



NEW MEXICO ENVIRONMENT DEPARTMENT

Surface Water Quality Bureau



JEMEZ RIVER WATERSHED
2014

Amended

FIELD SAMPLING PLAN

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5/5/14
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ACRONYMS

abv	above
AU	Assessment Unit
blw	below
BMP	Best Management Practices
FSP	Field Sampling Plan
IR	State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report
MASS	Monitoring, Assessment and Standards Section
NPDES	National Pollution Discharge Elimination System
NMED	New Mexico Environment Department
PSRS	Point Source Regulation Section
QAPP	Quality Assurance Project Plan
RPD	Resource Protection Division
SFNF	Santa Fe National Forest
SLD	Scientific Laboratory Division
SOP	Standard Operating Procedures
SVOC	Semi-Volatile Organic Compound
SWQB	Surface Water Quality Bureau
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
VCNP	Valles Caldera National Preserve
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
WPS	Watershed Protection Section
WQS	Water Quality Standards
WTU	Work Time Unit
WWTP	Wastewater Treatment Plant

INTRODUCTION

The purpose of this amendment to the 2013 Jemez Watershed Field Sampling Plan (FSP) is to provide a detailed description of the Jemez River Watershed Water Quality Survey to be conducted in 2014 by the New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB). This amendment was made necessary by scouring and flooding events during the 2013 field season that prevented completion of planned field work, primarily biological and habitat sampling. As with the 2013 FSP, this amendment has been prepared in accordance with SWQB Standard Operating Procedures (SOPs), and it describes project objectives and decision criteria, including the sampling plan with sampling locations, analytes, and sampling frequencies for physical, chemical and biological parameters (NMED/SWQB 2013a). It too may be amended as needed, and amendments will be documented and justified in the final survey report.

This amendment is a companion document to the SWQB Quality Assurance Project Plan (QAPP) for Water Quality Management Programs (NMED/SWQB 2014b). Data will be collected according to the QAPP and the most recent version of the SOPs for Water Quality Data Collection.

1.0 PROJECT PERSONNEL

1.1 Personnel Roles and Responsibilities

The survey is primarily conducted by the SWQB Monitoring, Assessment, and Standards Section (MASS). Staff from other sections within the SWQB are involved with planning, carrying out the work and using the data (Table 1).

Table 1. Survey personnel roles and responsibilities.

Name(s)	Role(s)	Responsibilities
Doug Eib 505-827-0106 Greg Huey 505-827-0596	- Project Coordinators -Monitoring Staff	-Organize, plan and design survey with input from other staff -Coordinate and participate in sample collection -Manage survey data and prepare data for assessment -Write survey report
Nina Wells 505-827-0572	Watershed Protection Section (WPS) liaison	-Provide information and data requirements pertaining to nonpoint sources of pollution and best management practices within the watershed -Collect and verify samples
Barbara Cooney 505-827-0212	Point Source Regulation Section (PSRS) Liaison	Provide information and data requirements pertaining to point source discharges located in the watershed
Meghan Bell 505-827-0669	Total Maximum Daily Load (TMDL) Liaison	-Provide information and data requirements pertaining to TMDL development in the watershed -Develop TMDLs as needed

Each team member is responsible for their assignments. If an individual is unable to fulfill their duties, it is that person's responsibility to find assistance and/or a replacement in coordination with appropriate supervisors.

1.2 Organization

For the responsibilities defined in this project, the Project Coordinators and Total Maximum Daily Load (TMDL) liaison report to the MASS Program Manager. The Point Source Regulation Section (PSRS) liaison reports to the PSRS Program Manager. The Watershed Protection Section (WPS) Liaison reports to the WPS Program Manager. Program Managers report to the SWQB Bureau Chief, who works under the Resource Protection Division (RPD) Director, who is appointed by the New Mexico Governor.

2.0 PROJECT DESCRIPTION

2.1 Background

The 2001 Valles Caldera National Preserve (VCNP) and 2005 Jemez River Watershed SWQB surveys identified waters that are meeting and not attaining their specific designated uses, also referred to as impaired. Waters are divided into assessment units (AUs) based on differing geological and hydrological properties, distance, and point source discharges. Each AU is assessed individually using data from more monitoring stations located within the AU. The impairment status of AUs not just from this survey, but from around the state is used to generate the State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report (IR). In most cases a TMDL document is written for impaired AUs. A list of AUs within the survey area appears below (Table 2) along with associated impairments, and TMDL status.

Table 2. Impairment, TMDL and listing status of Jemez Watershed AUs.

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
American Creek (Rio de las Palomas to headwaters)	-Livestock watering -Marginal warmwater aquatic life -Primary contact -Wildlife habitat	20.6.4.98	None	3	None
Calaveras Creek (Rio Cebolla to headwaters)	-Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact	20.6.4.108	None	2	None
Clear Creek (Rio de las Vacas to San Gregorio Lake)	-Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat	20.6.4.108	Benthic Macroinvertebrates	5/5C	None

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
East Fork Jemez (San Antonio to VCNP boundary)	-Domestic water supply -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat	20.6.4.108	Aluminum Arsenic Temperature	5/5B	303(d) List Completed 2009 Completed 2009
East Fork Jemez (VCNP boundary to headwaters)	-Domestic water supply -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat	20.6.4.108	Aluminum Oxygen, dissolved pH Temperature Turbidity	5/5B	303(d) List 303(d) List 303(d) List Completed 2006 Completed 2003
Fenton Lake	-Domestic water supply -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat	20.6.4.134	Nutrients	5/5C	303(d) List
Jaramillo Creek (East Fork Jemez to headwaters)	-Domestic water supply -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat	20.6.4.108	Aluminum Temperature Turbidity	5/5B	303(d) List Completed 2006 Completed 2006
Jemez River (Zia Pueblo boundary to Jemez Pueblo boundary)	-Irrigation -Livestock watering -Marginal warmwater aquatic life -Primary contact -Wildlife habitat	20.6.4.106	Arsenic Boron	4A	Completed 2009 Completed 2009

