions or comments regarding this survey report should be directed to the MASS project coordinators.

[1] https://www.waterqualitydata.us/portal/

[2] https://www.env.nm.gov/surface-water-quality/303d-305b/

Table 1. Personnel Roles and Responsibilities

Team Member	Position/Role	Responsibilities
Kris Barrios Monitoring, Assessment, Standards Kristopher.Barrios@state.nm.us 505- 946-8713	Program Manager	Program Manager responsibilities are completed in coordination with the Project Manager. Approve FSP, directs staff to publish the FSP according to program and/or grant requirements. Manage project personnel and resources throughout the project in coordination with Project Supervisor and Project Manager(s). Provide oversight and coordinate with QAO and Project Manager(s) on data collection activities not conducted in accordance with the FSP, QAPP, or current SOPs. Conduct environmental data collection activities in accordance with the developed FSP, QAPP, and current SWQB SOPs.

Team Member	Position/Role	Responsibilities
Charles Dentino Monitoring Team Supervisor Charles.Dentino1@env.nm.gov 505-946-8868	Project Manager	Manage project resources throughout the project in coordination with Program Manager and Project Supervisor. Conduct environmental data collection activities in accordance with the developed FSP, QAPP, and current SWQB SOPs. Data collection activities not conducted in accordance with the FSP, QAPP, or current SOPs will be documented and reported to the Program Manager and QAO. Conduct mid-survey meeting with team to discuss any changes to the project plan. Coordinate and conduct post-survey meeting with team to discuss differences between planned and actual sampling and what data gaps, if any, exist. Write, coordinate, and assemble report and/or other grant deliverables required of the project.
David Atencio Monitoring Team Scientist David.Atencio@env.nm.gov 505-365-3396 Eliza Martinez Monitoring Team Scientist Eliza.Martinez @env.nm.gov 505-819-8099 Diane Van Hoy Monitoring Team Scientist Diane.Van-Hoy@env.nm.gov 505-469-7658	Project Team	Conduct environmental data collection activities in accordance with the developed FSP, QAPP, and current SWQB SOPs. Data collection activities not conducted in accordance with the FSP, QAPP, or current SOPs will be documented and reported to the Project Manager. Maintain project files in dedicated survey folder. Calibration worksheets and field forms utilized for data collections will be maintained according to SOPs. Write assigned sections of reports and/or other grant deliverables required throughout the project.
Miguel Montoya Miguel.Montoya@env.nm.gov 505-819-9882	Quality Assurance Officer (QAO)	Approve and ensure FSP is retained in accordance with 1.21.2 NMAC, Retention and Disposition of Public Records. Conduct audits as needed to ensure compliance with FSP, QAPP and SOPs.

2.0 PROJECT DESCRIPTION

2.1 Background

Section 303(d) of the Federal Water Pollution Control Act, known as the Clean Water Act (CWA), requires that each state submit to the U.S. Environmental Protection Agency (EPA) a list of water quality limited segments that require load allocations, waste load allocations, and TMDLs. The current §303(d) Program in New Mexico consists of three major steps: monitoring of surface waters; assessing monitoring data against water quality standards (WQS); and developing TMDLs for those waters not meeting water quality standards (i.e., impaired).

CWA §305(b) requires that each state also submit a biennial report to the U.S. Congress through the EPA. The two requirements are combined into *The State of New Mexico §303(d)/§305(b) Integrated List and Report* (NMED/SWQB 2022) (IR). It also serves as a source of basic information on water quality and water pollution control programs in New Mexico.

In accordance with the above stated statutory requirements, the IR report contains the following information:

- An assessment of surface water quality;
- An analysis of the extent to which the CWA §101(a) goal of surface water quality to provide for protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water is being achieved;
- An overview of progress in water pollution control and recommendations for further action; and
- A description of the nature of nonpoint source pollution and of programs for nonpoint source control.

The activities described in this Report are focused toward meeting the goals of the most recent, EPA-approved IR (NMED/SWQB 2022). The impairments for AUs in this survey area listed in **Table 2** were identified during the SWQB's most recent survey of this watershed, conducted 2011, and may include data from a variety of other investigations. The "IR Category" column provides the current AU's status in the IR (see **Appendix A** for definitions). "WQS Reference" provides the applicable Water Quality Standard reference as assigned to each AU and described in 20.6.4 New Mexico Administrative Code (NMAC) as governed by the New Mexico Water Quality Control Commission (WQCC) (NMAC 2022). The purpose of 20.6.4 NMAC is to establish WQS that consist of applicable designated uses of surface waters of the state, the water quality criteria necessary to protect those uses, and an antidegradation policy. The "TMDL Completed" column lists the EPA-approved TMDLs for the AU.

Monitoring of surface waters across the State occurs on a ten-year watershed rotation, meaning a given waterbody is generally surveyed intensively, on average, every ten years. Monitoring occurs during the non-winter months (March through November); focuses on physical, chemical, and biological conditions in perennial waters; and includes sampling for most pollutants that have numeric and/or narrative criteria in the WQS. Each AU is represented by a small number of monitoring stations (often only one), each of which receives 4-8 site visits during the survey.

The monitoring described in this report was planned and documented in a Field Sampling Plan (SWQB 2021a) prepared in accordance with SWQB Standard Operating Procedure 2.1: Field Sampling Plan Development and Execution (NMED/SWQB 2019). The Plan describes project objectives and decision

criteria, and it includes the sampling schedule with locations, constituents, and frequencies for physical, chemical, and biological data collection. Through public outreach, inter-agency coordination, and a scoring system which considers a variety of factors, a three-tier monitoring system primary, secondary, and tertiary was developed to prioritize AUs. High ranking priority waters (primary AUs) received the greatest amount of monitoring, whereas low ranking waters (i.e., tertiary AUs) received the least. The two-year monitoring allows more data to be collected from the highest priority waters to better capture inter-annual variability due to hydrologic conditions during sampling events, and year-2 monitoring may be adjusted dependent on year-1 analytical results.

Assessment of surface waters against the WQS occurs after monitoring data have been verified and validated, using the most recent assessment protocols. Assessment protocols are updated every odd year (e.g., 2023) and are opened for EPA and public review and comment. Waterbodies determined to be impaired are reported as such every even year (e.g., 2024, 2026) on New Mexico's IR List. TMDLs or TMDL alternatives are typically developed for impaired AUs.

