# WATER QUALITY SURVEY SUMMARY
# FOR THE
# CHAMA RIVER AND SELECT TRIBUTARIES

**2007**

Prepared by

Surface Water Quality Bureau
New Mexico Environment Department

**January 2011**

## PRINCIPLE INVESTIGATORS


Surface Water Quality Bureau Office: (505) 827-0187

**Survey Leads**

| | |
|---|---|
| Water Chemistry: | Greg Huey |
| Biology/Habitat: | Danielle Shuryn |
| Watershed Protection: | Delbert Trujillo |
| Point Source Protection: | Barbara Cooney |
| TMDLs: | Heidi Henderson |

**GIS/Mapping** Bill Skinner



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 by grants from the U.S. Environmental Protection Agency.


*Cover Photo: Rio Chama above Abiquiu Reservoir, May 1999.*

## TABLE OF CONTENTS



## LIST OF TABLES



## LIST OF FIGURES

## LIST OF ACRONYMS

| | |
|---|---|
| ALU | Aquatic Life Use |
| AU | Assessment Unit |
| BLM | Bureau of Land Management |
| BMP | Best Management Practice |
| CWA | Clean Water Act |
| DO | Dissolved Oxygen |
| MAS | Monitoring and Assessment Section |
| NMAC | New Mexico Administrative Code |
| NPDES | National Pollutant Discharge Elimination System |
| PC | Primary Contact |
| PCBs | Polychlorinated biphenyls |
| RGA | Rapid Geomorphic Assessment |
| RHA | Rapid Habitat Assessment |
| SC | Secondary Contact |
| SCI | Stream Condition Index |
| SFNF | Santa Fe National Forest |
| STORET | Storage and Retrieval System |
| SWQB | Surface Water Quality Bureau |
| TMDL | Total Maximum Daily Load |
| UAA | Use Attainability Analysis |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| WPS | Watershed Protection Section |
| WQCC | Water Quality Control Commission |
| WQS | Water Quality Standards |
| WWTP | Wastewater Treatment Plant |

## *EXECUTIVE SUMMARY*

During 2007, the Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Chama River and several tributaries from Abiquiu Reservoir to headwaters. Tributaries of the Chama River sampled during the 2007 survey included Canjilon Creek, Cecilia Canyon Creek, Clear Creek, Placer Creek, Rio Chamita, Rio Gallina, Rio Puerco de Chama, Rio Tusas, and Rito Resumidero. Sampling at select tributary stream stations was conducted on a monthly basis from April through November when water was present at the station. Water quality sampling methods were in accordance with the *Quality Assurance Project Plan for Water Quality Management Programs* (NMED/SWQB 2007a).

The primary purpose of the 2007 water quality survey was to collect chemical, physical, and biological data to evaluate water quality within the tributary watersheds to supplement the data collected during the 1999 Chama River survey, particularly to fill data gaps for TMDL development. The data collected were assessed against New Mexico Water Quality Standards (WQS; NMAC 2007). Water quality impairment conclusions are summarized in the Integrated List portion of the biennial *State of New Mexico Integrated Clean Water Act §303(d)/305(b) Report* (NMED/SWQB 2010). It is important to note that both the assessment protocols and water quality standards are revised periodically to incorporate new information and refinements. Any assessment conclusions presented in this report are based on water quality standards and assessment protocols that existed at the time the report was developed. The U.S. Environmental Protection Agency (USEPA) uses the most recent state-developed assessment protocols and the most recent USEPA-approved water quality standards when deciding whether or not to approve impairment determinations on the biennial Integrated List. Therefore, the impairment conclusions in the current Integrated List supersede assessment conclusions in this survey report if they should differ.

Core water quality monitoring at survey stations included basic field parameters, major anions and cations, total nutrients, total and dissolved metals, cyanide, organics, radionuclides and *E. coli*. Data loggers were deployed at select stations to collect temperature, pH, dissolved oxygen (DO), conductivity, and turbidity data for two to seven days to monitor diurnal fluctuations. Biological surveys were conducted at select stations and included the collection of benthic macroinvertebrates, periphyton, fish, and associated habitat data. The macroinvertebrate community is generally the first to show a response to certain stressors such as the fine sediment suspended in the water column or settled on the bottom of the channel. The identified species are used to determine a stream condition index score (SCI) which expresses the amount of stress a macroinvertebrate community is encountering based on the diversity of species and the stress tolerance and feeding habitats of those taxa present in the stream reach. Macroinvertebrate data were assessed at 8 study sites; 5 study sites rated good and the other 3 study sites rated fair.

Water quality in the Chama River watershed was found to exceed a number of water quality standards. No impairments were noted in Cecilia Canyon Creek, Clear Creek, Rio Gallina, and Placer Creek. Documented findings of surface water quality impairment are as follows:

- **Aluminum*:*** Available data exceed the applicable criterion in the Rio Chama, Rio Chamita, and Rio Puerco de Chama.

- ***E. coli*:** Available data exceed the applicable criterion in the Rio Capulin, Rio Chama, Rio Chamita, and Rio Puerco de Chama.

- **Nutrients:** Assessment of available data indicate nutrient enrichment in Rio Chama, Rio Chamita, and Rio Tusas.

- **Specific Conductance:** Available data exceed the applicable criterion in Canjilon Creek.

- **Temperature:** Available water quality data exceed the temperature criterion in Canjilon Creek, Rio Chama, Rio Chamita, and Rio Puerco de Chama.

- **Turbidity:** Available water quality data exceed the historic segment-specific criterion of 25 NTU in Canjilon Creek, Rio Chama, and Rio Chamita. Benthic macroinvertebrate data were not available to confirm impairment on Canjilon Creek and Rio Chama (Rio Brazos to Little Willow Creek).

NMED collected **fish community** data in Cecilia Canyon Creek, Rio Chamita, Rio Puerco de Chama, and Rio Tusas. At Clear Creek and Rito Resumidero, collection efforts yielded no fish. In Cecilia Canyon Creek and Rio Puerco de Chama, non-native species comprised the entire collection, whereas in Rio Chamita and Rio Tusas, native fish comprised 42% and 79% of the fish collected, respectively. The fish collected were a mix of both cold and cool water species.

## *1.0 INTRODUCTION*

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Rio Chama watershed in 2007 between April and November. This water quality survey included 21 sampling sites (**Figures 1-3**, **Table 1**). Monitoring these sites enabled an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream from the sites. SWQB staff presented the monitoring plan at a public meeting on March 27, 2007 at the Rio Arriba Rural Events Center. Sites were selected throughout the Rio Chama watershed to collect additional data for assessment units needing additional data for TMDL development. Numerous TMDLs exist for waterbodies in this watershed, but additional data was needed to complete TMDLs on the remainder of the waterbodies. Information regarding previous sampling efforts by SWQB in the Rio Chama watershed is detailed in the Water Quality Survey Summary for the Lower Rio Chama Watershed (NMED/SWQB, 2004) available on the SWQB website.

Numerous species within this watershed are listed as either threatened or endangered by both State and Federal agencies. Federally listed endangered and threatened species of particular interest due to reliance on aquatic and riparian habitat in the watershed include the Rio Grande Silvery Minnow, Boreal Toad, Jemez Mountains Salamander, American Peregrine Falcon, Boreal Owl, and Southwestern Willow Flycatcher. (http://nhnm.unm.edu/query_bcd/bcd_watershed_query.php5).