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
Jemez River (Jemez Pueblo boundary To Rio Guadalupe)	<ul style="list-style-type: none"> -Coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.107	<ul style="list-style-type: none"> Aluminum Arsenic Boron Dissolved Oxygen Turbidity 	5/5B	<ul style="list-style-type: none"> 303(d) List Completed 2009 Completed 2009 303(d) List 303(d) List
Jemez River (Rio Guadalupe to Soda Dam)	<ul style="list-style-type: none"> -Coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.107	<ul style="list-style-type: none"> Aluminum Arsenic Boron Nutrients Temperature Turbidity 	5/5B	<ul style="list-style-type: none"> Completed 2003 Completed 2009 Completed 2009 Completed 2009 Completed 2009 Revised 2004
Jemez River (Soda Dam to East Fork)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	<ul style="list-style-type: none"> Aluminum Arsenic pH Boron Temperature Turbidity 	5/5B	<ul style="list-style-type: none"> Completed 2003 Completed 2009 303(d) List 303(d) List Completed 2004
La Jara Creek (East Fork Jemez to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum	5/5B	303(d) List

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
Redondo Creek (Sulphur Creek to VCNP boundary)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Turbidity	4A	Completed 2003
Redondo Creek (VCNP boundary to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum Temperature Turbidity	5/5B	303(d) List Completed 2003 Completed 2003
Rio Cebolla (Rio de las Vacas to Fenton Lake)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	None	2	None
Rio Cebolla (Fenton Lake to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum Sedimentation/Turbidity Turbidity	5/5B	303(d) List Completed 2003 303(d) List

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
Rio de las Vacas (Rio Cebolla to Clear Creek)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Nutrients Temperature	4A	Completed 2009 Completed 2003
Rio de las Vacas (Clear Creek to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum	5/5B	303(d) List
Rio Guadalupe (Jemez River to Rio Cebolla)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum Temperature	4A	Completed 2003 Completed 2009
Rito de las Palomas (Rio de las Vacas to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Sedimentation/Siltation Temperature Turbidity	5/5B	Completed 2009 Completed 2009 303(d) List

AU	Designated Use	Standards Segment Number	Impairment Sources	IR Category*	TMDL/Listing Status
Rito de los Indios (San Antonio Creek to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Aluminum	5/5B	303(d) List
Rito Peñas Negras (Rio de las Vacas to headwaters)	<ul style="list-style-type: none"> -Domestic water supply -Fish culture -High quality coldwater aquatic life -Irrigation -Livestock watering -Primary contact -Wildlife habitat 	20.6.4.108	Nutrients Sedimentation/Siltation Temperature Turbidity	5/5C	Completed 2009 Completed 2003 Completed 2003 303(d) List

*IR Category refers to the New Mexico Integrated Report (IR) categories – see Appendix A.

2.2 Objectives

The project objectives that have been identified to meet the various needs within the SWQB appear in Table 3. Data needs have been determined based on impairments from the previous surveys (NMED/SWQB 2006, 2009) and consultation with MASS, PSRS, and WPS staff, as well as other state and federal agencies, pueblos, local watershed groups, and interested parties.

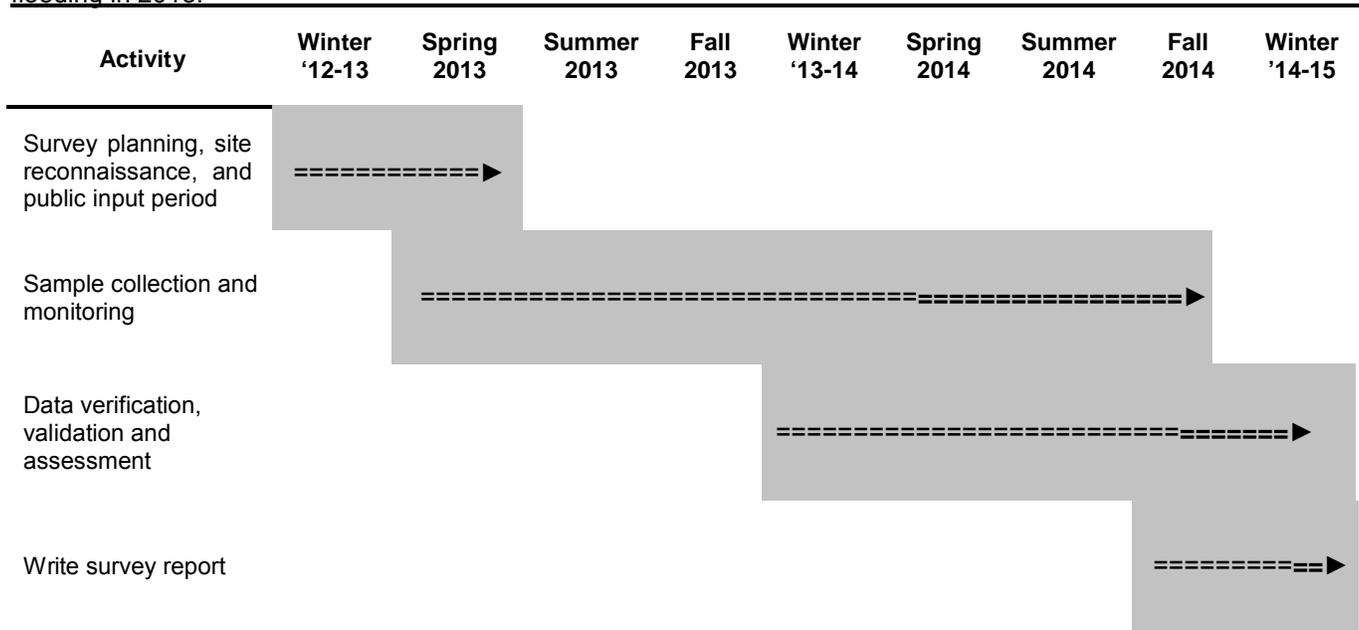
Table 3. Survey objectives

	Intended use of data	Questions to be answered	Deliverables	Decision Criteria
Primary Objective	Assess designated use attainment and provide information on surface water conditions throughout the watershed	Are sampled waterbodies meeting water quality standards (WQS) criteria?	Integrated 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 an AU can receive and meet WQS criteria	TMDL loading calculations and NPDES permit limits	WQS as interpreted by the Assessment Protocols
	Evaluate restoration and mitigation measures implemented to control NPS pollution	Have restoration activities and mitigation measures improved water quality?	Project summary reports, NPS annual report, IR	WQS as interpreted by the APs
	Develop or refine WQS	Are the existing designated uses appropriate for the AU?	Use Attainability Analyses (UAA); Amendments to the WQS	Data sufficient to support a petition to the Water Quality Control Commission (WQCC) to revise WQS