Table 2. Impairment and TMDL Status of Survey Assessment Units

Assessment Unit Name	WQS Reference	IR Category	Impairments	TMDL Completed
Bluewater Creek (Perennial prt Bluewater Rsvr to headwaters)	20.6.4.109	4A	Temperature	Nutrients|Temperature
Bluewater Creek (Perennial prt R San Jose to Bluewater Rsvr)	20.6.4.109	4A	Nutrients|Temperature	Nutrients|Temperature
Bluewater Lake	20.6.4.135	5/5A	Nutrients	
La Jara Creek (Perennial reaches abv Arroyo San Jose)	20.6.4.109	4A	Aluminum, Total Recoverable	Aluminum, Total Recoverable
Largo Creek (Carrizo Wash to headwaters)	20.6.4.98	3/3A		
Nacimiento Ck (Perennial prt HWY 126 to Clear Creek)	20.6.4.109	4A	Aluminum, Total Recoverable|Turbidity| Uranium, Dissolved	Aluminum, Total Recoverable|Turbidity| Uranium, Dissolved
Puerco River (Gallup WWTP to South Fork Puerco R)	20.6.4.98	3/3A		
Puerco River (non-tribal AZ border to Gallup WWTP)	20.6.4.99	5/5A	Ammonia, Total	
Quemado Lake	20.6.4.453	5/5A	Nutrients	
Ramah Reservoir	20.6.4.452	5/5A	Nutrients	
Rio Puerco (Arroyo Chijuilla to northern bnd Cuba)	20.6.4.131	5/5C	Ammonia, Total|Nutrients| Sedimentation/Siltation	Ammonia, Total|Nutrients| Sedimentation/Siltation
Rio Puerco (non-pueblo Arroyo Chico to Arroyo Chijuilla)	20.6.4.130	1		
Rio Puerco (non-pueblo Rio Grande to Arroyo Chico)	20.6.4.130	5/5C	*E. coli*|Mercury, Total	
Rio Puerco (Perennial prt northern bnd Cuba to headwaters)	20.6.4.109	4A	Sedimentation/Siltation	Sedimentation/Siltation
Rio San Jose (non-tribal HWY 117 to Grants BNSF RR crossing)	20.6.4.99	1		
Rito de los Pinos (Arroyo San Jose to headwaters)	20.6.4.98	3/3A		

Assessment Unit Name	WQS Reference	IR Category	Impairments	TMDL Completed
Rito Leche (Intermittent reaches above HWY 126)	20.6.4.98	2		
Rito Leche (Rio Puerco to Hwy 126)	20.6.4.98	2		
Senorito Creek (Nacimiento Mine to headwaters)	20.6.4.109	2		
Senorito Creek (San Pablo Canyon to Nacimiento Mine)	20.6.4.98	2		

2.2 Objectives

Table 3 outlines the project objectives that have been identified to meet the various needs within the SWQB. The SWQB determined its data needs based on impairments from previous studies, identified data gaps, and consultation with SWQB MASS, PSRS, and WPS staff as well as other state agencies, federal agencies, tribes, local watershed groups, and interested parties.

Table 3. Project Objectives

Purpose for Water Quality Data Collection	Question to be answered	Decision Criteria	Products/ Outcomes
Assess designated use attainment for the *Integrated Report* and provide information to the public on the condition of surface waters	Are sampled waterbodies meeting WQS criteria?	WQS criteria interpreted through the CALM	Integrated Report
Develop load and waste load allocations for TMDLs	What is the maximum pollutant load a waterbody can receive and meet the requirements of the WQS?	WQS criteria and critical flow volume	TMDL loading calculations and NPDES permit limits
Evaluate restoration and mitigation measures implemented to control NPS pollution	Have watershed restoration activities and mitigation measures improved water quality?	WQS criteria and historic data	Project Summary Reports, NPS Annual Report, *Integrated Report (De-Listing)*
Develop or refine the WQS	Are the existing uses appropriate for the waterbody?	Data sufficient to support a petition to the WQCC to revise WQS	Use Attainability Analyses (UAA); Site Specific Criteria; Amendments to WQS

Obtain data for ambient/baseline water quality upstream of NPDES outfall	What is the water quality above the NPDES outfall?	Survey chemical, physical and biological data	NPDES Permits / Certifications

2.3 Schedule

As part of the survey planning process, the NMED SWQB held a 30-day public comment period to solicit input on any areas of concern within the AUs surveyed and to inform interested parties about the SWQB water quality survey process, the specific sampling plans in the watershed, and the assessment and TMDL processes.

The NMED SWQB documented the progress of this project and tracked it from inception through implementation to ensure all sampling and analytical activities were performed in accordance with all applicable requirements and in a cost-effective manner**. Table 4** provides the project timeline.

Water chemistry results typically take several months to return from the analytical laboratory, the New Mexico Scientific Laboratory Division (SLD). The NMED SWQB has incorporated the lag time to receive results into the schedule. When sample results are received, they undergo verification and validation according to SWQB SOPs. The final step of the project is the publication of a survey report on the SWQB website that summarizes the data collection effort and documents changes to the original and revised FSP. The final survey report will be made available at: https://www.env.nm.gov/surface-water-quality/water-quality-monitoring/.

Following project completion, the data will be assessed for incorporation into the 2024-2026 IR List. Once the assessments are complete, the TMDL development process will begin for any identified impairments.

Table 4. Project Schedule

Activity	Winter 2020-2021	Spring 2021	Summer 2021	Fall 2021	Winter 2021-2022	Spring 2022	Summer 2022	Fall 2022	Winter 2022-2023	Spring 2023	Fall 2023
Survey Planning, Site Reconnaissance, and Public Input Period	==========	▶									
Data Collection & Submittal of WQ Samples to SLD		==========	==========	▶		==========	==========	▶			
Data Verification & Validation Procedures, Assessment of data		==========	==========	==========	==========	==========	==========	==========	==========	==========	▶
Publication of Survey Report									==========	==========	▶

2.4 Project Location

The project area includes the Rio Puerco, Rio San Jose, and Little Colorado River watersheds. The Rio Puerco watershed includes the Rio Puerco and tributaries from the headwaters near Cuba, NM to the Rio Grande south of Belen, NM. The Rio San Jose survey area includes the Rio San Jose and Bluewater Creek watersheds. The Little Colorado River survey area includes the Puerco River, Ramah Lake, and Quemado Lake. **Table 5** shows a complete list of stations illustrated in **Figures 2 and 3**.