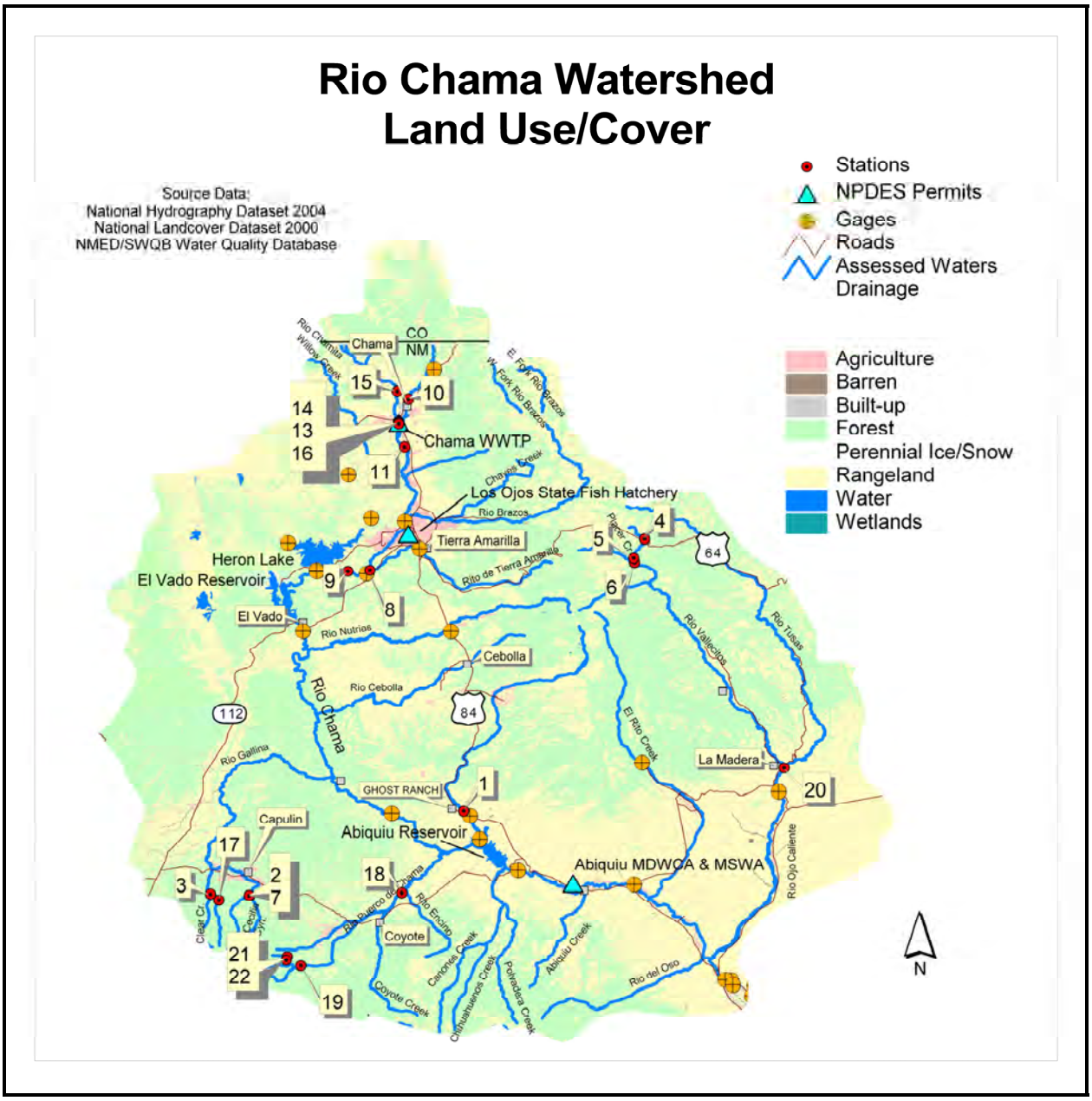


**Figure 1. Location of Rio Chama watershed sampling stations**

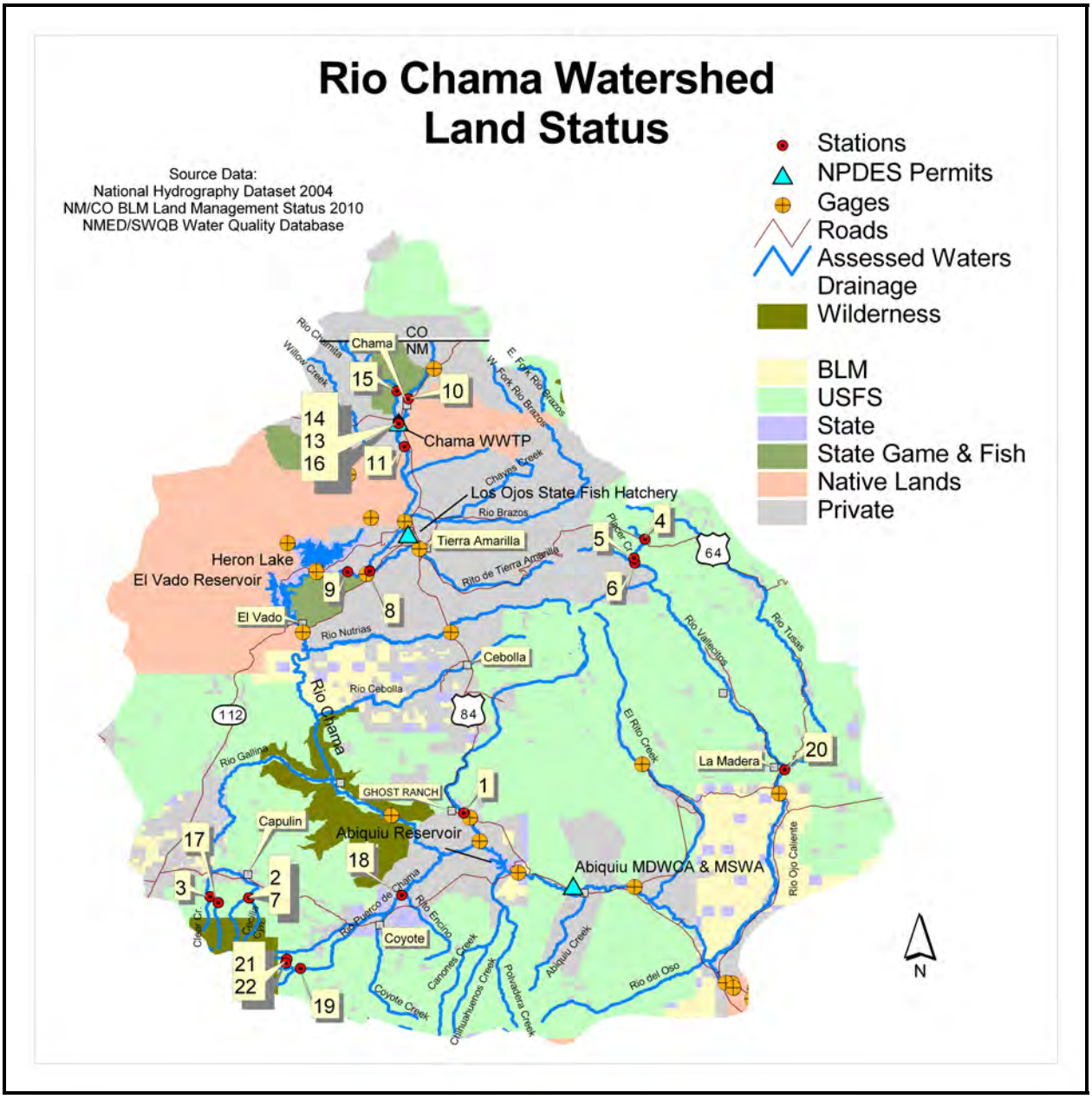


**Figure 2. Land ownership of the Rio Chama watershed**

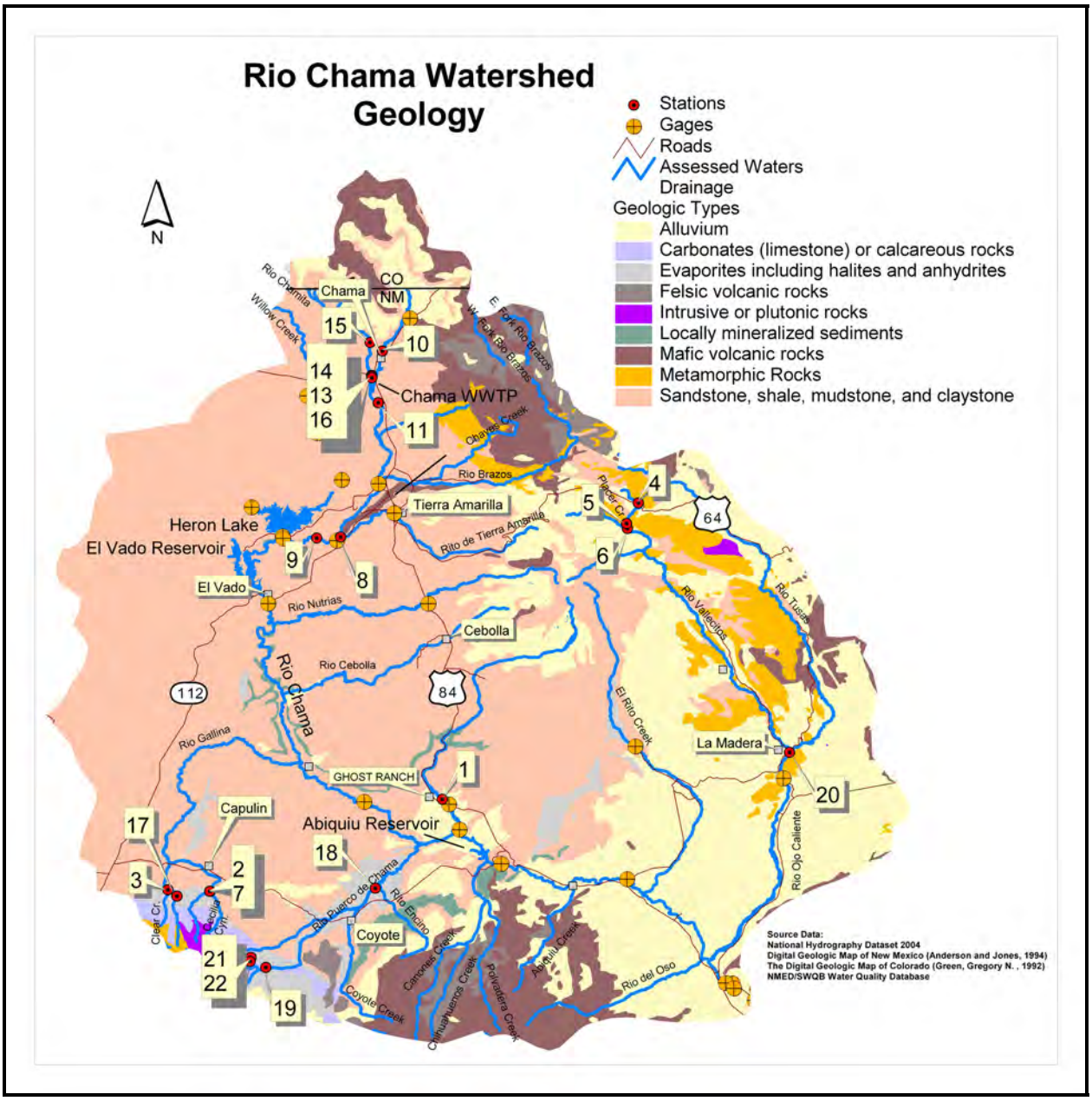


**Figure 3. Geology of the Rio Chama watershed**

## Table 1. Rio Chama survey sampling stations

| Station # | Assessment Unit & Site | STORET/ WQX ID | Station Rationale | WQS Reference (Aug 2007) |
|---|---|---|---|---|
| | **Canjilon Creek (Perennial reaches Abiquiu Res to headwaters)** | | | 20.6.4.119 |
| 1 | Canjilon Creek above Abiquiu Reservoir at US 84 | 29Canjil006.2 | Bottom of the AU; below interrupted reach. | |
| | **Cecilia Canyon Creek (Rio Capulin to USFS bnd)** | | | 20.6.4.119 |
| 2 | Cecilia Canyon Creek at FR 171 | 29Cecili000.1 | Bottom of AU. | |
| | **Clear Creek (Rio Gallina to headwaters)** | | | 20.6.4.119 |
| 3 | Clear Creek at FR 76 | 29ClearC000.1 | Bottom of AU. | |
| | **Placer Creek (Hopewell Lake to headwaters)** | | | 20.6.4.115 |
| 4 | Placer Creek at NM 64 | 29Placer005.1 | | |
| | **Placer Creek (Rio Vallecitos to Hopewell Lake)** | | | 20.6.4.115 |
| 5 | Placer Creek above Box | 29Placer001.0 | | |
| 6 | Placer Creek above Rio Vallecitos | 29Placer000.1 | | |
| | **Rio Capulin (Rio Gallina to headwaters)** | | | 20.6.4.119 |
| 7 | Rio Capulin above Cecilia Canyon Creek | 29RCapul010.3 | | |
| | **Rio Chama (El Vado Reservoir to Rio Brazos)** | | | 20.6.4.119 |
| 8 | Rio Chama below Rito de Tierra Amarilla above gage 08284100 | 29Rchama147.0 | Near bottom of AU and USGS gage. Above Heron Reservoir inflow. Below confluence with Rito de Tierra Amarilla. | |
| 9 | Rio Chama 1 mile upstream of La Puente | 29RChama143.8 | | |
| | **Rio Chama (Little Willow Creek to CO border)** | | | 20.6.4.119 |
| 10 | Rio Chama at NM 17 | 29RChama183.4 | Reference site above the Town of Chama. | |
| | **Rio Chama (Rio Brazos to Little Willow Creek)** | | | 20.6.4.119 |
| 11 | Rio Chama below Chama Town | 29RChama174.0 | Below Town of Chama, confluence with Rio Chamita, and the WWTP. | |
| | **Rio Chamita (Rio Chama to CO border)** | | | 20.6.4.119 |
