Sampling Summary

Jemez River Watershed

Water Quality Survey

Survey Conducted
March, 2012 to November, 2014

Summary Prepared
March, 2015

Monitoring, Assessment and Standards Section
Surface Water Quality Bureau
New Mexico Environment Department
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Abbreviations

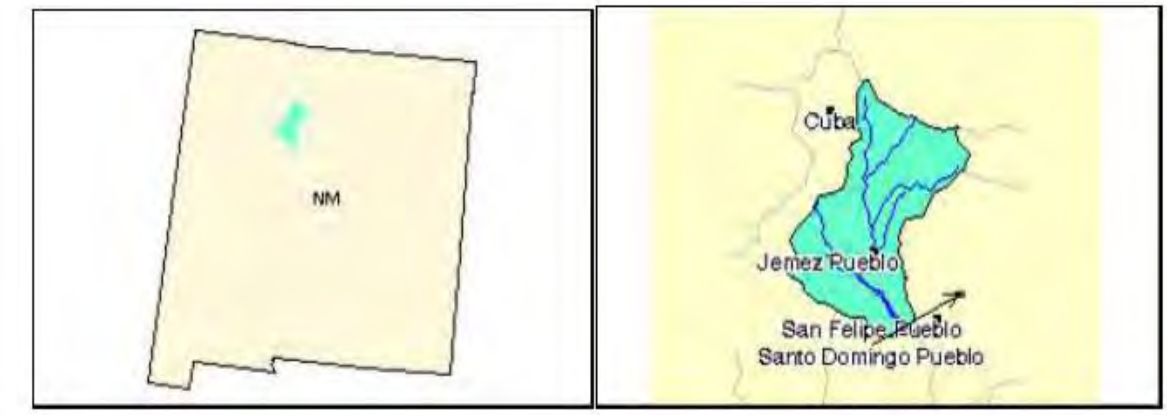
AP	Assessment Protocol
AU	Assessment Unit
BMP	Best Management Practice
BNSF	Burlington Northern – Santa Fe
CWA	Clean Water Act
FR	Forest Road
FSP	Field Sampling Plan
HP	Hydrology Protocol
IR	State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report
km	kilometer
m	meter
MASS	Monitoring, Assessment and Standards Section
NMED	New Mexico Environment Department
NMEDAS	New Mexico Environmental Data Analysis System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
PSRS	Point Source Regulation Section
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SLD	Scientific Laboratory Division
SOP	Standard Operating Procedures
SVOC	Semi-Volatile Organic Compounds
SWQB	Surface Water Quality Bureau
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
THM	Total Heavy Metals
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
VCNP	Valles Caldera National Preserve
VOC	Volatile Organic Compounds
WQCC	Water Quality Control Commission
WPS	Watershed Protection Section
WQS	Water Quality Standard
WWTP	Wastewater Treatment Plant

Introduction

The Jemez River Watershed is located in the Jemez Mountains, east of Cuba, New Mexico (Figure 1) and originates with high elevation streams located in the San Pedro Parks Wilderness and Valles Caldera that drain into the Rio San Antonio, the East Fork of the Jemez River, the Rio Cebolla and the Rio de las Vacas. The East Fork of the Jemez River and the Rio San Antonio join to form the main stem of the Jemez River below La Cueva, New Mexico, and the confluence of the Rio Cebolla and Rio de las Vacas at Porter Landing marks the origin of the Rio Guadalupe which joins the Jemez main stem below the village of Jemez Springs. In recent years, flow from the Jemez River is intermittent at the confluence with the Rio Grande on Santa Ana Pueblo.

Geologically, the Jemez River Watershed is dominated by the volcanic formations of the Valles Caldera. These basalts and tuffs form the floor and valley walls of much of the Rio San Antonio, East Fork of the Jemez River, and the Rio Cebolla. At the confluence of the Rio San Antonio and the East Fork of the Jemez River, The Jemez River cuts through the volcanic rock and into a series of sedimentary strata that form the valley floor in the lower elevation reaches of survey area.

Figure 1. Location of the Jemez Rver watershed in New Mexico.



All but the extreme lower terminus of the Jemez River watershed lies in Omerick level 3 ecoregion (Omerick and Griffifth, 2008) 21 (Southern Rockies). The streams in the Valles Caldera are primarily in level 4 ecoregions 21g (Volcanic Subalpine Forests) and 21j (Grassland Parks), while those on the western side of the watershed begin in 21b (Crystalline Subalpine Forests), 21c (Crystalline Mid-Elevation Forests), and descend through 21d (Foothill Woodlands and Shrublands), 21f (Sedimentary Mid-Elevation Forests), and 21h (Volcanic Mid-Elevation Forests). The confluence of the Jemez mainstem and the Rio Grande occurs in level 4 ecoregion 22m (Albuquerque Basin).