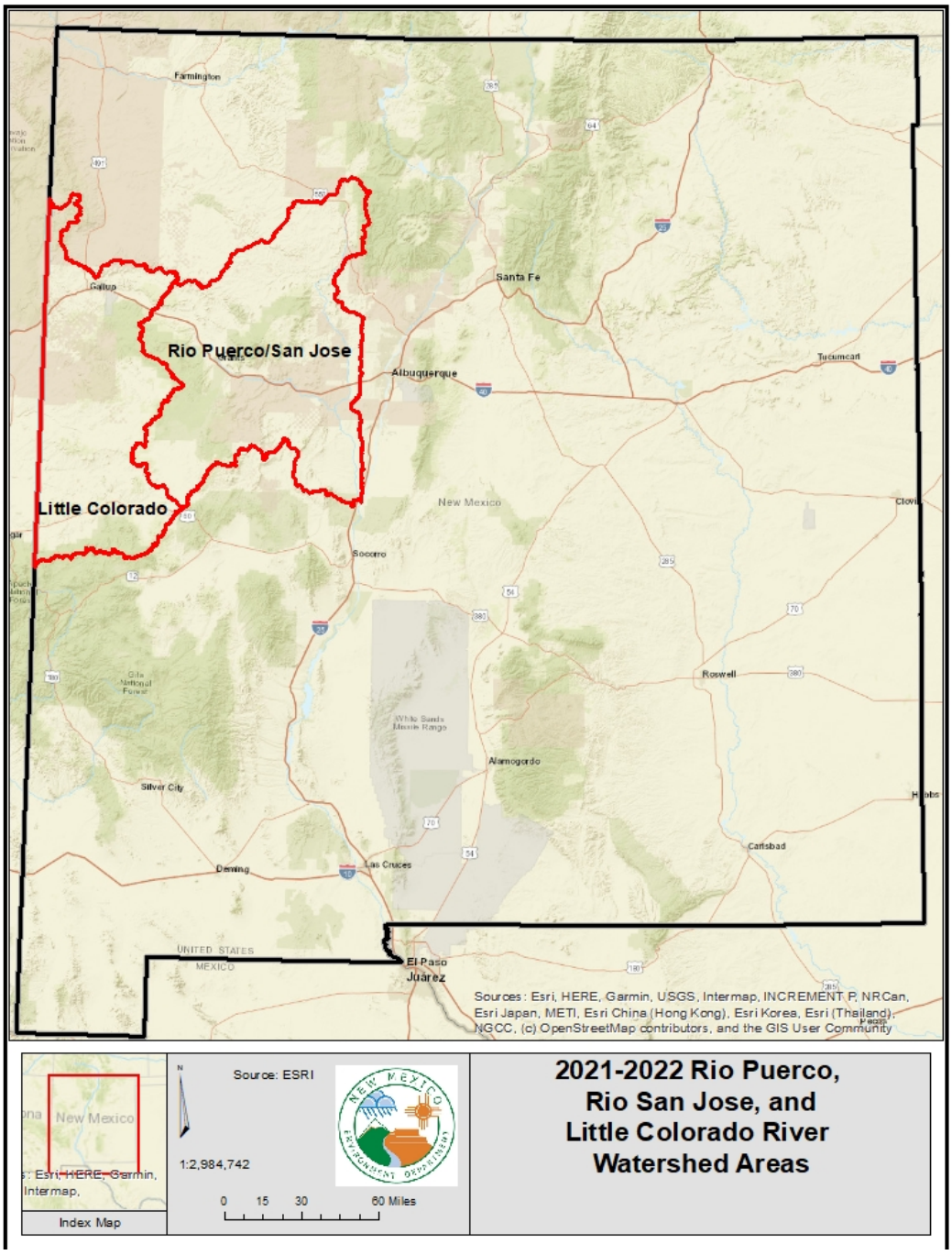

Figure 1. 2021-2022 Survey Area

Table 5. Water Quality Stations

Map #	Station Name	Station ID	Assessment Unit	Rationale/Comments
1	Bluewater Creek above Bluewater Lake at USGS gage 8341300 - 36Bluewa018.9	36Bluewa018.9	Bluewater Creek (Perennial prt Bluewater Rsvr to headwaters)	AU impaired for temperature, inlet station for Bluewater Lake
2	Bluewater Creek at Forest Road 178- 36Bluewa023.2	36Bluewa023.2	Bluewater Creek (Perennial prt Bluewater Rsvr to headwaters)	Station 18.9 is often dry.
3	BLUEWATER CREEK AT MOUTH OF BLUEWATER CANYON - 36Bluewa003.5	36Bluewa003.5	Bluewater Creek (Perennial prt R San Jose to Bluewater Rsvr)	AU impaired for nutrients and temperature
4	Bluewater Creek blw Dam - 36Bluewa016.7	36Bluewa016.7	Bluewater Creek (Perennial prt R San Jose to Bluewater Rsvr)	Outlet for Bluewater Lake
5	BLUEWATER LAKE AT DAM - 36BluWaterLkDm	36BluWaterLkDm	Bluewater Lake	AU impaired for nutrients
6	BLUEWATER LAKE NEAR PINE CANYON - 36BluWaterLkSh	36BluWaterLkSh	Bluewater Lake	AU impaired for nutrients
7	Cuba WWTP effluent - NM0024848	NM0024848	Rio Puerco (Arroyo Chijuilla to northern bnd Cuba)	NPDES permit
8	Gallup WWTP - NM0020672	NM0020672	Puerco River (non-tribal AZ border to Gallup WWTP)	NPDES permit
9	La Jara Creek abv irrigation diversion - 33LaJara009.7	33LaJara009.7	La Jara Creek (Perennial reaches abv Arroyo San Jose)	AU impaired for aluminum
10	Largo Creek abv Quemado Lake - 74LargoC071.5	74LargoC071.5	Largo Creek (Carrizo Wash to headwaters)	Lake Inlet
11	Largo Creek blw Quemado Reservoir - 74LargoC068.2	74LargoC068.2	Largo Creek (Carrizo Wash to headwaters)	Lake outlet
12	Nacimiento Creek at Eureka Rd. - 33Nacimi008.0	33Nacimi008.0	Nacimiento Ck (Perennial prt HWY 126 to Clear Creek)	AU impaired for aluminum, turbidity, and uranium. Below mine
13	Puerco River at Allison River - 76Puerco036.6	76Puerco036.6	Puerco River (Gallup WWTP to South Fork Puerco R)	Lowest Station in AU, abv WWTP
14	Puerco River at CR -1 - 76Puerco029.1	76Puerco029.1	Puerco River (non-tribal AZ border to Gallup WWTP)	AU impaired for ammonia
15	Quemado Dam - 74QuemadoDam	74QuemadoDam	Quemado Lake	Lake impaired for nutrients
16	RAMAH Reservoir DEEP Near DAM - 75RamahLKDeep	75RamahLKDeep	Ramah Reservoir	Lake impaired for nutrients
17	Rio Puerco abv northern bnd Cuba - 33RPuerc249.1	33RPuerc249.1	Rio Puerco (Perennial prt northern bnd Cuba to headwaters)	Station at 256.0 does not represent the lower AU