| 13 | Chama WWTP effluent | NM0027731 | NPDES permitted facility. | |
| 14 | Rio Chamita above Chama WWTP outfall | 29RChami002.8 | Above WWTP. | |
| 15 | Rio Chamita at NM 29 | 29RChami008.3 | Above Town of Chama. Bracket WWTP effluent discharge to Rio Chamita. | |
| 16 | Rio Chamita below Chama WWTP outfall | 29RChami002.7 | Bracket WWTP effluent discharge to Rio Chamita. | |

| Station # | Assessment Unit & Site | STORET/ WQX ID | Station Rationale | WQS Reference (Aug 2007) |
|---|---|---|---|---|
| | **Rio Gallina (Rio Capulin to headwaters)** | | | 20.6.4.119 |
| 17 | Rio Gallina @ FR 76 | 29RGalli045.1 | | |
| | **Rio Puerco de Chama (Abiquiu Reservoir to HWY 96)** | | | 20.6.4.118 |
| 18 | Rio Puerco de Chama at CR 211 | 29RPuerc011.0 | Bottom of AU. | |
| | **Rio Puerco de Chama (HWY 96 to headwaters)** | | | 20.6.4.119 |
| 19 | Rio Puerco de Chama at FR 103 | 29RPuerc037.5 | Near headwaters in upper AU & potential reference site. | |
| | **Rio Tusas (Rio Vallecitos to headwaters)** | | | 20.6.4.116 |
| 20 | Rio Tusas above Rio Vallecitos | 29RTusas000.1 | Bottom of AU. | |
| | **Rito Resumidero (Rio Puerco de Chama to headwaters)** | | | 20.6.4.119 |
| 21 | Rito Resumidero at FR 93 | 29RResum002.5 | Above diversion, above spring. | |
| 22 | Rito Resumidero below Resumidero Spring | 29RResum001.9 | | |

**NOTES:** AU = assessment unit; WWTP = wastewater treatment plant

### 1.1 Geology land use/cover and ownership

Ten tributary watersheds to the Rio Chama were sampled during the 2007 survey. Historic and current land uses in these watersheds include farming, ranching, forestry, and residential/commercial related activities. Some of the land ownership is private, but the United States Forest Service (USFS), State of New Mexico, Bureau of Land Management (BLM), and State of New Mexico also own and manage tracts of public lands in the watersheds. These watersheds are located in Omernick Level III ecoregions 21 (Southern Rockies) and 22 (Arizona/New Mexico Plateau). The elevation range for the various watersheds in the survey spanned from 1,882 to 3,176 meters (6,175 to 10,420 feet above sea level).