Land uses in the Jemez River Watershed include grazing, irrigated and dry-crop agriculture, silviculture, mining, and limited suburban development. The upper watershed is primarily forested cattle range, with some logging and pumice mining and is heavily used for recreational purposes such as fishing, camping, hunting, and off-road vehicle operation. The upper watershed has been subjected to long-term grazing by cattle and sheep, which has reduced native grasses and resulted in the establishment of exotic vegetation with diminished soil stabilizing abilities. In turn, this causes increased erosion and increased sedimentation in waterways (Muldavin and Tonne, 2003). Below the confluence of the Rio Guadalupe and the Jemez River there are diversions of water for irrigation.

Personnel Roles and Responsibilities

This survey was primarily conducted by the Surface Water Quality Bureau (SWQB) Monitoring, Assessment and Standards Section (MASS), but staff from other sections within SWQB were involved with planning, performing the work and using the data. Individual roles and responsibilities are described below (Table 1). In addition, long-term data was made available to the Surface Water Quality Bureau (SWQB) by the Santa Fe National Forest and the Valles Caldera National Preserve (VCNP).

Objectives

This survey had several objectives because the data it generates must serve the needs of all sections within the SWQB. These objectives are outlined in Table 2.

Table 1. Personnel roles and responsibilities.

Name	Position / Role	Responsibilities
Doug Eib 505-827-0106 Greg Huey 505-827-0596	Monitoring Staff	• Planned survey • Collected and documented chemical, biological, and habitat samples • Provided chemical, biological, and habitat results for final report • Wrote survey report
Dan Guevara 505-827-0505	Watershed Protection Section (WPS) Liaison	• Provided information and data needs pertaining to nonpoint sources of pollution and best management practices (BMPs) located within the study area
Barbara Cooney 505-827-0212	Point Source Regulation Section (PSRS) Liaison	• Provided information and data needs pertaining to point source discharges located within the study area • Assisted with development of final survey report
Meghan Bell 505-827-0669	Total Maximum Daily Load (TMDL) Liaison	• Provided information and data needs pertaining to TMDL development to be conducted in the study area • Assisted with development of final survey report; will develop TMDLs as needed

Schedule

This survey was made up of many components beginning with planning and ending with the generation of the State of New Mexico Clean Water Act (CWA) Section 303(d)/305(b) Integrated Report (IR). Total Maximum Daily Loads (TMDLs), will be written as necessary, or modified, following assessment of the survey data in 2016. A tentative schedule for the entire project is given below (Table 3).

Table 2. Survey Objectives.

	Intended use of data	Question to be answered	Products/ Outcomes	Decision Criteria
Primary Objective	Assess designated use attainment for the New Mexico Clean Water Act (CWA) §303(d)/305(b) *Integrated Report (IR)* and provide information to the public on the condition of surface water	Are sampled waterbodies meeting water quality standards (WQS) criteria?	Survey Report, IR	WQS as interpreted by the Assessment Protocols (APs)
Secondary Objectives	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?	TMDL loading calculations and National Pollutant Discharge Elimination System (NPDES) permit limits	WQS as interpreted by the APs
	Evaluate restoration and mitigation measures implemented to control NPS pollution	Have watershed restoration activities and mitigation measures improved water quality?	Project Summary Reports, Nonpoint Source (NPS) Annual Report, *IR (De-Listing)*	WQS as interpreted by the APs
	Develop or refine surface WQS	Are the existing uses appropriate for the waterbody?	Use Attainability Analyses (UAA), Amendments to WQS	Are data sufficient to support a petition to the Water Quality Control Commission (WQCC) to revise WQS?

As part of the survey planning process a public meeting was held March 5, 2013 at the Jemez Springs Public Library to answer questions and solicit input for the survey.

Table 3. Project Schedule.

Activity	Win '12	Spr '13	Sum '13	Fall '13	Winter '13-'14	Spr '14	Sum '14	Fall '14	Winter '14-'15	Spr '15	Sum '15	Fall '15	Winter '15- 16	Spr '16
Survey planning, site reconnaissance, public input period	======►													
Data collection, sample submittal to SLD		==========►				==========►								
Data verification & validation, data assessment				==========►										
Preparation of sampling summary, data assessment and TMDL development									==========►					

Sampling plan

The survey included chemical samples, which were collected monthly between March and October, biological sampling, conducted within the index period (August 15 - November 15) to standardize life stages at the time of sampling, and habitat measurements that were taken during periods of base flow. Data were collected according to SWQB standard operating procedures (SOPs; NMED/SWQB, 2007-2012) and the field sampling plan (FSP). An amendment to the FSP was written prior the 2014 field season to document data gaps remaining from 2013 and to identify data collection needs and locations.