2.3 Schedule

As part of the survey planning process, public meetings were held to solicit public input on any areas of concern within the watershed and to inform interested parties about the water quality survey, assessments, TMDL processes, and our specific sampling plans in the watershed. A public meeting was held on March 5, 2013 at the Jemez Springs conference room. Water chemistry results typically take several months to return from the NM Scientific Laboratory Division (SLD). When these data are received, they will be verified and validated as described in the SOPs. Once all data have been received, validated and verified, they will be assessed according to the most recent version of the assessment protocols in time for incorporation into the 2016-2018 Integrated Report (IR). Once the assessments are complete, the TMDL development process will begin for any identified impairments. TMDLs are tentatively scheduled for completion in early 2017. The tentative schedule (Table 4) illustrates that completion of all aspects of the survey will take between two and three years.

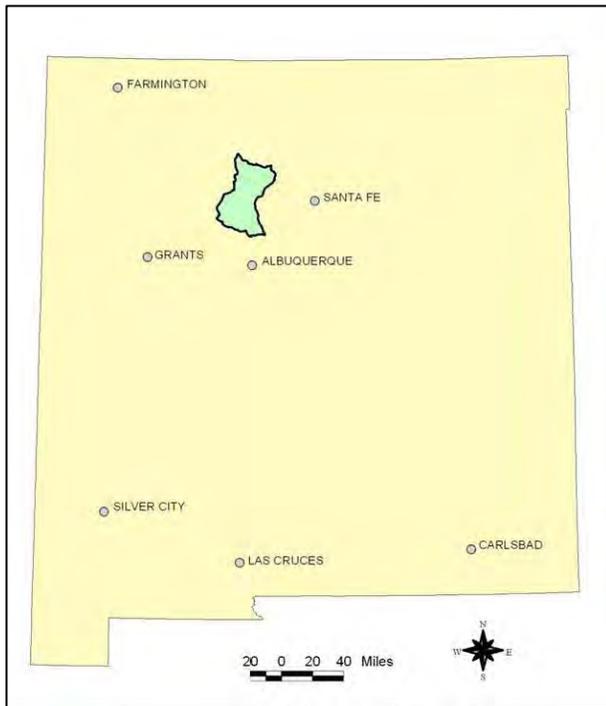
Table 4. Project schedule. Bolded sections of arrows indicate extended sampling period due to scouring flows and flooding in 2013.



2.4 Location

The study area consists of waters throughout the Jemez River watershed, reaching from the river's headwaters in the Jemez Mountains to the river crossing at NM Highway 4 upstream of San Ysidro, NM.

Figure 1. Jemez Watershed Location.



Tributaries to be sampled include American Creek, Calaveras Creek, Clear Creek, East Fork Jemez River, Jaramillo Creek, La Jara Creek, Redondo Creek, Rio Cebolla, Rio de las Vacas, Rio Guadalupe, Rito de las Palomas, Rito de los Indios, Rito Peñas Negras, San Antonio Creek, Sulphur Creek and Vallecito Creek (Table 2). Data will also be collected from Fenton and San Gregorio Lakes.

Land ownership in the upper Jemez basin is principally public, with approximately 94% of the study area managed by the Santa Fe National Forest (SFNF). Land use in the upper watershed is primarily forested cattle range, with some logging and several pumice mines. The area is heavily utilized by the public for hiking, fishing, hunting, camping and off-road vehicle use. The lower watershed below the Rio Guadalupe is primarily agricultural with numerous water diversions for irrigation.

The 89,000 acre Valles Caldera National Preserve (VCNP) contains the headwaters of the East Fork Jemez River and San Antonio Creek, including numerous tributaries with designated AUs. The VCNP is a federal property governed by an appointed board of trustees and operates as a working cattle ranch while maintaining open access to visitors and research scientists.

In 2011 the Las Conchas Fire burned 156,593 acres of the Jemez Mountains, including approximately 30,000 acres of the VCNP. Approximately 48% of the burn area ranged from moderate to high severity, with hydrophobic soils contributing to erosion and slow revegetation through those areas. NMED plans to measure and assess sedimentation in affected AUs, with impacts to benthic macroinvertebrate and fish communities being likely. A complete list of water quality stations is shown below (Table 5).

Table 5. Jemez River Watershed sampling stations.