The predominant lithologies within the Rio Chama are sandstones, shales, mudstones, and claystones of the Chinle, San Rafael, and Mesaverde Groups as well as the Animas, Nacimiento, Ojo Alamo, and San Jose Formations. In addition, the upper portion of the watershed consists partially of Tertiary felsic volcanic rocks of Bandelier Tuff and alluvium of the Santa Fe Group. Flint from these formations was mined by pre-Columbian Native Americans. The Cumbres Mountains near Chama are composed of Precambrian granite and more Tertiary volcanic rocks. (Chronic, 1987)

Land use/cover and ownership information specific to each watershed based on the National Landcover GIS grid is presented below and in **Figures 1 and 2** above:

- The **Canjilon Creek** watershed ranges from 1,890 to 3,176 meters (6,200 to 10,420 feet) in elevation, and covers approximately 430 $km^2$ (166 square miles $mi^2$). Primary land use/cover include 47% forest, 35% grassland, 16% shrubland, and <1% pasture. Land ownership is 77% USFS, 22% private, and <1% State and BLM.
- The **Cecilia Canyon Creek** watershed ranges from 2,458 to 3,152 meters (8,065 to 10,340 feet) in elevation, and covers approximately 15.3 $km^2$ (5.9 $mi^2$). Primary land use/cover include 91% forest, 8% grasslands, and 1% shrubland. Land ownership is 99% USFS and <1% private.

- The **Clear Creek** watershed ranges from 2,347 to 3,023 meters (7,700 to 9,920 feet) in elevation, and covers approximately 5.70 $km^2$ (2.2 $mi^2$). Primary land use/cover include 97% forest, 2% shrubland, and <1% grassland. Land ownership is 100% USFS.
- The **Placer Creek** watershed ranges from 2,976 to 3,042 meters (9,765 to 9,980 feet) in elevation, and covers approximately 12.9 $km^2$ (5 $mi^2$). Primary land use/cover include 42% grassland, 32% forest, 26% shrubland, and <1% commercial. Land ownership is 100% USFS.
- The **Rio Capulin** watershed ranges from 2,219 to 3,188 meters (7,280 to 10,460 feet) in elevation, and covers approximately 83 $km^2$ (32 $mi^2$). Primary land use/cover includes 79% forest, 11% pasture, and 10% grassland. Land ownership is 84% USFS and 16% private.
- The **Rio Chama** watershed from El Vado Reservoir to the Colorado border ranges from 2,109 to 2,225 meters (6,920 to 7,300 feet) in elevation and covers approximately 1,248 $km^2$ (482 $mi^2$). Primary land use/cover include 53% forest, 22% grassland, 20% shrubland, 4% pasture, and <1% low intensity residential, crops, and barren soil. Land ownership is 54% USFS, 31% Pueblo, 13% private, 1% State Game and Fish, and <1% State Parks.
- The **Rio Chamita** watershed ranges from 2,343 to 2,560 meters (7,687 to 8,400 feet) in elevation, and covers approximately 114 $km^2$ (44 $mi^2$). Primary land use/cover include 49% forest, 40% shrubland, 10% grassland, <1% pasture, and <1% low intensity residential. Land ownership is 95% private and 5% State Game and Fish.
- The **Rio Gallina** watershed ranges from 2,220 to 3,078 meters (7,282 to 10,100 feet) in elevation, and covers approximately 49.2 $km^2$ (19 $mi^2$). Primary land use/cover include 96% forest, 2% shrubland, <1% grassland, and <1% pasture. Land ownership is 99% USFS, <1% private, and <1% BLM.
- The **Rio Puerco de Chama** watershed ranges from 1,882 to 3,048 meters (6,175 to 10,000 feet) in elevation, and covers approximately 523 $km^2$ (202 $mi^2$). Primary land use/cover include 68% forest, 21% grassland, 10% shrubland, <1% orchards/vineyards, and <1% pasture. Land ownership is 91% USFS, 5% VCNP, 4% private, <1% State, and <1% BLM .
- The **Rio Tusas** watershed ranges from 1,981 to 3,139 meters (6,500 to 10,300 feet) in elevation, and covers approximately 513 $km^2$ (198 $mi^2$). Primary land use/cover include 56% forest, 24% shrubland, 20% grassland, and <1% pasture. Land ownership is 99% USFS and <1% private.
- The **Rito Resumidero** watershed ranges from 2,560 to 2,835 meters (8,400 to 9,300 feet) in elevation, and covers approximately 24.6 $km^2$ (9.5 $mi^2$). Primary land use/cover include 87% forest, 11% grassland, and 2% shrubland. Land ownership is 100% USFS.

## *2.0 NEW MEXICO WATER QUALITY STANDARDS*

State water quality standards (WQS) constitute the water quality baseline in effect for Clean Water Act purposes. The United States Environmental Protection Agency (USEPA) approved water quality standards were used to determine if waterbodies throughout the watershed are supporting their designated uses. The applicable WQS for Rio Chama assessment units covered in this report are set forth in sections 20.6.4.115, 206.4.116, 20.6.4.118 and 20.6.4.119 of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMAC 2007).

**20.6.4.115 RIO GRANDE BASIN - The perennial reaches of Rio Vallecitos and its tributaries, and perennial reaches of Rio del Oso and perennial reaches of El Rito creek above the town of El Rito.**

**A. Designated Uses**: domestic water supply, irrigation, high quality coldwater aquatic life, livestock watering, wildlife habitat and secondary contact.

**B. Criteria**:

**(1)** In any single sample: specific conductance 300 mhos/cm or less, pH within the range of 6.6 to 8.8 and temperature 20°C (68°F)µ or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

**(2)** The monthly geometric mean of E. coli 126 cfu/100 mL or less; single sample 235 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.115 NMAC - Rp 20 NMAC 6.1.2112, 10-12-00; A, 05-23-05]

**20.6.4.116 RIO GRANDE BASIN - The Rio Chama from its mouth on the Rio Grande upstream to Abiquiu reservoir, perennial reaches of the Rio Tusas, perennial reaches of the Rio Ojo Caliente, perennial reaches of Abiquiu creek and perennial reaches of El Rito creek below the town of El Rito.**

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

**B. Criteria**:

**(1)** In any single sample: pH within the range of 6.6 to 8.8 and temperature 31°C (87.8°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

**(2)** The monthly geometric mean of E. coli bacteria 548 cfu/100 mL or less; single sample 2507 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.116 NMAC - Rp 20 NMAC 6.1.2113, 10-12-00; A, 05-23-05]

**20.6.4.118 RIO GRANDE BASIN - The Rio Chama from the headwaters of Abiquiu reservoir upstream to El Vado reservoir and perennial reaches of the Rio Gallina and Rio Puerco de Chama north of state highway 96.**

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

**B. Criteria**:

**(1)** In any single sample: pH within the range of 6.6 to 8.8 and temperature 26°C (78.8°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

**(2)** The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.118 NMAC - Rp 20 NMAC 6.1.2115, 10-12-00; A, 05-23-05]

**20.6.4.119 RIO GRANDE BASIN - All perennial reaches of tributaries to the Rio Chama above Abiquiu dam except the Rio Gallina and Rio Puerco de Chama north of state highway 96 and the main stem of the Rio Chama from the headwaters of El Vado reservoir upstream to the New Mexico-Colorado line.**

**A. Designated Uses**: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and secondary contact.

**B. Criteria**:

**(1)** In any single sample: specific conductance 500 µmhos/cm or less (1,000 µmhos or less for Coyote creek), pH within the range of 6.6 to 8.8 and temperature 20°C (68°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

**(2)** The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 235 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.119 NMAC - Rp 20 NMAC 6.1.2116, 10-12-00; A, 05-23-05]

Current impairment listings are included in the *2010-2012 State of New Mexico Clean Water Act §303(d)/ §305(b) Integrated List* (NMED/SWQB 2010). The Integrated List is a catalog of assessment units (AUs)

throughout the state with a summary of their current status-assessed/not assessed and impaired/not impaired. Once a stream AU is identified as impaired, a TMDL guidance document is developed for that segment with guidelines for stream restoration.