Chemical Sampling

Chemical sampling sites were usually allocated one per assessment unit (AU) and were usually positioned near the lower end of the AU. Additional stations were located to document the condition of AUs below potential pollution sources and to justify merging and splitting of AUs. 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. Chemical analytes and their sampling frequencies are outlined in Table 4 and the location of sampling stations is shown in Figure 2. In addition to the analytes listed, field measurements (temperature, specific conductance, dissolved oxygen concentration and percent saturation, pH, and turbidity) were taken during each sampling visit or during deployments of 3-21 days with a multi-parameter sonde. Secchi depth readings, as well as depth profiles, also obtained with a multi-parameter sonde, were recorded as part of reservoir sampling visits.

Table 4. Summary of planned/actual chemical and *E. coli* samples collected during the 2013-2014 Jemez Watershed Survey.

Station Number from Figure 2	Station Name	Assessment Unit	TSS/TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
1	Clear Creek above San Gregorio Lake	Clear Creek (San Gregorio Lake to headwaters)	6/7	8/6	3/4	3/4	0/0	0/0	0/0	6/6
2	San Gregorio Lake	San Gregorio Lake	2/4	2/5	0/3	2/3	2/1	2/1	2/1	2/5
3	Clear Creek at NM 126	Clear Creek (Rio de las Vacas to San Gregorio Lake)	6/6	6/6	2/3	3/3	0/0	0/0	0/0	6/6
4	Rio de las Vacas at NM 126	Rio de las Vacas (Clear Creek to headwaters)	6/6	6/8	3/3	3/5	0/0	0/0	0/0	6/8
5	American Creek above Rito de las Palomas	American Creek (Rito de las Palomas to headwaters)	6/6	6/8	3/3	3/5	0/0	0/0	0/0	6/8
6	Rito de las Palomas at NM 126	Rito de las Palomas (Rio de las Vacas to headwaters)	6/2	6/2	3/2	3/2	0/0	0/0	0/0	6/2
7	Rito Penas Negras at NM 126	Rito Penas Negras (Rio de las Vacas to headwaters)	6/2	6/2	3/3	3/2	0/0	0/0	0/0	6/2
8	Calaveras Creek above Rio Cebolla on NM 126	Calaveras Creek (Rio Cebolla to headwaters)	6/5	6/5	3/3	3/3	0/0	0/0	0/0	6/5
9	Seven Springs Fish Hatchery	Rio Cebolla (Fenton Lake to headwaters)	3/4	3/5	0/4	3/4	0	0	0/1	3/5

Station Number from Figure 2	Station Name	Assessment Unit	TSS / TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
10	Rio Cebolla above Fenton Lake	Rio Cebolla (Fenton Lake to headwaters)	6/8	6/12	2/4	3/4	0/0	0/0	0/0	6/7
11	Fenton Lake at Dam	Fenton Lake	3/7	3/11	3/2	3/5	2/4	2/4	2/2	3/8
12	Rio Cebolla at Lake Fork Canyon	Rio Cebolla (Rio de las Vacas to Fenton Lake)	6/5	6/6	3/0	0/0	0/0	0/0	0/0	6/5
13	Rio de las Vacas above the Rio Cebolla	Rio de las Vacas (Rio Cebolla to Clear Creek)	8/6	8/7	3/4	3/3	0/0	0/0	0/1	8/6
14	Rio Cebolla above Rio de las Vacas	Rio Cebolla (Rio de las Vacas to Fenton Lake)	8/6	8/8	3/4	3/5	0/0	0/0	0/0	8/7
15	Rio Guadalupe at Deer Creek Landing	Rio Guadalupe (Jemez River to Rio Cebolla)	8/6	8/6	3/5	3/4	0/0	0/0	0/0	8/5
16	Rio Guadalupe above Jemez River	Rio Guadalupe (Jemez River to Rio Cebolla)	8/7	8/7	0/4	3/3	2/2	2/2	2/2	8/8
17	San Antonio Creek above Rito de los Indios	San Antonio Creek (VCNP boundary to headwaters)	6/5	6/4	3/4	0/2	0/0	0/0	0/0	6/6
18	Rito de los Indios above San Antonio Creek	Rito de los Indios (San Antonio Creek to headwaters)	6/5	6/4	0/4	3/3	0/0	0/0	0/0	6/5
19	San Antonio Creek below Warm Springs	San Antonio Creek (VCNP boundary to headwaters)	6/5	6/5	2/2	0/2	0/0	0/0	0/0	6/6