Map #	Station Name	Station ID	Assessment Unit	Rationale/Comments
18	Rio Puerco at CR13 Bridge - 33RPuerc256.0	33RPuerc256.0	Rio Puerco (Perennial prt northern bnd Cuba to headwaters)	Lowest station in AU
19	Rio Puerco at HWY 197 Bridge - 33RPuerc245.8	33RPuerc245.8	Rio Puerco (Arroyo Chijuilla to northern bnd Cuba)	Access abv WWTP at 244.0 can be locked
20	Rio Puerco at Hwy 279 Bridge near San Luis - 33RPuerc198.4	33RPuerc198.4	Rio Puerco (non-pueblo Arroyo Chico to Arroyo Chijuilla)	Lowest station in AU
21	Rio Puerco at I-25 - 33RPuerc004.6	33RPuerc004.6	Rio Puerco (non-pueblo Rio Grande to Arroyo Chico)	AU impaired for *E. coli* and Mercury, lowest station in AU
22	Rio Puerco at I-40 - 33RPuerc102.2	33RPuerc102.2	Rio Puerco (non-pueblo Rio Grande to Arroyo Chico)	Added due to long AU
23	Rio Puerco blw WWTP at Sanchez Property - 33RPuerc241.8	33RPuerc241.8	Rio Puerco (Arroyo Chijuilla to northern bnd Cuba)	AU impaired for ammonia, nutrients, sedimentation/siltation, lowest station in AU
24	Rio San Jose abv Unnamed Arroyo - 36RSanJo119.6	36RSanJo119.6	Rio San Jose (non-tribal HWY 117 to Grants BNSF RR crossing)	Above WWTP
25	Rio San Jose at Hwy 117 - 36RSanJo111.0	36RSanJo111.0	Rio San Jose (non-tribal HWY 117 to Grants BNSF RR crossing)	Lowest station in AU
26	Rito de los Pinos at USFS gate on FR 95 - 33RPinos006.8	33RPinos006.8	Rito de los Pinos (Arroyo San Jose to headwaters)	Most likely station in AU to be wet
27	Rito Leche at Cubita Rd. - 33RLeche001.3	33RLeche001.3	Rito Leche (Rio Puerco to Hwy 126)	Only station in AU, likely dry
28	Rito Leche at Hwy 126 - 33RLeche002.6	33RLeche002.6	Rito Leche (Intermittent reaches above HWY 126)	Lowest station in AU
29	Senorito Creek abv Nacimiento Mine - 33Senori008.8	33Senori008.8	Senorito Creek (Nacimiento Mine to headwaters)	Above mine
30	Senorito Creek blw Nacimiento Mine - 33Senori006.8	33Senori006.8	Senorito Creek (San Pablo Canyon to Nacimiento Mine)	Lowest station in AU, below mine

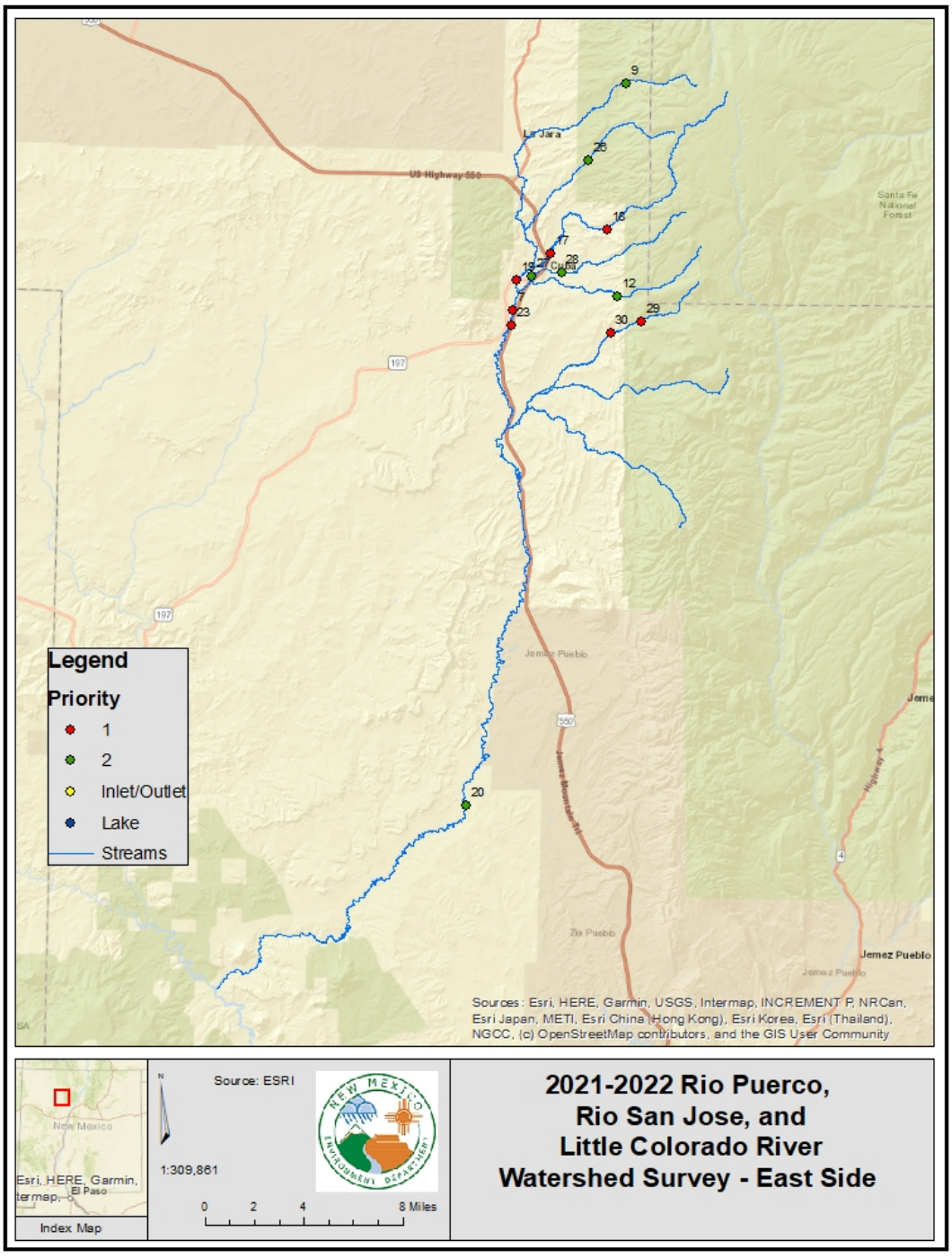

Figure 2. Rio Puerco, Rio San Jose, and Little Colorado River Sampling Locations – East Side