Subsection J of Section 20.6.4.900 NMAC, as referenced in the above site-specific criteria, provides a list of water chemistry analytes for which SWQB tests and the associated criteria for varying designated uses. The table of numeric criteria provided in this section is used for assessing streams for use attainment. General criteria for sedimentation/siltation, plant nutrients, and turbidity are also addressed in this report, and found in 20.6.4.13 NMAC, subsections A, E, and J, respectively.

## *3.0 METHODS*

All water quality data within this project were collected in accordance with the procedures set forth in the *SWQB Quality Assurance Project Plan* (NMED/SWQB 2007a) and generally following the procedures detailed in the *SWQB Standard Operating Procedures for Data Collection* (NMED/SWQB 2007b).

## *4.0 SAMPLING SUMMARY*

A map of the study area is provided in **Figures 1 and 2**. The station numbers, USEPA Storage and Retrieval database (STORET) identification codes, and rationale of AUs and sampling stations selected for this survey are provided in **Table 1**. Stations are often located at AU breaks to include all inputs from that upstream watershed area before entering a new AU. The Village of Chama Wastewater Treatment Plant (WWTP) effluent channel was also sampled to account for pollutant loading from this permitted facility into the receiving stream.

Water samples were collected and analyzed for plant nutrients, ions, total and dissolved metals, bacteria, radionuclides, and anthropogenic organic compounds. Variables such as dissolved oxygen (DO), pH, turbidity, and specific conductance were measured in the field. Physical habitat and benthic macroinvertebrate communities were surveyed to determine the impacts of excessive nutrients and settled sediment on aquatic life within a stream. The specific types of monitoring at each site are summarized in **Table 2**. The numbers of sampling events by parameter or parameter suite collected during the SWQB MAS 2007 survey are included in the table. Fish community data were also collected during the 2007 MAS survey.

**Table 2. SWQB Chama River and tributaries sampling summary**

| **Assessment Unit /** Station Name | Field Data | Ions | Nutrients | Total Metals | Dissolved Metals | *E. coli* | Cyanide | Radionuclides | Organics | Thermograph | Sonde Deployment | Fish Community | Habitat Survey | Macroinvertebrates | Periphyton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Canjilon Creek (Perennial reaches Abiquiu Res to headwaters)** | | | | | | | | | | | | | | | |
| Canjilon Creek above Abiquiu Reservoir at US 84 | 6 | 6 | 5 | 5 | 5 | 6 | 4 | 0 | 0 | x[(c)] | -- | -- | -- | -- | -- |
| **Cecilia Canyon Creek (Rio Capulin to USFS bnd)** | | | | | | | | | | | | | | | |
| Cecilia Canyon Creek at FR 171 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 0 | 0 | -- | -- | x | x | x | -- |

| **Assessment Unit /** Station Name | **Field Data** | **Ions** | **Nutrients** | **Total Metals** | **Dissolved Metals** | ***E. coli*** | **Cyanide** | **Radionuclides** | **Organics** | **Thermograph** | **Sonde Deployment** | **Fish Community** | **Habitat Survey** | **Macroinvertebrates** | **Periphyton** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Clear Creek (Rio Gallina to headwaters)** | | | | | | | | | | | | | | | |
| Clear Creek at FR 76 | 8 | 8 | 8 | 7 | 7 | 7 | 6 | 0 | 0 | x | -- | -- | x | x | -- |
| **Placer Creek (Hopewell Lake to headwaters)** | | | | | | | | | | | | | | | |
| Placer Creek at NM 64 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | -- | -- | -- | -- | -- | -- |
| **Placer Creek (Rio Vallecitos to Hopewell Lake)** | | | | | | | | | | | | | | | |
| Placer Creek above Box | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | -- | -- | -- | -- | -- | -- |
| Placer Creek above Rio Vallecitos | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- |
| **Rio Capulin (Rio Gallina to headwaters)** | | | | | | | | | | | | | | | |
| Rio Capulin above Cecilia Canyon Creek | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 0 | 0 | x | -- | -- | -- | -- | -- |
| **Rio Chama (El Vado Reservoir to Rio Brazos)** | | | | | | | | | | | | | | | |
| Rio Chama below Rito de Tierra Amarilla above gage 08284100 | 7[(b)] | 6 | 7[(b)] | 6 | 6 | 6 | 5 | 0 | 0 | x | -- | x | -- | -- | x |
| Rio Chama 1 mile upstream of La Puente | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -- | -- | x | -- | x | -- |
| **Rio Chama (Little Willow Creek to CO border)** | | | | | | | | | | | | | | | |
| Rio Chama at NM 17 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 4 | 3 | x | -- | x | -- | x | -- |
| **Rio Chama (Rio Brazos to Little Willow Creek)** | | | | | | | | | | | | | | | |
| Rio Chama Below Chama Town | 8 | 8 | 8 | 8 | 8 | 7 | 6 | 4 | 3 | x | x | -- | -- | -- | x |
| **Rio Chamita (Rio Chama to CO border)** | | | | | | | | | | | | | | | |
| Chama WWTP effluent | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 4 | 3 | -- | -- | -- | -- | -- | -- |
| Rio Chamita above Chama WWTP outfall | 1[(a)] | 1[(a)] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -- | -- | -- | -- | -- | x |
| Rio Chamita at NM 29 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 4 | 3 | x | -- | -- | -- | -- | -- |
| Rio Chamita below Chama WWTP outfall | 8[(b)] | 7 | 8[(b)] | 7 | 7 | 7 | 6 | 4 | 3 | x | x | x | x | x | x |
| **Rio Gallina (Rio Capulin to headwaters)** | | | | | | | | | | | | | | | |
| Rio Gallina @ FR 76 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 0 | 0 | x[(c)] | -- | -- | -- | -- | -- |
| **Rio Puerco de Chama (Abiquiu Reservoir to HWY 96)** | | | | | | | | | | | | | | | |
| Rio Puerco de Chama at CR 211 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 0 | 0 | x | -- | -- | -- | -- | -- |

| **Assessment Unit /** Station Name | Field Data | Ions | Nutrients | Total Metals | Dissolved Metals | *E. coli* | Cyanide | Radionuclides | Organics | Thermograph | Sonde Deployment | Fish Community | Habitat Survey | Macroinvertebrates | Periphyton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rio Puerco de Chama (HWY 96 to headwaters)** | | | | | | | | | | | | | | | |
| Rio Puerco de Chama at FR 103 | 8 | 8 | 8 | 7 | 7 | 7 | 6 | 0 | 0 | x | -- | x | x | x | -- |
| **Rio Tusas (Rio Vallecitos to headwaters)** | | | | | | | | | | | | | | | |
| Rio Tusas above Rio Vallecitos | 8 | 8 | 8 | 7 | 7 | 7 | 6 | 0 | 0 | x | x | x | x | x | x |
| **Rito Resumidero (Rio Puerco de Chama to headwaters)** | | | | | | | | | | | | | | | |
| Rito Resumidero at FR 93 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 0 | 0 | -- | -- | x | -- | -- | -- |
| Rito Resumidero below Resumidero Spring | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 0 | 0 | x | -- | -- | -- | x | -- |

**NOTES:** (a) 2006 sampling only (b) 2006 & 2007 sampling (c) Air and water thermograph

## *5.0 WATER QUALITY IMPAIRMENTS*

For many water quality analytes, the State of New Mexico maintains numeric water quality standards; whereas standards for other parameters such as plant nutrients and bottom deposits are narrative. Data are assessed for designated use attainment status for both numeric and narrative water quality standards by application of the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report [Assessment Protocols]* (NMED/SWQB 2008, 2009). When available, outside sources of data that meet quality assurance requirements are combined with data collected by SWQB during the watershed survey to determine final impairment status. Final designated use impairment status is housed in the Assessment Database (ADB) and is reported in the biennial *State of New Mexico CWA §303(d)/§305(b) Integrated Report* (NMED/SWQB 2010).