Station Number	Station Name	Rationale for Sampling at Station
1	Clear Creek abv San Gregorio Reservoir	Only station in AU
2	San Gregorio Reservoir	Only station in AU
3	Clear Creek at NM 126	Lowest station in AU
4	Rio de Las Vacas at NM 126	Lowest station in AU
5	American Creek abv Rito de las Palomas	Only station in AU
6	Rito de las Palomas at M 126	Only station in AU
7	Rito Penas Negras at NM 126	Only station in AU
8	Calaveras Creek abv Rio Cebolla	Only station in AU
9	Seven Springs Fish Hatchery Effluent	NPDES discharge
10	Rio Cebolla abv Fenton Lake	Only station in AU
11	Fenton Lake	Only station in AU
12	Rio Cebolla at Lake Fork Canyon	WPS project
13	Rio de las Vacas abv Rio Cebolla	Lowest station in AU
14	Rio Cebolla abv Rio de las Vacas	Lowest station in AU
15	Rio Guadalupe at Deer Creek Landing	Potential AU break
16	Rio Guadalupe abv Jemez River	Lowest station in AU
17	San Antonio Creek abv Rito de los Indios	Only station in AU
18	Rito de los Indios abv San Antonio Creek	Only station in AU
19	San Antonio Creek blw Warm Springs	WPS Project, potential AU break
20	San Antonio Creek at VCNP boundary	Lowest station in AU
21	San Antonio Creek abv San Antonio Hot Springs	WPS project
22	San Antonio Hot Springs	Only station in AU
23	Sulphur Creek abv VCNP boundary	Lowest station in AU, potential AU merge
24	Sulphur Creek abv Redondo Creek	Lowest station in AU
25	Redondo Creek abv VCNP boundary	Lowest station in AU, potential AU merge
26	Redondo Creek abv Sulphur Creek	Lowest station in AU, potential AU merge
27	Sulphur Creek abv San Antonio Creek	Lowest station in AU, potential AU merge
28	San Antonio Creek abv La Cueva	WPS project
29	Spence Hot Spring	Only station in AU
30	San Antonio Creek abv East Fork Jemez River	Lowest station in AU
31	Jaramillo Creek abv Cerro Pinon Creek	Only station in AU
32	La Jara Creek abv VCNP Headquarters	Only station in AU
33	East Fork Jemez River blw Las Conchas	Only station in AU
34	East Fork Jemez abv San Antonio Creek	Only station in AU
35	Jemez River blw Battleship Rock	WPS project
36	Jemez River abv Soda Dam	Lowest station in AU

Station Number	Station Name	Rationale for Sampling at Station
37	Jemez River at Jemez State Monument	WPS project
38	Jemez Hot Spring	Only station in AU
39	Jemez Springs WWTP effluent	NPDES Discharge
40	Jemez River abv Rio Guadalupe	Lowest station in AU
41	Jemez Valley Schools WWTP effluent	NPDES Discharge
42	Jemez River near Canon	Only station in AU
43	Vallecito Creek at Paliza Campground	WPS project
44	Vallecito Creek abv Ponderosa Diversion	Lowest station in AU
45	Jemez River abv San Ysidro at NM 4	Only station in AU

3.0 DOCUMENTATION

Project documents include this FSP, probable source sheets, calibration records, data validation and verification records, field and lab data sheets (including sonde and thermograph deployment/retrieval sheets), and analytical data in hard copy or in electronic form. Documents will be maintained according to the SWQB QAPP (NMED/SWQB, 2013).

Project activities will be documented in SWQB Monitoring Section Field Sheets. Information from the field sheets is entered in the SWQB database or maintained in the Project Coordinator's files which are placed in the survey files at the conclusion of the project. Analytical results are electronically transferred into the Bureau's database and eventually moved to STORET WQX. The project is completed with the completion of the Survey Report. Figure 2 shows the survey area and sampling locations.

4.0 SAMPLING PLAN

The survey includes chemical samples to be collected between April and October. Biological sampling is conducted within a biological index period, August 15 through November 15, for appropriate comparability of samples and life history requirements. Multi-parameter sondes will be deployed at select sites in the stream for 3-21 days to record field parameters (dissolved oxygen, pH, turbidity, conductivity, temperature and salinity). Thermographs (data logging thermometers) will be deployed from May through September at select sites throughout the survey to measure temperature fluctuations and document presence of water.

The SFNF and VCNP are currently using sondes to collect field parameters in the upper watershed in conjunction with the SWQB WPS. This survey will include collection of geomorphological and chemical data at those locations.

4.1 Chemical Sampling

Chemical samples will be collected and submitted to SLD or processed in the SWQB laboratory. Chemical sampling stations are usually positioned near the lower end of the AU, access permitting. Additional stations may be located within the AU to document the condition of the stream below potential pollution sources and at other locations of interest. Stations from previous surveys are used whenever possible to allow the evaluation of trends. Planned sampling frequencies for chemical analytes at each monitoring station are specified in Table 6. A map (Figure 2) shows the sampling station locations within the watershed. In addition to the variables listed, field parameters and discharge are usually measured or estimated as part of each sampling event. Total residual chlorine (TRC) will be measured in WWTP effluent not disinfected by UV light.

Table 6. Planned chemical sampling at each station.

Station Number and Name		Assessment Unit	TDS/TSS ¹	Nutrients ²	Dissolved Metals ³	Total Metals ⁴	E. coli	SVOC ⁵	VOC ⁶	Radionuclides ⁷
1	Clear Creek above San Gregorio Lake	Clear Creek (San Gregorio Lake to headwaters)								
2	San Gregorio Lake	San Gregorio Lake	2	2			2			
3	Clear Creek at NM 126	Clear Creek (Rio de las Vacas to San Gregorio Lake)								
4	Rio de las Vacas at NM 126	Rio de las Vacas (Clear Creek to headwaters)								
5	American Creek above Rito de las Palomas	American Creek (Rio de las Palomas to headwaters)			1	1				
6	Rito de las Palomas at NM 126	Rito de las Palomas (Rio de las Vacas to headwaters)			1	1				
7	Rito Penas Negras at NM 126	Rito Penas Negras (Rio de las Vacas to headwaters)			1	1				
8	Calaveras Creek above Rio Cebolla on NM 126	Calaveras Creek (Rio Cebolla to headwaters)								
9	Seven Springs Fish Hatchery	Rio Cebolla (Fenton Lake to headwaters)								
10	Rio Cebolla above Fenton Lake	Rio Cebolla (Fenton Lake to headwaters)		2			2			
11	Fenton Lake at dam	Fenton Lake	2	2			2			
12	Rio Cebolla at Lake Fork Canyon	Rio Cebolla (Rio de las Vacas to Fenton Lake)								
13	Rio de las Vacas above the Rio Cebolla	Rio de las Vacas (Rio Cebolla to Clear Creek)								
14	Rio Cebolla above Rio de las Vacas	Rio Cebolla (Rio de las Vacas to Fenton Lake)								
15	Rio Guadalupe at Deer Creek Landing	Rio Guadalupe (Jemez River to Rio Cebolla)								
16	Rio Guadalupe above Jemez River	Rio Guadalupe (Jemez River to Rio Cebolla)								
17	San Antonio Creek above Rito de los Indios	San Antonio Creek (VCNP boundary to headwaters)		2			2			
18	Rito de los Indios above San Antonio Creek	Rito de los Indios (San Antonio Creek to headwaters)		2			2			
19	San Antonio Creek below warm springs	San Antonio Creek (VCNP boundary to headwaters)								