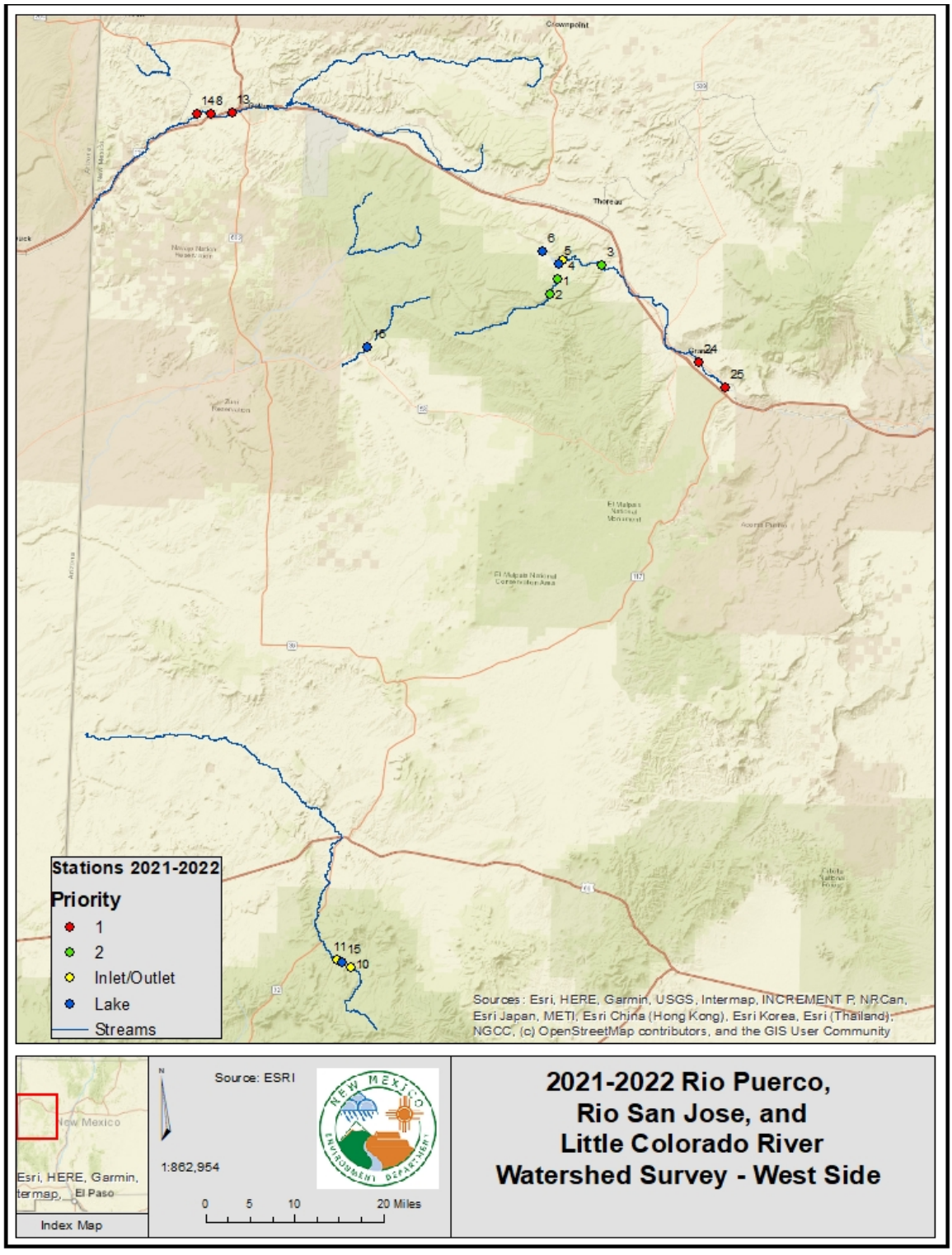

Figure 3. Rio Puerco, Rio San Jose, and Little Colorado River Sampling Locations – West Side

3.0 DOCUMENTATION

Project documents include the field sampling plan, probable source sheets, calibration records, field sheets (including sonde and thermograph deployment/retrieval sheets), electronic data logger downloads, data validation and verification records, sample collection data, lab submittal forms, and records of analytical data in hard copy or in electronic form. Documents are maintained in accordance with the requirements of the SWQB Quality Assurance Project Plan (QAPP; NMED/SWQB 2021b).

Project documentation will include narrative descriptions of progress throughout the life of the project relating to planning and implementation efforts, including deviations from the original plan and issues that arise along with any associated corrective actions.

Project activities will be documented in SWQB Monitoring Field Sheets. Information from field sheets is entered in the SWQB database or maintained in the Project Coordinator's survey files at the conclusion of the project. Analytical results are electronically transferred into the Bureau's database and eventually moved to US EPA'S Water Quality Exchange database. The project is completed with the finalization of this Survey Report.

4.0 SAMPLING PLAN

4.1 Methods

All data were collected in accordance with procedures documented in the SWQB QAPP (NMED/SWQB 2021b) and the applicable SWQB Standard Operating Procedures for Data Collection available at https://www.env.nm.gov/surface-water-quality/protocols-and-planning/. Water quality samples were submitted to the SLD or processed in the SWQB laboratory in accordance with procedures as outlined in the SWQB SOPs.

4.2 Chemistry Sampling

For the survey, one chemical sampling station was planned near the lower end of each AU, access permitting, and at actively discharging NPDES permit locations in the watershed. Additional stations were located to document the conditions downstream of potential pollution sources and where AU or water quality standards revisions are recommended. Stations from previous surveys were used whenever possible to evaluate trends. Water samples for chemical analyses were submitted to the New Mexico Scientific Laboratory Division (SLD). E. coli samples were processed in the SWQB laboratory or with mobile equipment. **Table 6** outlines the water quality analytes measured and the sampling conducted for each analyte during the two-year survey. In addition to the analytes listed, field parameters (temperature, specific conductance, salinity, dissolved oxygen concentration, dissolved oxygen saturation, pH, and turbidity) were measured at each site using a multi-parameter sonde.

Table 6. Water Chemistry Sampling Frequency

Map #	Station Name	TDS/TSS		Total Nutrients (TP, NH4, TKN, Nitrate+Nitrite)		Dissolved Organic Carbon		Total Metals[1]		Dissolved Metals[2]		SWQB E. *coli*		Volatile Organics[3]		Semi-Volatile Organics[4]		Radionuclides[5]	
Planned/Completed		P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
1	Bluewater Creek above Bluewater Lake at USGS gage 8341300 - 36Bluewa018.9	4		4		4		4		4		4							
2	Bluewater Creek at Forest Road 178 - 36Bluewa023.2	4	3	4	3	4	2	4	3	4	3	4	3						
3	BLUEWATER CREEK AT MOUTH OF BLUEWATER CANYON - 36Bluewa003.5	4	3	4	3	4	2	4	3	4	3	4	3						
4	Bluewater Creek blw Dam - 36Bluewa016.7	4	2	4	2	4	1	4	2	4	2	4	2						
5	BLUEWATER LAKE AT DAM - 36BluWaterLkDm	4	2	4	2	4	1	4	2	4	2	4	2	2	1	2	1	2	2
6	BLUEWATER LAKE NEAR PINE CANYON - 36BluWaterLkSh	4		4		4						4							
7	Cuba WWTP effluent - NM0024848	8		8								8							
8	Gallup WWTP - NM0020672	8	7	8	7		2		4		4	8	7						
9	La Jara Creek abv irrigation diversion - 33LaJara009.7	4	4	4	4	4	3	4	4	4	4	4	4						
10	Largo Creek abv Quemado Lake - 74LargoC071.5	1		1		1						1							
11	Largo Creek blw Quemado Reservoir - 74LargoC068.2	1		1		1						1							
12	Nacimiento Creek at Eureka Rd. - 33Nacimi008.0	4	4	4	4	4	2	4	4	4	4	4	4						
13	Puerco River at Allison Road - 76Puerco036.6	8	3	8	3	6	1	6	2	6	2	8	3						
14	Puerco River at CR -1 - 76Puerco029.1	8	8	8	8	6	2	6	5	6	6	8	8						
15	Quemado Dam - 74QuemadoDam	4	1	4	1	4	1	4	1	4	1	4	1	2	1	2	1	2	1
16	RAMAH Reservoir DEEP Near DAM - 75RamahLKDeep	4	1	4	1	4		4	1	4	1	4	1	2		2		2	1