Station Number from Figure 2	Station Name	Assessment Unit	TSS/TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
20	San Antonio Creek at VCNP Boundary	San Antonio Creek (VCNP boundary to headwaters)	6/5	6/4	3/3	3/4	0/0	0/0	0/0	6/5
21	San Antonio Creek above San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)	6/4	6/4	0/5	0/3	0/0	0/0	0/0	6/2
22	San Antonio Hot Springs	N/A	2/2	2/4	2/2	2/3	0/0	0/0	0/0	2/2
23	Sulphur Creek above VCNP Boundary	Sulphur Creek (VCNP to headwaters)	6/3	6/4	3/3	3/3	0/0	0/0	0/0	6/4
24	Sulphur Creek above Redondo Creek	Sulphur Creek (Redondo Creek to VCNP boundary)	8/6	8/6	3/4	3/5	0/0	0/0	0/0	8/6
25	Redondo Creek above VCNP boundary	Redondo Creek (VCNP boundary to headwaters)	6/3	6/3	3/2	3/2	0/0	0/0	0/0	6/3
26	Redondo Creek above Sulphur Creek	Redondo Creek (Sulphur Creek to VCNP boundary)	8/5	8/5	3/5	3/4	0/0	0/0	0/0	8/5
27	Sulphur Creek above San Antonio Creek	Sulphur Creek (San Antonio Creek to Redondo Creek)	8/4	8/4	3/3	3/2	0/0	0/0	0/0	8/6
28	San Antonio Creek above La Cueva	San Antonio Creek (East Fork Jemez to VCNP boundary)	8/4	8/4	0/1	0/1	0/0	0/0	0/0	8/4

Station Number from Figure 2	Station Name	Assessment Unit	TSS / TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
29	Spence Hot Spring	N/A	2/1	2/1	2/1	2/1	0/0	0/0	0/0	2/1
30	San Antonio Creek above East Fork Jemez River	San Antonio Creek (East Fork Jemez to VCNP boundary)	8/7	8/7	3/4	3/3	0/0	0/0	2/0	8/7
31	Jaramillo Creek above Cerro Piñon Creek	Jaramillo Creek (East Fork Jemez River to headwaters)	6/5	6/5	3/3	3/3	0/0	0/0	0/0	6/6
32	La Jara Creek at VCNP Headquarters	La Jara Creek (Perennial reaches above Arroyo San Jose)	6/5	6/5	3/4	3/4	0/0	0/0	0/0	6/5
33	East Fork Jemez River below Las Conchas day use area	East Fork Jemez River (VCNP to headwaters)	8/7	8/9	3/5	3/5	0/0	0/0	0/0	8/8
34	East Fork Jemez River above San Antonio Creek	East Fork Jemez River (San Antonio Creek to VCNP)	8/7	8/7	3/5	3/3	0/0	0/0	2/0	8/7
35	Jemez River at USGS gage below Battleship Rock	Jemez River (Soda Dam to East Fork Jemez River)	8/7	8/9	0/1	0/2	0/0	0/0	0/0	8/8
36	Jemez River above Soda Dam	Jemez River (Soda Dam to East Fork Jemez River)	8/7	8/11	3/4	3/3	0/0	0/0	0/0	8/7
37	Jemez River at Jemez State Monument	Jemez River (Rio Guadalupe to Soda Dam)	8/6	8/6	0/0	0/0	0/0	0/0	0/0	8/7

Station Number from Figure 2	Station Name	Assessment Unit	TSS / TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
38	Jemez Hot Spring	N/A	2/2	2/3	2/2	2/3	0/0	0/0	0/0	2/1
39	Jemez Springs WWTP outfall	Jemez River (Rio Guadalupe to Soda Dam)	3/4	3/4	3/5	3/4	0/0	0/0	0/1	3/6
40	Jemez River above Rio Guadalupe	Jemez River (Rio Guadalupe to Soda Dam)	8/8	8/11	3/4	3/4	2/2	2/2	2/2	8/7
41	Jemez Valley Public Schools WWTP Outfall	Jemez River (Jemez Pueblo boundary to Rio Guadalupe	3/3	3/3	3/3	3/3	0/0	0/0	0/1	3/4
42	Jemez River near Cañon	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)	8/7	8/9	3/4	3/3	2/3	2/2	2/2	8/8
43	Vallecito Creek at Paliza Campground	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)	6/5	6/5	0/0	0/0	0/0	0/0	0/0	6/5
44	Vallecito Creek above Ponderosa diversion	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)	6/6	6/8	3/4	3/3	0/0	0/0	0/0	6/6
45	Jemez River above San Ysidro at Hwy 4	Jemez River (Zia Pueblo boundary to Jemez Pueblos boundary)	8/6	8/10	3/6	3/5	2/3	2/3	2/2	8/8