### 5.1 Water Quality Impairments for Numeric Criteria

#### *5.1.1 Physicochemical Grab Data*

Water samples were analyzed for major ions, nutrients, total and dissolved metals, bacteria, radionuclides, and anthropogenic organic compounds. Variables such as temperature, dissolved oxygen (DO), pH, turbidity, and specific conductance were measured in the field. Results from the water quality data assessment of grab data indicated designated use impairments due to aluminum, *E. coli*, nutrients, specific conductance, temperature, and turbidity. **Table 3** provides designated use attainment decisions based on assessment of these physicochemical data. SWQB's *Assessment Protocol* details the assessment and listing procedures (NMED/SWQB 2008, 2009). A complete dataset can be obtained through EPA STORET database (*http://www.epa.gov/storet/*) or by contacting the SWQB.

**Table 3. Summary of physicochemical assessments**

| Assessment Unit | Aluminum (dissolved) | *E.coli* | Nutrients | Specific Conductance | Temperature | Turbidity |
|---|---|---|---|---|---|---|
| Canjilon Creek (perennial reaches Abiquiu Res to headwaters) | FS | FS | FS | **NS**[1] | **NS**[1] | **NS**[1] |
| Cecilia Canyon Creek (Rio Capuliln to USFS bnd) | FS | FS | FS | FS | FS | FS |
| Clear Creek (Rio Gallina to headwaters) | FS | FS | FS | FS | FS | FS |
| Placer Creek (Hopewell Lake to headwaters) | FS | FS | FS | FS | FS | FS |
| Placer Creek (Rio Vallecitos to Hopewell Lake) | FS | FS | FS | FS | FS | FS |
| Rio Capulin (Rio Gallina to headwaters) | FS | **NS** | FS | FS | FS | FS |
| Rio Chama (El Vado Reservoir to Rio Brazos) | **NS** | **NS** | **NS** | FS | **NS** | **NS** |
| Rio Chama (Little Willow Creek to CO border) | **NS** | **NS** | FS | FS | **NS** | FS |
| Rio Chama (Rio Brazos to Little Willow Creek) | **NS** | **NS** | **NS** | FS | **NS**[1] | **NS** |
| Rio Chamita (Rio Chama to CO border) | **NS**[1] | **NS** | **NS**[1,2] | FS | **NS**[1] | **NS** |
| Rio Gallina (Rio Capulin to headwaters) | FS | FS | FS | FS | FS | FS |
| Rio Puerco de Chama (Abiquiu Reservoir to Hwy 96) | **NS** | **NS** | FS | FS | **NS**[1] | FS |
| Rio Puerco de Chama (Hwy 96 to headwaters) | FS | FS | FS | FS | FS | FS |
| Rio Tusas (Rio Vallecitos to headwaters) | FS | FS | **NS** | FS | FS | FS |
| Rito Resumidero (Rio Puerco de Chama to headwaters)[3] | FS | FS | FS | FS | FS | FS |

**NOTES:**
**NS = Not Supporting**; FS = Fully Supporting
[1] = confirmed historic listing
[2] = plus ammonia impairment
[3] = Benthic-macroinvertebrate bioassessment impairment

### *5.1.2 Data from Continuous Monitoring Devices*

Temperature data loggers (thermographs) were deployed at selected stations within the study area. YSI multi-parameter sondes were also deployed at selected stations to examine diel fluxes in pH and dissolved oxygen (DO). The thermographs and sondes were programmed to record temperature, DO, and/or pH once per hour over their respective collection intervals.

Large datasets generated from data loggers (e.g., sondes and thermographs) are assessed according to protocols developed specifically for such datasets (NMED/SWQB 2009). This is because, unlike a typically small grab sample data set, it is not reasonable to list as not supporting on the basis of a few exceedences out of several hundred data points.

Temperature (given in °C) and pH assessment criteria are tied to the criteria in the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMAC 2007). Dissolved oxygen assessment criteria are linked to the presence of sensitive, *i.e.* early life stages, aquatic organisms and designated use such as coldwater aquatic life use. **Table 4** summarizes the assessment conclusions based on thermograph and sonde data.

**Table 4. Summary of thermograph and sonde assessment conclusions**

| Assessment Unit | Aquatic Life Use | Temperature Criterion (°C) | Temperature Assessment | pH Criterion (SU) | pH Assessment | DO Criterion (mg/L) | DO Assessment |
|---|---|---|---|---|---|---|---|
| Canjilon Creek (perennial reaches Abiquiu Res to headwaters) | HQCW | ≤20 | **NS** | 6.6 – 8.8 | no data* | ≥6 | no data |
| Cecilia Canyon Creek (Rio Capuliln to USFS bnd) | HQCW | ≤20 | no data | 6.6 – 8.8 | no data | ≥6 | no data |
| Clear Creek (Rio Gallina to headwaters) | HQCW | ≤20 | FS | 6.6 – 8.8 | no data | ≥6 | no data |
| Placer Creek (Hopewell Lake to headwaters) | HQCW | ≤20 | no data | 6.6 – 8.8 | no data | ≥6 | no data |
| Placer Creek (Rio Vallecitos to Hopewell Lake) | HQCW | ≤20 | no data | 6.6 – 8.8 | no data | ≥6 | no data |
| Rio Capulin (Rio Gallina to headwaters) | HQCW | ≤20 | FS | 6.6 – 8.8 | no data | ≥6 | no data |
| Rio Chama (El Vado Reservoir to Rio Brazos) | HQCW | ≤20 | **NS** | 6.6 – 8.8 | no data* | ≥6 | no data* |
| Rio Chama (Little Willow Creek to CO border) | HQCW | ≤20 | **NS** | 6.6 – 8.8 | no data | ≥6 | no data |
| Rio Chama (Rio Brazos to Little Willow Creek) | HQCW | ≤20 | **NS** | 6.6 – 8.8 | FS | ≥6 | FS |
| Rio Chamita (Rio Chama to CO border) | HQCW | ≤20 | **NS** | 6.6 – 8.8 | FS | ≥6 | FS |
| Rio Gallina (Rio Capulin to headwaters) | HQCW | ≤20 | FS | 6.6 – 8.8 | no data | ≥6 | no data |
| Rio Puerco de Chama (Abiquiu Reservoir to Hwy 96) | CW | ≤26 | **NS** | 6.6 – 8.8 | no data* | ≥6 | no data* |
| Rio Puerco de Chama (Hwy 96 to headwaters) | HQCW | ≤20 | FS | 6.6 – 8.8 | no data | ≥6 | no data |
| Rio Tusas (Rio Vallecitos to headwaters) | CW | ≤31 | FS | 6.6 – 8.8 | FS | ≥6 | **NS** |
| Rito Resumidero (Rio Puerco de Chama to headwaters)[2] | HQCW | ≤20 | FS | 6.6 – 8.8 | no data | ≥6 | no data |

NOTES:
"no data" = no long term data set available to assess
**NS = Not Supporting**; FS = Fully Supporting;
* = sonde deployment planned for Fall 2010
HQCW = High Quality Coldwater
CW = Coldwater

## 5.2 Water Quality Impairments For Narrative Criteria

### *5.2.1 Sedimentation Assessment and Macroinvertebrate Community*

Since the narrative standard for bottom deposits (i.e., sedimentation/siltation) is dependent on biological condition, the assessment of this physically-based narrative sedimentation criteria is determined using a biological response variable that links excess settled sediment levels to aquatic life use attainment. The macroinvertebrate community is generally the first to show a response to certain stressors such as the fine sediment that settles to the bottom of the channel.