Map #	Station Name	TDS/TSS		Total Nutrients (TP, NH4, TKN, Nitrate+Nitrite)		Dissolved Organic Carbon		Total Metals[1]		Dissolved Metals[2]		SWQB E. *coli*		Volatile Organics[3]		Semi-Volatile Organics[4]		Radionuclides[5]	
17	Rio Puerco abv northern bnd Cuba - 33RPuerc249.1	8	6	8	6	6	3	6	6	6	6	8	6						
18	Rio Puerco at CR13 Bridge - 33RPuerc256.0	8	5	8	5	6	3	6	5	6	5	8	5						
19	Rio Puerco at HWY 197 Bridge - 33RPuerc245.8	8	6	8	6	6	3	6	6	6	6	8	7	2	2	2	2	2	3
20	Rio Puerco at Hwy 279 Bridge near San Luis - 33RPuerc198.4	4	3	4	3	4		4	3	4	2	4	3						
21	Rio Puerco at I-25 - 33RPuerc004.6	8	3	8	3	6	2	6	3	6	3	8	3	2	1	2	1	2	1
22	Rio Puerco at I-40 - 33RPuerc102.2	4	4	4	4	4	1	4	2	4	1	4	4						
23	Rio Puerco blw WWTP at Sanchez Property - 33RPuerc241.8	8	6	8	6	6	3	6	5	6	5	8	6	2	2	2	2	2	2
24	Rio San Jose abv Unnamed Arroyo - 36RSanJo119.6	8	2	8	2	6	1	6	2	6	2	8	3	2	1	2	1	2	1
25	Rio San Jose at Hwy 117 - 36RSanJo111.0	8	6	8	6	6	3	6	6	6	6	8	7	2	3	2	3	2	3
26	Rito de los Pinos at USFS gate on FR 95 - 33RPinos006.8	4		4		4		4		4		4							
27	Rito Leche at Cubita Rd. - 33RLeche001.3	4	3	4	3	4		4	3	4	3	4	3						
28	Rito Leche at Hwy 126 - 33RLeche002.6	4	2	4	2	4		4	2	4	2	4	2						
29	Senorito Creek abv Nacimiento Mine - 33Senori008.8	8	4	8	4	6	1	6	4	6	4	8	4	2		2		2	1
30	Senorito Creek blw Nacimiento Mine - 33Senori006.8	8		8		6		6		6		8		2		2		2	
Total		166	88	166	88	128	37	122	78	122	77	166	91	20	11	20	11	20	15
Percent Completed		53.0		53.0		28.9		63.9		63.11		54.8		55.0		55.0		75.0	

[1]Suite includes aluminum, mercury, selenium
[2]Suite includes aluminum, antimony, arsenic, barium, boron, beryllium, calcium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, mercury, magnesium, nickel, selenium, silicon, silver, thallium, tin, uranium, vanadium, and zinc.

[3]See Appendix B for a complete list of analytes.

[4]See Appendix B for a complete list of analytes.
[5]Radionuclide samples include gross alpha and gross beta and depending on detections may include Uranium mass and Radium 226 + 228.

4.3 Long-term Dataset, Biological, and Physical Habitat Sampling

Temperature data loggers (thermographs) were deployed at strategic locations within the study area to record maximum and maximum-duration temperature data. Multi-parameter data loggers (sondes) and DO loggers were deployed at stations in selected assessment units primarily to examine diel fluxes in pH, conductivity, or dissolved oxygen (DO) and to record turbidity data for assessment against maximum-duration thresholds. Thermographs sondes, and DO loggers were programmed to record at 15-minute intervals. Thermographs were deployed season long (approximately May to October). Sondes and DO loggers were deployed for a minimum of 14 days. Chlorophyll and phytoplankton data were collected at lake stations for nutrient assessments. Flow was collected for assessment and TMDL calculations. Physical habitat data includes stream morphology, pebble counts, canopy cover, large woody debris, and flow. **Table 7** summarizes the long-term, biological, and physical habitat sampling conducted during the survey.

Table 7. Summary of Long-Term Deployment, Biological and Physical Habitat Sampling

Map #	Station Name	Dissolved Oxygen		Turbidity		Conductivity		pH		Temperature		Flow		Physical Habitat		Chlorophyll a + Phytoplankton		Microcystins		Macroinvertebrates		Fish	
Planned/Completed		P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
1	Bluewater Creek above Bluewater Lake at USGS gage 8341300 - 36Bluewa018.9											8	3										
2	Bluewater Creek at Forest Road 178 - 36Bluewa023.2	1		1		1		1		1	1	4	3							1		1	
3	BLUEWATER CREEK AT MOUTH OF BLUEWATER CANYON - 36Bluewa003.5									1	1	8	3										
4	Bluewater Creek blw Dam - 36Bluewa016.7											4	2										

Map #	Station Name	Dissolved Oxygen		Turbidity		Conductivity		pH		Temperature		Flow		Physical Habitat		Chlorophyll a + Phytoplankton		Microcystins		Macroinvertebrates		Fish	
5	BLUEWATER LAKE AT DAM - 36BluWaterLkDm															4	2	2					1
6	BLUEWATER LAKE NEAR PINE CANYON - 36BluWaterLkSh															4		2					
7	Cuba WWTP effluent - NM0024848																						
8	Gallup WWTP - NM0020672																						
9	La Jara Creek abv irrigation diversion - 33LaJara009.7									1	1	8	5		Prob								
10	Largo Creek abv Quemado Lake - 74LargoC071.5											4	1										
11	Largo Creek blw Quemado Reservoir - 74LargoC068.2											4	1										
12	Nacimiento Creek at Eureka Rd. - 33Nacimi008.0	1		1		1		1		1	1	8	4										
13	Puerco River at Allison Road - 76Puerco036.6											8	6										
14	Puerco River at CR -1 - 76Puerco029.1											8	8										
15	Quemado Dam - 74QuemadoDam															4	1	2					1
16	RAMAH Reservoir DEEP Near DAM - 75RamahLKDeep															4	1	2					
17	Rio Puerco abv northern bnd Cuba - 33RPuerc249.1											8	6										
18	Rio Puerco at CR13 Bridge - 33RPuerc256.0											8	5	1									
19	Rio Puerco at HWY 197 Bridge - 33RPuerc245.8											8	7										
20	Rio Puerco at Hwy 279 Bridge near San Luis - 33RPuerc198.4											4	7										
21	Rio Puerco at I-25 - 33RPuerc004.6											8	5										

Map #	Station Name	Dissolved Oxygen		Turbidity		Conductivity		pH		Temperature		Flow		Physical Habitat		Chlorophyll a + Phytoplankton		Microcystins		Macroinvertebrates		Fish	
22	Rio Puerco at I-40 - 33RPuerc102.2											8	8										
23	Rio Puerco blw WWTP at Sanchez Property - 33RPuerc241.8											8	6										
24	Rio San Jose abv Unnamed Arroyo- 36RSanJo119.6											8	7										
25	Rio San Jose at Hwy 117 - 36RSanJo111.0									1		8	8										
26	Rito de los Pinos at USFS gate on FR 95 - 33RPinos006.8									1		4	2										
27	Rito Leche at Cubita Rd. - 33RLeche001.3											4	6										
28	Rito Leche at Hwy 126 - 33RLeche002.6									1		4	6										
29	Senorito Creek abv Nacimiento Mine - 33Senori008.8										1	8	5										
30	Senorito Creek blw Nacimiento Mine - 33Senori006.8									1		8	4										
	Total	2		2		2		2		8	5	160	118	1		16	4	8		1		1	2
	Percent Completed	0		0		0		0		62.5		73.8		0		25.0		0		0		200	

4.4 DEVIATIONS FROM THE FIELD SAMPLING PLAN

4.4.1 Sampling Station Changes

Bluewater Creek blw Restoration 36Bluewa002.5 and was not sampled due to lack of access and is not included in the tables or maps of this report. Bluewater Creek at FR 178 36Bluewa023.2 was added because Bluewater Creek above Bluewater Lake at USGS gage 8341300 36 Bluewa018.9 was always dry. Rio Puerco abv WWTP 33RPuerc244.0 was moved to Rio Puerco at HWY 197 Bridge - 33RPuerc245.8 due to issues with access. Station Rio Puerco abv northern bnd Cuba - 33RPuerc249.1 was added to be more representative of the AU then Rio Puerco at CR13 Bridge - 33RPuerc256.0.