Station Number from Figure 2	Station Name	Assessment Unit	TSS / TDS[1]	Nutrients[2]	Total Metals[3]	Dissolved Metals[4]	SVOCs[5]	VOCs[6]	Radionulides[7]	*E.coli*
N/A[8]	Upper Virgin Canyon	Virgin Canyon (Rio Guadalupe to headwaters)	2	2	2	2	0	0	0	3
N/A[8]	Lower Virgin Canyon	Virgin Canyon (Rio Guadalupe to headwaters)	2	3	2	3	0	0	0	3
N/A[8]	Vallecito Creek below Ponderosa Diversion	Vallecito Creek (perennial reaches Jemez River to diversion)	4	4	5	4	0	0	0	4
N/A[8]	Rio Cebolla at campground above 7 Springs Hatchery	Rio Cebolla (Fenton Lake to headwaters)	4	7	0	0	0	0	0	6

[1]Total Suspended Solids / Total Dissolve Solids. [2]Suite includes total Kjeldahl nitrogen (TKN), nitrate+nitrite, ammonia and total phosphorus. [3]Aluminum, selenium and mercury only. [4]Suite includes aluminum, antimony, arsenic, barium, boron, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, silicon, silver, tin, vanadium, zinc and hardness [5]Semi-Volatile Organic Compounds; see Appendix A for a list of analytes included in the suite. [6]Volatile Organic Compounds; see Appendix A for a list of analytes included in this suite. [7]A radionuclide sample is initially analyzed for gross alpha and gross beta radiation and, depending on results of the gross alpha and gross beta screen, may also include uranium mass and radium 226 + 228. [8]Station added during survey and was not included in the FSP.

Biological and Habitat Sampling

Biological indicators and habitat measurements give an overall indication of the condition of the AU. Stations were selected for biological and habitat monitoring based on their current IR status and results of level 1 nutrient and physical habitat assessments. Resource limitations and access issues did not allow for the collection of biological and habitat data in all AUs.

The SWQB collected periphyton, and physical habitat data at select sites to assess waterbodies for potential impairment from sediment deposition and nutrient enrichment, and to obtain data to support water quality standards development. A summary of biological and habitat monitoring appears below (Table 5). Sondes were deployed continuously at some locations in the Western part of the survey area during 2013 -2014 by the United States Forest Service (USFS) and Valles Caldera National Preserve and this data was used to augment sonde data recorded by the SWQB.

Figure 2. Project area and sampling stations for 2013-2014 Jemez River Watershed survey.