Station Number and Name		Assessment Unit	TDS/TSS ¹	Nutrients ²	Dissolved Metals ³	Total Metals ⁴	E. coli	SVOC ⁵	VOC ⁶	Radionuclides ⁷
20	San Antonio Creek at VCNP boundary	San Antonio Creek (VCNP boundary to headwaters)		2			2			
21	San Antonio Creek above San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)								
22	San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)	1	1	1	1	1			2
23	Sulphur Creek above VCNP boundary	Sulphur Creek (VCNP to headwaters)								
24	Sulphur Creek above Redondo Creek	Sulphur Creek (Redondo Creek to VCNP boundary)								
25	Redondo Creek above VCNP boundary	Redondo Creek (VCNP boundary to headwaters)								
26	Redondo Creek above Sulphur Creek	Redondo Creek (Sulphur Creek to VCNP boundary)		2			2			
27	Sulphur Creek above San Antonio Creek	Sulphur Creek (San Antonio Creek to Redondo Creek)								
28	San Antonio Creek above La Cueva	San Antonio Creek (East Fork Jemez to VCNP boundary)								
29	Spence Hot Spring	Jemez River (Soda Dam to East Fork Jemez River)	2	2			2			2
30	San Antonio Creek above East Fork Jemez River	San Antonio Creek (East Fork Jemez to VCNP boundary)		2			2			
31	Jaramillo Creek above Cerro Piñon Creek	Jaramillo Creek (East Fork Jemez River to headwaters)								
32	La Jara Creek at VCNP Headquarters	La Jara Creek (Perennial reaches above Arroyo San Jose)								
33	East Fork Jemez River below Las Conchas day use area	East Fork Jemez River (VCNP to headwaters)								
34	East Fork Jemez River above San Antonio Creek	East Fork Jemez River (San Antonio Creek to VCNP)								
35	Jemez River at USGS gage below Battleship Rock	Jemez River (Soda Dam to East Fork Jemez River)								
36	Jemez River above Soda Dam	Jemez River (Soda Dam to East Fork Jemez River)		2			2			
37	Jemez River at Jemez State Monument	Jemez River (Rio Guadalupe to Soda Dam)								

Station Number and Name		Assessment Unit	TDS/TSS ¹	Nutrients ²	Dissolved Metals ³	Total Metals ⁴	E. coli	SVOC ⁵	VOC ⁶	Radionuclides ⁷
38	Jemez Hot Spring	Jemez River (Rio Guadalupe to Soda Dam)	2	2	2	2	2			2
39	Jemez Springs WWTP outfall	Jemez River (Rio Guadalupe to Soda Dam)								
40	Jemez River above Rio Guadalupe	Jemez River (Rio Guadalupe to Soda Dam)		2			2			
41	Jemez Valley Public Schools WWTP Outfall	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)								
42	Jemez River near Cañon	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)		2			2			
43	Vallecito Creek at Paliza Campground	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)								
44	Vallecito Creek above Ponderosa diversion	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)								
45	Jemez River above San Ysidro at NM Hwy 4	Jemez River (Zia Pueblo boundary to Jemez Pueblos boundary)		2			2			
Added Station	Rio Cebolla below Fenton Lake	Rio Cebolla (Rio de las Vacas to Fenton Lake)		2			2			
Added Station	Vallecito below Diversion	Vallecito Creek (Jemez River to Diversion)		2			2			
Quality Control Samples			0	4	1		4			
Totals			9	37	7	6	37			6

¹Total Dissolved Solids/Total Suspended Solids. ²Suite includes total Kjeldahl nitrogen (TKN), nitrate+nitrite, ammonia and total phosphorus. ³Suite includes aluminum, antimony, arsenic, barium, boron, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, silicon, silver, tin, vanadium, zinc and hardness. ⁴Aluminum, selenium and mercury only. ⁵Semi-volatile organic compounds. See Appendix B for a list of analytes included in this suite. ⁶Volatile organic compounds. See Appendix B for a list of analytes included in this suite. ⁷A radionuclide sample is initially screened for gross alpha and gross beta radiation. Depending on results of the screen, further analyses for gross alpha, gross beta, uranium mass, and radium 226 + 228 may also be conducted.

4.2 Biological and Habitat Sampling

Measuring biological response indicators concurrent to physical habitat and water chemistry gives an overall interpretation of the biological integrity of a reach, provides more complete information on characteristics of sediment and nutrients currently cycling through the stream, and may provide enough information to investigate or eliminate specific potential sources of water quality stress. SWQB is currently collecting fish, periphyton, macroinvertebrate, and physical habitat data at select sites to assess water bodies for potential impairment from increased temperatures, sediment deposition, nutrient enrichment and toxic pollutants. Sampling methods are conducted in accordance with SWQB SOPs.