**Substrate Composition**

It is essential to characterize the physical habitat in order to relate stream biological condition to land use impacts and potential anthropogenic disturbances. The physical habitat components most directly impacting aquatic communities are the stream geomorphology (physical structure), the riparian corridor that supports and protects aquatic life, and the composition of the substrate where the aquatic

communities live. Streams existing in similar landscapes express similar compositions of these three attributes and can be compared to a reference site within that group. A reference site is a stream reach that has been exposed to the least amount of human disturbance within a certain landscape.

Habitat surveys were conducted at eight study sites and one reference site to collect data for sedimentation/siltation impairment determinations. **Table 5** describes the watershed size, elevation, and ecoregion of each station where a habitat survey was conducted. The reference site indicated was chosen as the least disturbed by the professional judgment of the Monitoring and Assessment staff familiar with sites around the state.

**Table 5. Watershed characteristics of reference and study sites**

| Station # | Station Name* | Watershed Area ($km^2$) | Elevation (m) | Omernick Ecoregion |
|---|---|---|---|---|
| 2 | Cecilia Canyon Creek at FR 171 | 15.3 | 2446 | 21 (Southern Rockies) |
| 3 | Clear Creek at FR 76 | 5.7 | 2354 | 21 (Southern Rockies) |
| 9 | Rio Chama 1 mile upstream of La Puente | 1230 | 2166 | 21 (Southern Rockies) |
| 10 | Rio Chama at NM 17 | 168 | 2414 | 21 (Southern Rockies) |
| 16 | Rio Chamita below Chama WWTP outfall | 502 | 2366 | 21 (Southern Rockies) |
| *19* | *Rio Puerco de Chama at FR 103* | *38.8* | *2514* | *21 (Southern Rockies)* |
| 20 | Rio Tusas above Rio Vallecitos | 513 | 1976 | 21 (Southern Rockies) |
| 22 | Rito Resumidero below Resumidero Spring | 24.6 | 2712 | 21 (Southern Rockies) |

**NOTES:**
**Italic* indicate reference site for station #2, 3, 20

Pebble counts in representative riffles were conducted as part of the habitat surveys. The size of sediment within a stream system is one of the most important physical attributes in determining the health of aquatic communities. There are two components to sediment load that impact aquatic life: suspended load and bed load. Suspended load is quantified through the measurement of turbidity and total suspended solids. Bed load describes the particles that settle to or roll along the bottom (saltation) of the channel. Larger bed load particles provide increased interstitial space between particles, thus allowing for different aquatic communities than those found among small particles with little or no space. The size of sediment has a natural progression from course, large particles in streams at high elevation with smaller watershed size, gradually decreasing to sand in low elevation streams with large watersheds. Therefore, to determine whether a stream exhibits an unnaturally fine bed load, knowledge of the location of the stream segment within the watershed is necessary. Particles smaller than 2 mm are considered "fines", and "percent fines" thresholds are used for assessment purposes (see 20.6.4.13(A) NMAC and NMED/SWQB 2009). The percent fines is calculated by adding the % sand and % silt-clay fractions (**Table 6**). Other metrics in **Table 6** describe the size classes found in the reach, including the size of the median of the cumulative frequency distribution (D50) and the D84.

**Table 6. Substrate composition data for the Rio Chama and tributaries**

| Station Name* | % Fines (>2mm) | D50 (mm) | D84 (mm) |
|---|---|---|---|
| Cecilia Canyon Creek at FR 171 | 26 | 32 | 73 |
| Clear Creek at FR 76 | 21 | 16.5 | 40 |
| Rio Chama 1 mile upstream of La Puente | 13 | 80.7 | 169 |
| Rio Chama at NM 17 | 8 | 49.9 | 120 |
| Rio Chamita below Chama WWTP outfall | 12 | 68.5 | 207 |
| *Rio Puerco de Chama at FR 103* | 3 | 160.7 | 420 |
| Rio Tusas above Rio Vallecitos | 39 | 7.7 | 79 |
| Rito Resumidero below Resumidero Spring | 7 | 79.5 | 180 |

**NOTES:**
**Italic* indicate reference site

### Macroinvertebrate Sampling

By collecting data on the macroinvertebrate communities that are present in a stream reach SWQB can identify changes that indicate stress on the community. Depending on the ecoregion of the study site, this is done by utilizing either the Rapid Bioassessment Protocol (RBP) (Plafkin et. al 1989, Barbour et. al 1999) or Mountain Stream Condition Index (M-SCI) (Jacobi et al., 2006) as described in SWQB's main assessment protocol (NMED/SWQB 2009). The RBP or M-SCI score is a percentage comparison of the sum of selected metric scores derived from the macroinvertebrate communities and used to compare the study site to the selected reference site or reference condition in order to determine the degree of impairment. For example, when the macroinvertebrate community at a study site in ecoregion 21 or 23 has an M-SCI score less than 56.70% of the reference condition, it can be concluded that there is stress on that community and it would be deemed impaired (i.e. non-support) (**Table 7**).

**Table 7. Biological integrity attainment matrix using M-SCI[1] for mountain sites**

| M-SCI Index | Biological Condition Category[2] |
|---|---|
| > 78.36% | Very Good (Full Support) |
| 78.35 – 56.70% | Good (Full Support) |
| 56.69 – 37.20% | Fair (Non-Support) |
| 37.19 – 18.90% | Poor (Non-Support) |
| < 18.89% | Very Poor (Non-Support) |

**NOTES:**
1. M-SCI Index and percentages based on Jacobi, *et al.* (2006)
2. New Mexico has combined the "very good" and "good" categories into "Full Support," while the remaining categories define "Non-Support."

### Sedimentation/Siltation Assessment

In order to assess for excess sedimentation, the biological index score and the percent fines in the stream reach are first assessed independently for their support of the aquatic life use. Reference sites are

currently used to determine the amount of fines appropriate for each stream reach. If a low biological index score coincides with percent fines greater than 20% and this value exceeds a 28% increase from the associated reference site, excess fine sediment is indicated as a cause of impairment. If only the biological index score is low, excess fine sediment is not indicated as a cause of impairment because it is assumed that something other than fine sediment is causing stress to the benthic macroinvertebrate community.

Macroinvertebrate and sediment data were assessed at the eight sites (**Table 8**). The Mountain – Stream Condition Index (M-SCI) of 56.70 was used to determine biological impairment. Cecilia Canyon Creek, Clear Creek, Rio Chama at Hwy 17, Rio Puerco de Chama, and Rio Tusas had biological assessment scores in the "good" range indicating no substantial biological impairment. The three remaining study sites had biological assessment scores in the "fair" range indicating the biological communities in those reaches are stressed. Five sites exhibited low fine sediment (i.e., less than 20% fines in a representative riffle). According to Appendix D of the Assessment Protocol (NMED/SWQB 2009), raw percent values of ≤ 20% fine sediment at a study site are evaluated as "Full Support" for sedimentation/siltation regardless of the condition of the benthic community. However, because the macroinvertebrate communities scored low at three of these sites, these associated assessment units were listed for unidentified benthic-macroinvertebrate impairment until the exact cause of the biological impairment is determined.