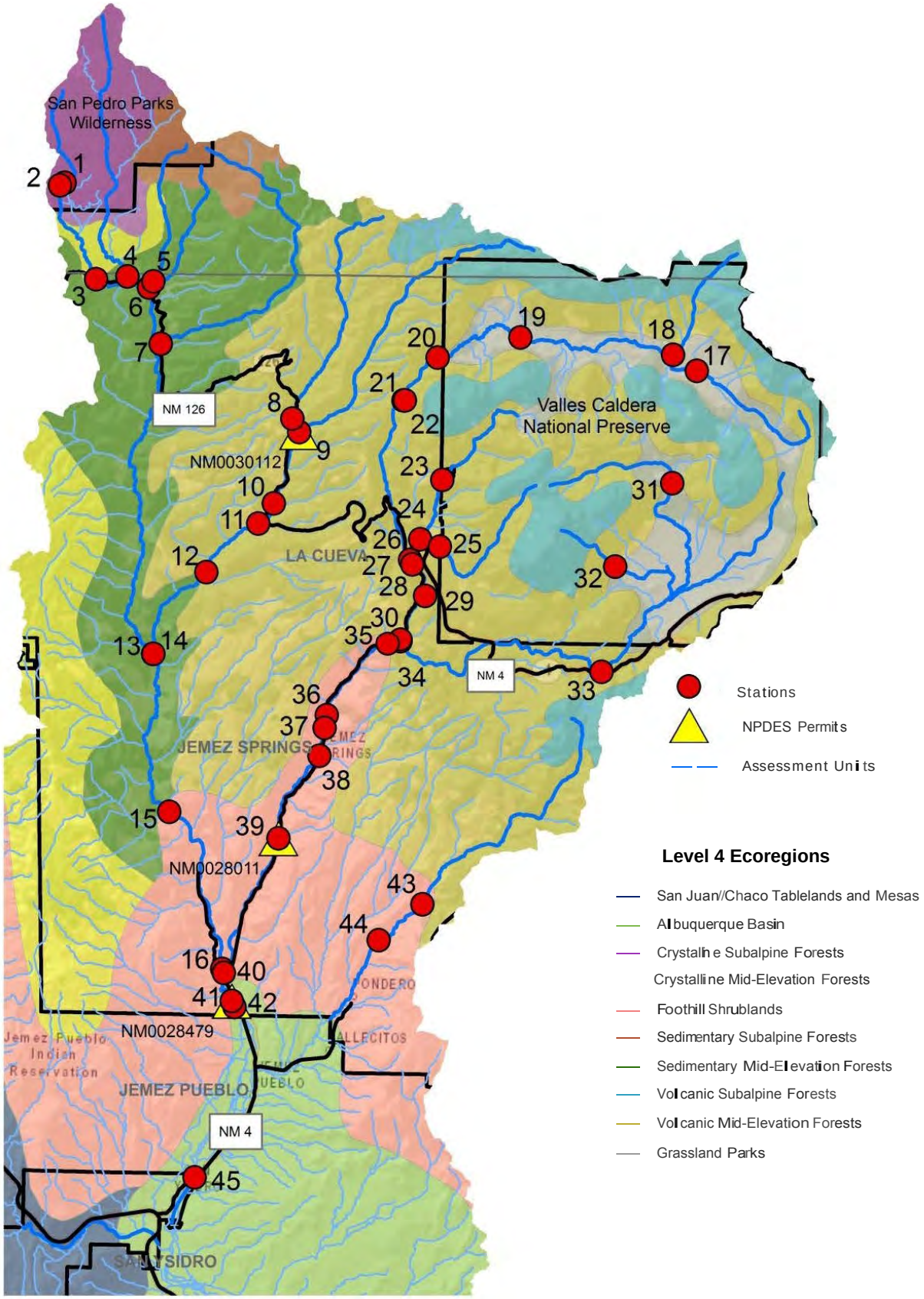


Table 5. Summary of planned/actual biological and habitat sampling during the 2013-2014 Jemez Watershed Survey.

Station Number from Figure 2	Station Name	Assessment Unit (AU)	Sedimentation[1] and Habitat[2,3]	Thermograph	Sonde[3]	Nutrient Survey[4]	Macroinvertebrates	Fish	Chlorophyll a	Phytoplankton
1	Clear Creek above San Gregorio Lake	Clear Creek (San Gregorio Lake to headwaters)	L1 + SSTemp	1/1	1/2	L1	1/1	0/0	N/A	N/A
2	San Gregorio Lake	San Gregorio Lake	N/A	N/A	N/A	N/A	N/A	N/A	2/4	0/5
3	Clear Creek at NM 126	Clear Creek (Rio de las Vacas to San Gregorio Lake)	L1 + SSTemp+ L2	1/1	1/2	L1 + L2	1/1	0/0	1	N/A
4	Rio de las Vacas at NM 126	Rio de las Vacas (Clear Creek to headwaters)	L1	1/1	1/2	L1 + L2	0/0	0/0	1	N/A
5	American Creek above Rito de las Palomas	American Creek (Rio de las Palomas to headwaters)	1/HP	1/1	1/0	1/0	1/0	0/0	N/A	N/A
6	Rito de las Palomas at Hwy 126	Rito de las Palomas (Rio de las Vacas to headwaters)	1/HP	1/1	1/0	1/0	1/0	0/0	N/A	N/A
7	Rito Penas Negras at NM 126	Rito Penas Negras (Rio de las Vacas to headwaters)	1/HP	1/1	1/0	1/0	0/0	0/0	N/A	N/A
8	Calaveras Creek above Rio Cebolla on NM 126	Calaveras Creek (Rio Cebolla to headwaters)	L1	1/1	0/1	L1	0/0	0/0	N/A	N/A
10	Rio Cebolla above Fenton Lake	Rio Cebolla (Fenton Lake to headwaters)	L1	1/1	1/2	L1 + L2	0/0	0/0	2	N/A
11	Fenton Lake at dam	Fenton Lake	N/A	N/A	N/A	N/A	N/A	N/A	3/5	0/6
12	Rio Cebolla at Lake Fork Canyon	Rio Cebolla (Rio de las Vacas to Fenton Lake)	0/0	0/1	1/2	L1 + L2	0/0	1/0	2	N/A