4.4.2 Chemical Samples and Flow

Missing chemical samples are due to dry conditions, time limitations from staff shortages, and issues with sample location access for example after the 2021 sampling season Ramah Lake was closed to the public.

4.4.3 DO/Conductivity/Turbidity/pH Long-term Deployments

Long-term deployments were originally schedule for Bluewater Creek above Bluewater Lake at USGS gage 8341300 36Bluewa018.9 and Nacimiento Creek at Eureka Rd. - 33Nacimi008.0. The deployment at 36Bluewa018.9 was supposed to be moved to 36Bluewa023.2 due to dry conditions at 36Bluewa018.9. Due to time limitations from staff shortages, issues with malfunctioning sonde sensors that ended up having to be replaced, and sonde deployments for surveys in other watersheds no sondes were deployed during this survey.

4.4.4 Thermographs

The thermograph planned for Senorito Creek blw Nacimiento Mine 33Senori006.8 was moved to Senorito Creek abv Nacimiento Mine 33Senori008.8 due to flow conditions at Senorito Creek blw Nacimiento Mine 33Senori006.8. The thermographs planned for Rito Leche at Hwy 126 33RLeche002.6 and Rio San Jose at Hwy 117 36RSanJo111.0 were not deployed due to time limitations from staff shortages. Rito de los Pinos at USFS gate on FR 95 33RPinos006.8 was dry during both site visits, so no thermograph was deployed.

4.4.5 Chlorophyll and Phytoplankton

Missing chlorophyll and phytoplankton samples are due to time limitations from staff shortages and issues with sample location access for example after the 2021 sampling season Ramah Lake was closed to the public.

4.4.6 Microcystin Sampling

Although scheduled at lake stations, sample collection was not completed due to lack of visible algae blooms, which produce microcystins.

4.4.7 Macroinvertebrate Sampling

Macroinvertebrate sampling was originally planned for Bluewater Creek above Bluewater Lake at USGS gage 8341300 36Bluewa018.9. The sample at 36Bluewa018.9 was supposed to be moved to 36Bluewa023.2 due to dry conditions at 36Bluewa018.9. Due to time limitations from staff shortages, samples were not collected at 36Bluewa023.2.

4.4.8 Fish Sampling

Fish sampling was originally planned for Bluewater Creek above Bluewater Lake at USGS gage 8341300 36Bluewa018.9. The sample at 36Bluewa018.9 was supposed to be moved to 36Bluewa023.2 due to dry conditions at 36Bluewa018.9. Due to time limitations from staff shortages, samples were not collected at 36Bluewa023.2. Samples were collected at 36BluWaterLkDm and 74QuemadoDam as part of a joint sampling with the New Mexico Fish and Wildlife Department.

5.0 SUMMARY

The data from this project will be assessed to determine the impairment status of the sampled waters. The assessments are conducted in accordance with the Comprehensive Assessment and Listing Methodology (NMED/SWQB 2023) which is available on the SWQB website at https://www.env.nm.gov/surface-water-quality/calm/. Assessment conclusions will be incorporated into the 2024-2026 Integrated Report, which is planned for completion in 2024 and will be posted to the SWQB website at https://www.env.nm.gov/surface-water-quality/303d-305b/. In cases where impairments to water and habitat quality are found or confirmed, data from this survey will be used to draft TMDL planning documents.

To supplement data collected for this project, SWQB accepts readily available water quality data submitted from outside sources that meet SWQB QA/QC review and documentation requirements. Data from outside sources will undergo review by the SWQB QA Officer to ensure only data meeting specific requirements are used for assessment purposes.

The data from the 2021-2022 survey have been validated and verified according to SWQB SOP (NMED/SWQB 2020) and will be uploaded to USEPA's Water Quality Portal via The Water Quality Exchange (WQX) fall 2023. To download this dataset, visit the Water Quality Portal at https://www.waterqualitydata.us/portal/ and query Organization ID *21NMEX_WQX* and HUCs 15020006, 15020004, 15020003, 15020002, 15020001, 13020207, 13020206, 13020205, and 13020204. For assistance with queries to the portal, please contact the Project Coordinators listed in Table 1. The data collected during this survey are also available by public records request to the SWQB.

6.0 REFERENCES

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APPENDIX A: INTEGRATED REPORT CATEGORIES

IR (Integrated Report) Category: Overall water quality standards attainment category for each assessment unit as determined by combining individual designated use support decisions. The unique assessment categories for New Mexico are described as follows:

IR Category 1 Attaining the water quality standards for all designated and existing uses. AUs are listed in this category if there are data and information that meet all requirements of the assessment and listing methodology and support a determination that the water quality criteria are attained.

IR Category 2 Attaining some of the designated or existing uses based on numeric and narrative parameters that were tested, and no reliable monitored data is available to determine if the remaining uses are attained or threatened. AUs are listed in this category if there are data and information that meet requirements of the assessment and listing methodology to support a determination that some, but not all, uses are attained based on numeric and narrative water quality criteria that were tested. Attainment status of the remaining uses is unknown because there is no reliable monitored data with which to make a determination.

IR Category 3 Insufficient or no reliable data and/or information to determine if any designated or existing use is attained. AUs are listed in this category where sufficient data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology. In order to relay additional information to stakeholders including SWQB staff, Category 3 is further broken down in New Mexico into the following categories:

3A. Limited data available, no exceedances. AUs are listed in this subcategory when there are no exceedances in the limited data set. These are considered low priority for follow up monitoring.

3B. Limited data available, exceedance. AUs are listed in this subcategory when there is an exceedance in the limited data set. These are considered high priority for follow up monitoring.

IR Category 4A Impaired for one or more designated uses but does not require development of a TMDL because a TMDL has been completed. AUs are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of an AU, the AU remains in Category 5A (see below) until all TMDLs for each pollutant have been completed and approved by USEPA.

IR Category 4B Impaired for one or more designated uses but does not require development of a TMDL because other pollution control requirements are reasonably expected to result in

attainment of the water quality standard in the near future. Consistent with the regulation under 40 CFR 130.7(b)(i), (ii), and (iii), AUs are listed in this subcategory where other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard (WQS) applicable to such waters.