Figure 2. Project Area and Sampling Locations

Jemez Watershed 2014 Sampling Plan

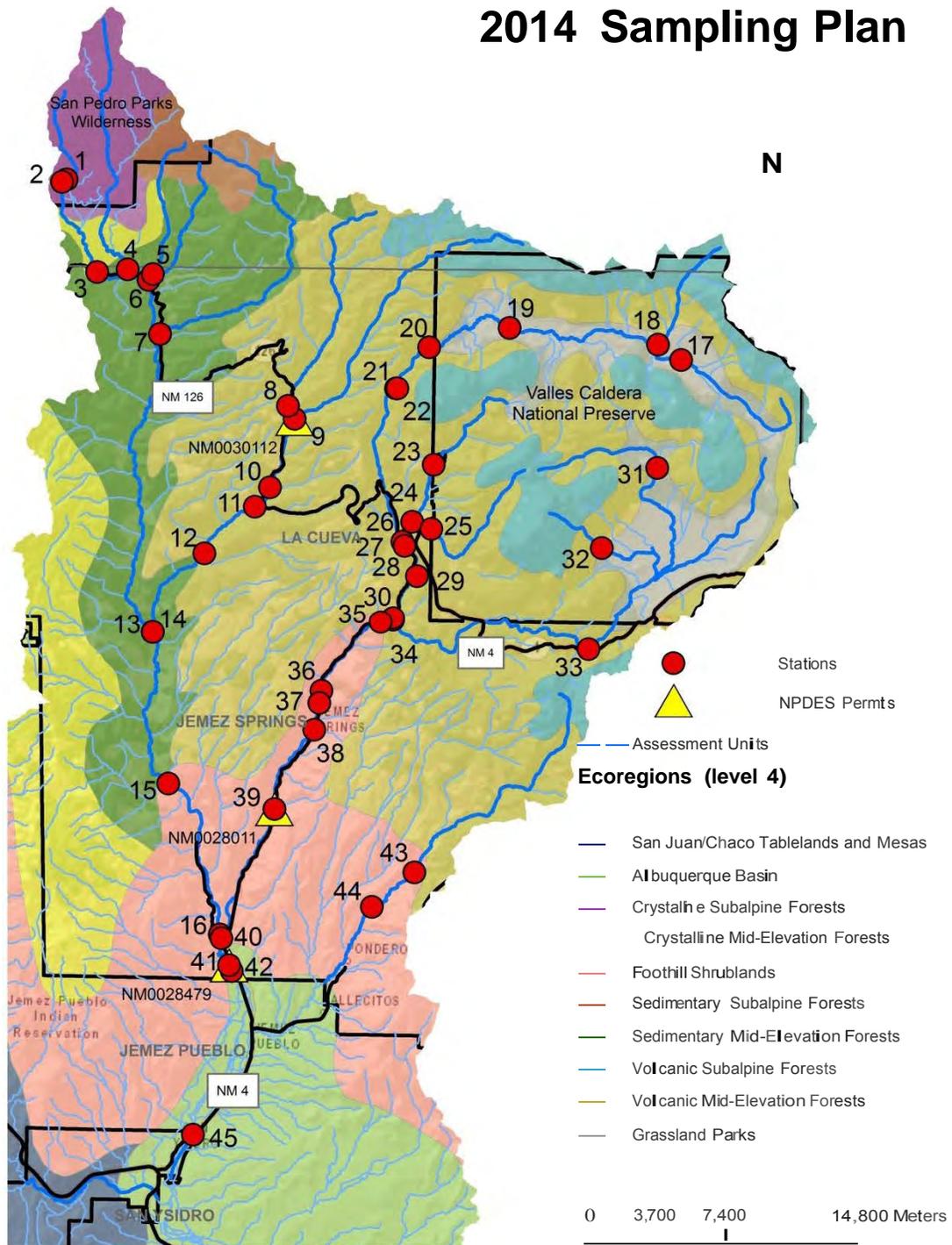


Table 7. Planned biological and habitat sampling.

Station Number and Name		Assessment Unit	Macroinvertebrates	Level 1 Nutrient	Chlorophyll a	Sonde	Pebble Count	Thermograph	Fish	Hydroprotocol
1	Clear Creek above San Gregorio Lake	Clear Creek (San Gregorio Lake to headwaters)								
2	San Gregorio Lake	San Gregorio Lake			2					
3	Clear Creek at NM 126	Clear Creek (Rio de las Vacas to San Gregorio Lake)								
4	Rio de las Vacas at NM 126	Rio de las Vacas (Clear Creek to headwaters)								
5	American Creek above Rito de las Palomas	American Creek (Rio de las Palomas to headwaters)								1
6	Rito de las Palomas at NM 126	Rito de las Palomas (Rio de las Vacas to headwaters)								1
7	Rito Penas Negras at NM 126	Rito Penas Negras (Rio de las Vacas to headwaters)								1
8	Calaveras Creek above Rio Cebolla on NM 126	Calaveras Creek (Rio Cebolla to headwaters)								
9	Seven Springs Fish Hatchery	Rio Cebolla (Fenton Lake to headwaters)								
10	Rio Cebolla above Fenton Lake	Rio Cebolla (Fenton Lake to headwaters)			1	1	1			
11	Fenton Lake at dam	Fenton Lake			2					
12	Rio Cebolla at Lake Fork Canyon	Rio Cebolla (Rio de las Vacas to Fenton Lake)								
13	Rio de las Vacas above the Rio Cebolla	Rio de las Vacas (Rio Cebolla to Clear Creek)								
14	Rio Cebolla above Rio de las Vacas	Rio Cebolla (Rio de las Vacas to Fenton Lake)					1			
15	Rio Guadalupe at Deer Creek Landing	Rio Guadalupe (Jemez River to Rio Cebolla)								
16	Rio Guadalupe above Jemez River	Rio Guadalupe (Jemez River to Rio Cebolla)								
17	San Antonio Creek above Rito de los Indios	San Antonio Creek (VCNP boundary to headwaters)					1			
18	Rito de los Indios above San Antonio Creek	Rito de los Indios (San Antonio Creek to headwaters)					1			