Station Number from Figure 2	Station Name	Assessment Unit (AU)	Sedimentation[1] and Habitat[2,3]	Thermograph	Sonde[3]	Nutrient Survey[4]	Macroinvertebrates	Fish	Chlorophyll a	Phytoplankton
13	Rio de las Vacas above the Rio Cebolla	Rio de las Vacas (Rio Cebolla to Clear Creek)	L1 + L2	1/2	1/1	L1 + L2	1/1	0/1	1	N/A
14	Rio Cebolla above Rio de las Vacas	Rio Cebolla (Rio de las Vacas to Fenton Lake)	L1 + SSTemp+ L2	1/1	1/1	L1 + L2	1/1	0/1	1	N/A
15	Rio Guadalupe at Deer Creek Landing	Rio Guadalupe (Jemez River to Rio Cebolla)	L1 + SSTemp	1/1	1/2	L1 + L2	0/1	0/0	1	N/A
16	Rio Guadalupe above Jemez River	Rio Guadalupe (Jemez River to Rio Cebolla)	L1	1/1	1/3	L1 + L2	0/1	0/1	1	N/A
17	San Antonio Creek above Rito de los Indios	San Antonio Creek (VCNP boundary to headwaters)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A
18	Rito de los Indios above San Antonio Creek	Rito de los Indios (San Antonio Creek to headwaters)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A
19	San Antonio Creek below Warm Springs	San Antonio Creek (VCNP boundary to headwaters)	1/0	1/1	0/0	L1	0/1	0/0	N/A	N/A
20	San Antonio Creek at VCNP boundary	San Antonio Creek (VCNP boundary to headwaters)	1/0	1/1	1/1	L1	0/1	0/0	N/A	N/A
21	San Antonio Creek above San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)	L1 + SSTemp+ L2	1/1	1/2	L1	1/0	0/0	N/A	N/A
23	Sulphur Creek above VCNP boundary	Sulphur Creek (VCNP to headwaters)	1/0	1/0	1/0	1/0	0/0	0/0	N/A	N/A

Station Number from Figure 2	Station Name	Assessment Unit (AU)	Sedimentation[1] and Habitat[2,3]	Thermograph	Sonde[4]	Nutrient Survey[5]	Macroinvertebrates	Fish	Chlorophyll *a*	Phytoplankton
24	Sulphur Creek above Redondo Creek	Sulphur Creek (Redondo Creek to VCNP boundary)	1/0	1/0	1/0	L1	0/0	0/0	N/A	N/A
25	Redondo Creek above VCNP Boundary	Redondo Creek (VCNP boundary to headwaters)	1/0	1/0	1/0	1/0	0/0	0/0	N/A	N/A
26	Redondo Creek above Sulphur Creek	Redondo Creek (Sulphur Creek to VCNP boundary)	1/0	1/1	1/0	L1	1/0	0/0	N/A	N/A
27	Sulphur Creek above San Antonio Creek	Sulphur Creek (San Antonio Creek to Redondo Creek)	1/0	1/1	1/0	1/0	1/0	0/0	N/A	N/A
28	San Antonio Creek above La Cueva	San Antonio Creek (East Fork, Jemez to VCNP boundary)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A
30	San Antonio Creek above East Fork Jemez River	San Antonio Creek (East Fork Jemez to VCNP boundary)	1/0	1/0	1/1	L1	0/0	0/0	N/A	N/A
31	Jaramillo Creek above Cerro Piñon Creek	Jaramillo Creek (East Fork Jemez River to headwaters)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A
32	La Jara Creek above irrigation diversion at VCNP	La Jara Creek (Perennial reaches above Arroyo San Jose)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A
33	East Fork Jemez River below Las Conchas day use area	East Fork Jemez River (VCNP to headwaters)	1/0	1/1	1/1	L1	1/0	0/0	N/A	N/A

Station Number from Figure 2	Station Name	Assessment Unit (AU)	Sedimentation[1] and Habitat[2,3]	Thermograph	Sonde[4]	Nutrient Survey[5]	Macroinvertebrates	Fish	Chlorophyll a	Phytoplankton
34	East Fork Jemez River above San Antonio Creek	East Fork Jemez River (San Antonio Creek to VCNP)	1/0	1/1	1/0	L1	0/0	0/0	N/A	N/A
35	Jemez River at USGS gage below Battleship Rock	Jemez River (Soda Dam to East Fork Jemez River)	1/0	1/0	0/0	L1 + L2	0/0	0/0	1	N/A
36	Jemez River above Soda Dam	Jemez River (Soda Dam to East Fork Jemez River)	L1	1/1	1/1	L1 + L2	1/1	0/0	1	N/A
37	Jemez River at Jemez State Monument	Jemez River (Rio Guadalupe to Soda Dam)	0/0	0/0	1/1	L1	0/1	0/0	N/A	N/A
40	Jemez River above Rio Guadalupe	Jemez River (Rio Guadalupe to Soda Dam)	L1 + SSTemp+ L2	1/1	1/3	L1 + L2	1/1	1/0	1	N/A
42	Jemez River near Cañon	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)	0/0	0/0	1/1	L1	0/0	0/0	N/A	N/A
43	Vallecito Creek at Paliza Campground	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)	0/0	0/0	0/0	L1	0/0	0/0	N/A	N/A
44	Vallecito Creek above Ponderosa diversion	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)	L1 + SSTemp+ L2	1/1	1/2	L1 + L2	1/1	0/0	1	N/A
45	Jemez River above San Ysidro at NM 4	Jemez River (Zia Pueblo boundary to Jemez Pueblo boundary)	L1 + SStemp + L2	1/1	1/1	L1 + L2	1/1	1/0	1	N/A