IR Category 4C Impaired for one or more designated uses but does not require development of a TMDL because impairment is not caused by a pollutant. AUs are listed in this subcategory if a pollutant does not cause the impairment. For example, USEPA considers flow alteration to be "pollution" vs. a "pollutant."

IR Category 5A Impaired for one or more designated or existing uses and a TMDL is underway or scheduled. AUs are listed in this category if the AU is impaired for one or more designated uses by a pollutant. Where more than one pollutant is associated with the impairment of a single AU, the AU remains in Category 5A until TMDLs for all pollutants have been completed and approved by USEPA.

IR Category 5B Impaired for one or more designated or existing uses and a review of the water quality standard will be conducted. AUs are listed in this category when it is possible that water quality standards are not being met because one or more current designated use is inappropriate. After a review of the water quality standard is conducted, a Use Attainability Analysis (UAA) will be developed and submitted to USEPA for consideration, or the AU will be moved to Category 5A and a TMDL will be scheduled.

IR Category 5C Impaired for one or more designated or existing uses and additional data will be collected before a TMDL is scheduled. AUs are listed in this category if there is not enough data to determine the pollutant of concern or there is not adequate data to develop a TMDL. For example, AUs with biological impairment will be listed in this category until further research can determine the pollutant(s) of concern. When the pollutant(s) are determined, the AU will be moved to Category 5A and a TMDL will be scheduled. If it is determined that the current designated uses are inappropriate, it will be moved to Category 5B and a UAA will be developed. If it is determined that "pollution" is causing the impairment (vs. a "pollutant"), the AU will be moved to Category 4C.

APPENDIX B: VOLATILE AND SEMI-VOLATILE ORGANIC ANALYTICAL SUITE

Organics (semi-volatiles)	Organics (volatiles)
1,2,4-Trichlorobenzene	1,1,1,2-Tetrachloroethane
1,2-Dichlorobenzene	1,1,1-Trichloroethane
1,2-Dinitrobenzene	1,1,2,2-Tetrachloroethane
1,3-Dichlorobenzene	1,1,2-Trichloroethane
1,3-Dinitrobenzene	1,1-Dichloroethane
1,4-Dichlorobenzene	1,1-Dichloroethene
1,4-Dinitrobenzene	1,1-Dichloropropene
1-Methylnaphthalene	1,2,3-Trichlorobenzene
2,3,4,6-Tetrachlorophenol	1,2,3-Trichloropropane
2,3,5,6-Tetrachlorophenol	1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol	1,2,4-Trimethylbenzene
2,4,6-Trichlorophenol	1,2-Dibromo-3-chloropropane (DBCP)
2,4-Dichlorophenol	1,2-Dibromoethane (EDB)
2,4-Dimethylphenol	1,2-Dichlorobenzene
2,4-Dinitrophenol	1,2-Dichloroethane
2,4-Dinitrotoluene	1,2-Dichloropropane
2,6-Dinitrotoluene	1,3,5-Trimethylbenzene
2-Chloronaphthalene	1,3-Dichlorobenzene
2-Chlorophenol	1,3-Dichloropropane
2-Methylnaphthalene	1,4-Dichlorobenzene
2-Methylphenol	1,4-Dioxane
2-Nitroaniline	2,2-Dichloropropane
2-Nitrophenol	2-Butanone (MEK)
3,3'-Dichlorobenzidine	2-Chloroethyl vinyl ether
3-Methylphenol & 4-Methylphenol	2-Chlorotoluene

Organics (semi-volatiles)	Organics (volatiles)
3-Nitroaniline	2-Hexanone
4,4'-DDD	4-Chlorotoluene
4,4'-DDE	4-Isopropyltoluene
4,4'-DDT	4-Methyl-2-pentanone
4,6-Dinitro-2-methylphenol	Acetone
4-Bromophenyl Phenyl Ether	Acetonitrile
4-Chloro-3-methylphenol	Acrolein
4-Chloroaniline	Acrylonitrile
4-Chlorophenyl Phenyl Ether	Allyl chloride
4-Nitroaniline	Benzene
4-Nitrophenol	Bromobenzene
Acenaphthene	Bromochloromethane
Acenaphthylene	Bromodichloromethane
Alachlor	Bromoform
Aldrin	Bromomethane
alpha-BHC	Carbon disulfide
Aniline	Carbon tetrachloride
Anthracene	Chlorobenzene
Atrazine	Chloroethane
Azobenzene	Chloroform
Benzidine	Chloromethane
Benzo(a)anthracene	Chloroprene
Benzo(a)pyrene	cis-1,2-Dichloroethene
Benzo(b)fluoranthene	cis-1,3-Dichloropropene
Benzo(g,h,i)perylene	cis-1,4-Dichloro-2-butene
Benzo(k)fluoranthene	Dibromochloromethane

Organics (semi-volatiles)	Organics (volatiles)
Benzyl alcohol	Dibromomethane
beta-BHC	Dichlorodifluoromethane
bis(2-Chloroethoxy)methane	Ethyl methacrylate
bis(2-Chloroethyl)ether	Ethylbenzene
bis(2-Chloroisopropyl)ether	Hexachlorobutadiene
bis(2-Ethylhexyl)adipate	Iodomethane
bis(2-Ethylhexyl)phthalate	Isobutyl alcohol
Butyl Benzyl Phthalate	Isopropylbenzene
Carbazole	m- & p-Xylenes
Chrysene	Methyl methacrylate
cis-Chlordane	Methylacrylonitrile
Cyanazine	Methylene chloride (Dichloromethane)
delta-BHC	Naphthalene
Dibenz(a,h)anthracene	n-Butylbenzene
Dibenzofuran	Nitrobenzene
Dieldrin	o-Xylene
Diethylphthalate	Pentachloroethane
Dimethylphthalate	Propionitrile
Di-n-butyl Phthalate	Propylbenzene
Di-n-octyl phthalate	sec-Butylbenzene
Endosulfan I	Styrene
Endosulfan II	tert-Butyl methyl ether (MTBE)
Endosulfan sulfate	tert-Butylbenzene
Endrin	Tetrachloroethene
Endrin aldehyde	Tetrahydrofuran (THF)
Endrin ketone	Toluene

Organics (semi-volatiles)	Organics (volatiles)
Fluoranthene	Total trihalomethanes
Fluorene	Total xylenes
gamma-BHC (lindane)	trans-1,2-Dichloroethene
Heptachlor	trans-1,3-Dichloropropene
Heptachlor epoxide	trans-1,4-Dichloro-2-butene
Hexachlorobenzene	Trichloroethene
Hexachlorobutadiene	Trichlorofluoromethane
Hexachlorocyclopentadiene	Vinyl acetate
Hexachloroethane	Vinyl chloride
Indeno(1,2,3-cd)pyrene	
Isophorone	
Methoxychlor	
Metolachlor	
Metribuzin	
Naphthalene	
Nitrobenzene	
N-nitrosodimethylamine	
N-nitroso-di-n-propylamine	
N-nitrosodiphenylamine	
Pentachlorophenol	
Phenanthrene	
Phenol	
Prometryne	
Pyrene	
Pyridine	
Simazine	

Organics (semi-volatiles)	Organics (volatiles)
trans-Chlordane	