Station Number and Name		Assessment Unit	Macroinvertebrates	Level 1 Nutrient	Chlorophyll a	Sonde	Pebble Count	Thermograph	Fish	Hydroprotocol
19	San Antonio Creek below warm springs	San Antonio Creek (VCNP boundary to headwaters)								
20	San Antonio Creek at VCNP boundary	San Antonio Creek (VCNP boundary to headwaters)								
21	San Antonio Creek above San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)	1	1	1	1	1	1		
22	San Antonio Hot Springs	San Antonio Creek (East Fork Jemez to VCNP boundary)								
23	Sulphur Creek above VCNP boundary	Sulphur Creek (VCNP to headwaters)								
24	Sulphur Creek above Redondo Creek	Sulphur Creek (Redondo Creek to VCNP boundary)					1	1		
25	Redondo Creek above VCNP boundary	Redondo Creek (VCNP boundary to headwaters)								
26	Redondo Creek above Sulphur Creek	Redondo Creek (Sulphur Creek to VCNP boundary)			1	1	1			1
27	Sulphur Creek above San Antonio Creek	Sulphur Creek (San Antonio Creek to Redondo Creek)					1			
28	San Antonio Creek above La Cueva	San Antonio Creek (East Fork Jemez to VCNP boundary)								
29	Spence Hot Spring	Jemez River (Soda Dam to East Fork Jemez River)								
30	San Antonio Creek above East Fork Jemez River	San Antonio Creek (East Fork Jemez to VCNP boundary)			1	1	1	1		
31	Jaramillo Creek above Cerro Piñon Creek	Jaramillo Creek (East Fork Jemez River to headwaters)		1	1	1	1	1		
32	La Jara Creek at VCNP Headquarters	La Jara Creek (East Fork Jemez River to headwaters)		1	1	1	1			
33	East Fork Jemez River below Las Conchas day use area	East Fork Jemez River (VCNP to headwaters)								
34	East Fork Jemez River above San Antonio Creek	East Fork Jemez River (San Antonio Creek to VCNP)			1	1	1			

Station Number and Name		Assessment Unit	Macroinvertebrates	Level 1 Nutrient	Chlorophyll a	Sonde	Pebble Count	Thermograph	Fish	Hydroprotocol
35	Jemez River at USGS gage below Battleship Rock	Jemez River (Soda Dam to East Fork Jemez River)								
36	Jemez River above Soda Dam	Jemez River (Soda Dam to East Fork Jemez River)	1		1	1	1			
37	Jemez River at Jemez State Monument	Jemez River (Rio Guadalupe to Soda Dam)								
38	Jemez Hot Spring	Jemez River (Rio Guadalupe to Soda Dam)								
39	Jemez Springs WWTP outfall	Jemez River (Rio Guadalupe to Soda Dam)								
40	Jemez River above Rio Guadalupe	Jemez River (Rio Guadalupe to Soda Dam)	1		1	1	1			
41	Jemez Valley Public Schools WWTP Outfall	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)								
42	Jemez River near Cañon	Jemez River (Jemez Pueblo boundary to Rio Guadalupe)			1	1	1			
43	Vallecito Creek at Paliza Campground	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)								
44	Vallecito Creek above Ponderosa diversion	Vallecito Creek (Perennial reaches from diversion above Ponderosa to headwaters)	1		1	1	1	1		
45	Jemez River above San Ysidro at NM Hwy 4	Jemez River (Zia Pueblo boundary to Jemez Pueblos boundary)			1	1	1	1		
Added Station	Rio Cebolla below Fenton Lake	Rio Cebolla (Rio de las Vacas to Fenton Lake)			1	1				
<i>Quality Control Samples</i>			1		2		3			2
Totals			5	3	9	13	20	6	8	6

5.0 RESOURCE REQUIREMENTS

Chemical samples submitted to SLD are paid for with an internal currency, work-time units (WTUs), supplied by means of a memorandum of agreement between NMED and the New Mexico Department of Health. *E. coli* samples are analyzed in the SWQB laboratory or using portable field equipment. Chlorophyll *a* and benthic macroinvertebrate, samples are sent to contract labs for analyses paid for with United States Environmental Protection Agency funding. These expenditures are summarized below (Table 8).

A round trip for this survey is approximately 150 miles. Gasoline costs are estimated at \$3.00 per gallon. Vehicles typically used for surveys average 15 miles per gallon. An estimated six trips will be required for chemical sampling and 10 trips are planned for biological, habitat and nutrient surveys, and conducting the hydrology protocol. Transportation costs are estimated below (Table 9).

Due to the close proximity of the Jemez Watershed to Santa Fe, the majority of work should be achievable in day trips, however some overnight trips may be more efficient when conducting biological and habitat sampling. Therefore the per diem estimate includes 5 overnights for 2 staff.

Table 8. Estimated analytical charges.

Analyte/ Analysis	Number of Samples	Cost per Sample	Total
TDS/TSS	5	24	120
Nutrients	37	100	3,700
Dissolved Metals	7	235	1,645
Total Metals	6	90	540
Rads	6	220	1,320
Total WTUs			7,325
<i>E.coli</i>	37	\$5.08	\$187.96
Benthic Macroinvertebrates	5	\$175	\$875
Chlorophyll a	9	\$45	\$405
Dry Ice			\$30
Total (\$)			\$1,497.96

Table 9. Estimated fuel costs.

Purpose of Trip	Approximate Mileage	Number of Trips	Fuel Cost
Chemical Sampling	150	6 day trips	\$180
Biological and Habitat Sampling	150	5 overnights	\$150
Total			\$280

Table 10. Estimated Staff Time and Per Diem Costs.

Purpose of Trip	Number of Trips	Number of Staff	Staff Days	Per Diem
Chemical Sampling	6	2	12	\$48
Biological and Habitat Sampling	5	2	20	\$850
Total			28	\$898

A summary of the estimated resources needed for the entire survey is shown in Table 11, but excludes items such, preservatives, replacement parts and service charges for sampling equipment, vehicle repairs and maintenance, and calibration standards.

Table 11. Total Survey Resource Requirements.