Station Number from Figure 2	Station Name	Assessment Unit (AU)	Sedimentation[1] and Habitat[2,3]	Thermograph	Sonde[4]	Nutrient Survey[5]	Macroinvertebrates	Fish	Chlorophyll a	Phytoplankton
N/A[6]	Rio Cebolla at campground above 7 Springs Hatchery	Rio Cebolla (Fenton Lake to headwaters)	0	0	1	L1 + L2	0	0	1	N/A
N/A[6]	Rio Cebolla below Fenton Lake in State Park	Rio Cebolla (Rio de las Vacas to Fenton Lake)	0	1	1	L1 + L2	0	0	2	N/A
N/A[6]	Jemez River at Entrada Road	Jemez River (Soda Dam to East Fork Jemez River)	0	1	0	L1	0	0	0	N/A

[1]If level 1 (L1) sedimentation data (pebble counts) showed excessive percent fines (particles < 2 mm in diameter), as determined by exceedences of threshold values established for mountain, plains and foothills regions, more extensive habitat data were collected during a level 2 (L2)procedure. [2]Habitat data collection for SSTemp, a model that relates water temperature to channel dimensions, stream flow and riparian canopy condition, was triggered by temperature exceedences measured with thermographs. [3]If an AU was dry or if its perenniality was questionable, a Hydrology Protocol (HP) was performed in place of the L1 habitat procedure. [4]Sondes were deployed to collect long-term turbidity data and as part of level 2 nutrient surveys. Values in this column include sondes deployed by the USFS and VCNP. [5]Nutrient surveys consist of two parts: A level 1 screening (L1) consists or a preliminary visual assessment of periphyton, together with an assessment of early season total phosphorus and nitrogen concentrations and is used to determine if a level 2 survey (L2), consisting of periphyton collection, chlorophyll determinations, further water samples for nitrogen and phosphorus, and a sonde deployment to record diurnal variations in pH and dissolved oxygen concentrations, was warranted. [6]Station added during survey and was not included in FSP.

Deviations from the FSP were caused by five main factors:

1. Lack of water during some or all sampling visits to a given site resulting in collection of fewer samples than planned (stations 3, 5, 6, 7, 24, 25, 26, and 27).

2. The addition of new stations, added after the survey began. Some of these were due to discovery of, or access to, waters that were unknown when the FSP was written (Virgin Canyon stations) or to better document conditions in an area of interest (Jemez River at Entrada Road and Rio Cebolla at campground above 7 Springs Hatchery).

3. Loss of access resulting from fire, fire restrictions or flooding, as well as the secondary consequences of fire and flooding, such as ash deposition in stream channels, that prevented meaningful biological and habitat data collection. These factors were responsible for the decision to continue the survey during the 2014 field season.

4. A surplus of analytical services made available from not sampling stations because of factors 1-3 (above) that resulted in more samples being collected at other stations than were planned when the FSP was written.

Summary

Although a detailed FSP was prepared prior to beginning sampling, a large number of deviations occurred over the course of the survey. The main causes of these deviations were the Thompson Ridge Fire, lingering impacts from the Conchas Fire, and the heavy rains that occurred in the late summer and fall of 2013. These events required the addition of a second year to the survey to complete as much work as was possible. However, habitat and nutrient surveys remain to be done in a number of AUs, particularly those in the vicinity of the VCNP and La Cueva, that need more complete flushing of ash to obtain meaningful results.

The data from this survey have been validated and verified according to SWQB standard operating procedures (SOPs; NMED/SWQB 2011) and are currently undergoing assessment to determine the impairment status of the sampled waters. The assessment conclusions will be incorporated into the 2016-2018 IR. In cases where impairments to water and habitat quality are found, data from this survey will also be used to calculate or modify TMDLs, depending on the outcome of assessments and listing. All of the data will be uploaded to USEPA's STORET Data Warehouse via The Water Quality Exchange (WQX) where they are available to the public. All of the data collected during these surveys are also available by request to the Monitoring Staff associated with this survey.

References

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Appendix A. Analytes included in Volatile (VOC) and Semi-volatile (SVOC) organic compound suites.

Semi-Volatile Organic Compounds	Volatile Organic Compounds
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
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

Semi-Volatile Organic Compounds	Volatile Organic Compounds
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
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
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	

Semi-Volatile Organic Compounds	Volatile Organic Compounds
Nitrobenzene	
N-nitrosodimethylamine	
N-nitroso-di-n-propylamine	
N-nitrosodiphenylamine	
Pentachlorophenol	
Phenanthrene	
Phenol	
Prometryne	
Pyrene	
Pyridine	
Simazine	
trans-Chlordane	