WTUs	Chemical Analyses	Fuel	Per Diem	Staff Days
7,325	\$1,497.96	\$280	\$898	28

6.0 REFERENCES

NMED/SWQB 2006. *Water Quality Survey Summary for the Valles Caldera National Preserve Watershed, 2001*. New Mexico Environment Department Surface Water Quality Bureau. (www.nmenv.state.nm.us/swqb/Surveys/VallesCalderaWQS2001.pdf)

NMED/SWQB 2009. *Water Quality Survey Summary for the Jemez River Watershed, 2005*. New Mexico Environment Department Surface Water Quality Bureau. (www.nmenv.state.nm.us/swqb/documents/swqbdocs/MAS/Surveys/JemezRiverWatershed-2005SurveySummary.pdf)

NMED/SWQB. 2013a. *Standard Operating Procedures for Sample Collection and Handling*. New Mexico Environment Department Surface Water Quality Bureau. (www.nmenv.state.nm.us/swqb/SOP/index.html)

NMED/SWQB. 2013b. *Quality Assurance Project Plan for Water Quality Management Programs*, New Mexico Environment Department Surface Water Quality Bureau. (www.nmenv.state.nm.us/swqb/QAPP)

NMED/SWQB. 2014b. *Quality Assurance Project Plan for Water Quality Management Programs*, New Mexico Environment Department Surface Water Quality Bureau. (www.nmenv.state.nm.us/swqb/QAPP)

APPENDIX A

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 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	No reliable monitored data and/or information to determine if any designated or existing use is attained. AUs are listed in this category where data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology.
IR Category 4A	Impaired for one or more designated uses, but does not require development of a TMDL because 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 5/5A	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 5/5B

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 5/5C

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 particular 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

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
1,2-Diphenylhydrazine	1,1,2-Trichloroethane
1,3-Dichlorobenzene	1,1-Dichloroethane
1,3-Dinitrobenzene	1,1-Dichloroethene
1,4-Dichlorobenzene	1,1-Dichloropropene
1,4-Dinitrobenzene	1,2,3-Trichlorobenzene
1-Methylnaphthalene	1,2,3-Trichloropropane
2,3,4,6-Tetrachlorophenol	1,2,4-Trichlorobenzene
2,3,5,6-Tetrachlorophenol	1,2,4-Trimethylbenzene
2,4,5-Trichlorophenol	1,2-Dibromo-3-chloropropane (DBCP)
2,4,6-Trichlorophenol	1,2-Dibromoethane (Ethylene dibromide (EDB))
2,4-Dichlorophenol	1,2-Dichlorobenzene
2,4-Dimethylphenol	1,2-Dichloroethane
2,4-Dinitrophenol	1,2-Dichloropropane
2,4-Dinitrotoluene	1,3,5-Trimethylbenzene
2,6-Dinitrotoluene	1,3-Dichlorobenzene
2-Chloronaphthalene	1,3-Dichloropropane
2-Chlorophenol	1,4-Dichlorobenzene
2-Methylnaphthalene	1,4-Dioxane
2-Methylphenol	2,2-Dichloropropane
2-Nitroaniline	2-Butanone (MEK)
2-Nitrophenol	2-Chloroethyl Vinyl Ether
3,3'-Dichlorobenzidine	2-Chlorotoluene
3-Methylphenol & 4-Methylphenol	2-Hexanone
3-Nitroaniline	4-Chlorotoluene
4,4'-DDD	4-Isopropyltoluene
4,4'-DDE	4-Methyl-2-pentanone
4,4'-DDT	Acetone
4,6-Dinitro-2-methylphenol	Acetonitrile
4-Bromophenyl Phenyl Ether	Acrolein
4-Chloro-3-methylphenol	Acrylonitrile
4-Chloroaniline	Allyl Chloride
4-Chlorophenyl Phenyl Ether	Benzene
4-Nitroaniline	Bromobenzene
4-Nitrophenol	Bromochloromethane
Acenaphthene	Bromodichloromethane
Acenaphthylene	Bromoform
Alachlor	Bromomethane
Aldrin	Carbon Disulfide
alpha-BHC	Carbon Tetrachloride
Aniline	Chlorobenzene
Anthracene	Chloroethane
Atrazine	Chloroform
Azobenzene	Chloromethane
Benzidine	Chloroprene
Benzo(a)anthracene	cis-1,2-Dichloroethene
Benzo(a)pyrene	cis-1,3-Dichloropropene
Benzo(b)fluoranthene	cis-1,4-Dichloro-2-butene
Benzo(g,h,i)perylene	Dibromochloromethane
Benzo(k)fluoranthene	Dibromomethane

Organics (semi-volatiles)	Organics (volatiles)
Benzyl alcohol	Dichlorodifluoromethane
beta-BHC	Ethyl Methacrylate
bis(2-Chloroethoxy)methane	Ethylbenzene
bis(2-Chloroethyl)ether	Hexachlorobutadiene
bis(2-Chloroisopropyl)ether	Iodomethane
bis(2-Ethylhexyl)adipate	Isobutyl Alcohol
bis(2-Ethylhexyl)phthalate	Isopropylbenzene
Butyl Benzyl Phthalate	meta para Xylene mix
Carbazole	Methacrylonitrile
Chrysene	Methyl Methacrylate
cis-Chlordane	Methylene Chloride (Dichloromethane)
Cyanazine	Naphthalene
delta-BHC	n-Butylbenzene
Dibenz(a,h)anthracene	Nitrobenzene
Dibenzofuran	ortho-Xylene
Dieldrin	Pentachloroethane
Diethylphthalate	Propionitrile
Dimethylphthalate	Propylbenzene
Di-n-butyl Phthalate	sec-Butylbenzene
Di-n-octyl phthalate	Styrene
Endosulfan I	tert-Butyl Methyl Ether (MTBE)
Endosulfan II	tert-Butylbenzene
Endosulfan sulfate	Tetrachloroethene
Endrin	Tetrahydrofuran (THF)
Endrin aldehyde	Toluene
Endrin ketone	trans-1,2-Dichloroethene
Fluoranthene	trans-1,3-Dichloropropene
Fluorene	trans-1,4-Dichloro-2-butene
gamma-BHC (lindane)	Trichloroethene
Heptachlor	Trichlorofluoromethane
Heptachlor epoxide	Trihalomethanes
Hexachlorobenzene	Vinyl Acetate
Hexachlorobutadiene	Vinyl Chloride
Hexachlorocyclopentadiene	Xylene
Hexachloroethane	
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	
trans-Chlordane	
1,2,4-Trichlorobenzene	