**Table 8. Sediment evaluations for the Rio Chama and its Tributaries**

| Station Name | Biological Index Score | Biological Assessment | % Fine Sediment | Sediment Assessment |
|---|---|---|---|---|
| Cecilia Canyon Creek at FR 171 | 59.45 | FS | 26 | FS |
| Clear Creek at FR 76 | 73.04 | FS | 21 | FS |
| Rio Chama 1 mile upstream of La Puente | 56.31 | **NS** | 13 | FS |
| Rio Chama at NM 17 | 73.03 | FS | 8 | FS |
| Rio Chamita below Chama WWTP outfall | 48.66 | **NS** | 12 | FS |
| Rio Puerco de Chama at FR 103 | 62.25 | FS | 3 | FS |
| Rio Tusas above Rio Vallecitos | 62.14 | FS | 39 | FS |
| Rito Resumidero below Resumidero Spring | 54.82 | **NS** | 7 | FS |

NOTES: **NS = Not Supporting**; FS = Fully Supporting

### *5.2.2 Periphyton Community and Nutrient Assessment*

**Periphyton Sampling**

The periphyton community is another biological indicator that can express system stress in ways that the macroinvertebrate community may not reveal. The use of periphyton community data is still in early stages of development and does not provide conclusive information on stream health at this time. Periphyton is collected in biological surveys for a community composition analysis and for the quantification of chlorophyll *a* for the second level of nutrient assessments. A Level 1 nutrient screen is performed at each survey station to determine if excess nutrients may be an issue for the reach. If necessary, a series of data is collected for the nutrient Level 2 survey to determine impairment status.

**Nutrient Level 2 Assessment**

Level 2 nutrient surveys were conducted at sites that were previously listed as impaired due to plant nutrients or where the Level 1 nutrient assessment indicated the possibility of nutrient impairment. For more information on this process refer to the *Nutrient Assessment Protocol for Wadeable, Perennial Streams* (NMED/SWQB 2009). The Level 2 nutrient survey consists of data collection on a number of indicators including total phosphorus, total nitrogen, dissolved oxygen, pH, and periphyton chlorophyll *a* concentration in order to perform a weight-of-evidence based impairment determination. Chlorophyll *a* is a quantitative measure of algal biomass which is the direct or indirect cause of most problems associated with nutrient impairment. The indicators are compared to the applicable criteria or threshold values to generate an exceedence ratio, or the number of exceedences divided by the total number of times the parameter was measured (**Table 9**). For total phosphorus, total nitrogen, and chlorophyll *a*, the threshold values are dependent on the ecoregion and designated aquatic life use. Level 2 nutrient surveys were conducted in six assessment units. Four of these AUs were determined impaired for nutrients as noted in Table 9.

**Table 9. Nutrient Level 2 assessment data for Chama River watershed**

| Assessment Unit | Ecoregion – Aquatic Life Use | DO & pH – long term datasets | DO %Sat. – grab (# and % of exceedences) | DO conc – grab (# and % of exceedences) | pH – grab (# and % of exceedences) | Total Nitrogen (# and % of exceedences) | Total Phosphorus (# and % of exceedences) | Chlorophyll a exceedence? | Nutrient Assessment |
|---|---|---|---|---|---|---|---|---|---|
| **Canjilon Creek** (Perennial portions Abiquiu Rsvr to headwaters) | AZ/NM Plateau - HQCWAL | Supports HQCWAL | **2/6 = 33%** | 0/6 = 0% | 0/6 = 0% | **5/5 = 100%** | **4/5 = 80%** | no | FS |
| **Rio Chama** (Rio Brazos to Little Willow Creek) | Southern Rockies - HQCWAL | Supports HQCWAL | **2/8 = 25%** | 0/8 = 0% | **2/8 = 25%** | **6/8 = 75%** | **8/8 = 100%** | **YES** | **NS** |
| **Rio Chama** (El Vado Rsvr to Rio Brazos) | Southern Rockies - HQCWAL | **pH does NOT support HQCWAL** | **4/10 = 40%** | 0/10 = 0% | 1/10 = 10% | **8/9 = 89%** | **9/9 = 100%** | **YES**** | **NS** |
| **Rio Chamita** (Rio Chama to Colorado border) | Southern Rockies - HQCWAL | Supports HQCWAL | 2/16 = 13% | 0/16 = 0% | 0/17 = 0% | **15/16 = 94%** | **16/16 = 100%** | **YES** | **NS** |
| **Rio Tusas** (Rio Vallecitos to headwaters) | Southern Rockies – CW&WWAL | **D.O. does NOT support CWAL** | **2/8 = 25%** | 0/8 = 0% | 0/8 = 0% | **8/8 = 100%** | **8/8 = 100%** | no | **NS** |
| **Rio Puerco de Chama** (Abiquiu Rsvr to Hwy 96) | AZ/NM Plateau – CW&WWAL | Supports CWAL | **4/10 = 40%** | 0/10 = 0% | 1/10 = 10% | **4/7 = 57%** | **5/7 = 71%** | no | FS |

NOTES: **Bolded Cells** indicate parameters that exceed the thresholds and/or exceedence ratios.
HQCWAL = High Quality Coldwater Aquatic Life
CW&WWAL = Coldwater and Warmwater Aquatic Life (transitional)
** = Chlorophyll *a* exceeds the ecoregion threshold value but is within the margin of error for this analysis.
**NS = Not Supporting**; FS = Fully Supporting

### *5.2.3 Fish Community Data*

Fish community data are collected for one or more of the following reasons:

- Development and/or refinement of water quality standards, particularly for designated aquatic life uses and/or temperature criteria;
- Development of fish-based biocriteria and/or bioassessment procedures; or
- To document and characterize a given water's fish community for comparison with future or past records.

The characteristics and habits of fish species (**Table 10**) can be correlated with physical habitat to provide information about how changes may be impacting the fish community.

Fish surveys occurred between September 6 and October 11, 2007 at six stations. **Table 11** provides the results of fish collection in the Chama watershed.

- At Clear Creek and Rito Resumidero, collection efforts yielded no fish.

- At Cecilia Canyon Creek and Rio Puerco de Chama, all fish collected were non-native, cold water species (brown and rainbow trout). This is indicative of support for the high quality cold water aquatic life use designation and consistent with temperature data collected at Rio Puerco de Chama (maximum = 15.0°C) during the survey. However, the complete lack of native fish species indicates biological degradation to the extent that conservation of native species is a desirable goal.

- At Rio Chamita, the fish community was dominated by cool and warm water species (83%). Considering that this location is at an elevation of 2366 m and has a high quality cold water aquatic life use designation, the dominance of cool and warm water fishes is a cause for concern. Temperature data collected during the survey were beyond the acceptable range for a high quality cold water designation (maximum = 25.3°C). The preponderance of non-native species (58%) is yet another indication of degradation.

- At Rio Tusas, the fish community is dominated by cool water species (99%), but in this case it is also dominated by native species (79%). The aquatic life use designation is cold water, but with a temperature criterion of 31°C. The highest temperature recorded at that location during the survey was 24.6°C, well within the range that would support a cool water community. The elevation (1976 m) and other characteristics of this location suggest that a cool water aquatic community is to be expected. These results indicate that refinement of the aquatic life use designation and/or temperature criterion may be warranted.

**Table 10. Characteristics of fish species found in the Chama River watershed**

| Species | Common Name | Native | Temperature | Gravel Spawner | Feeding Guild | Water Quality Tolerance |
|---|---|---|---|---|---|---|
| *Casostomus commersoni* | White sucker | No | Cool | Yes | Omnivore | Tolerant |
| *Catostomus (Pantosteus) plebeius* | Rio Grande sucker | Yes | Cool | Yes | Omnivore | Intermediate |
| **Species** | **Common Name** | **Native** | **Temperature** | **Gravel Spawner** | **Feeding Guild** | **Water Quality Tolerance** |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Gila pandora* | Rio Grande chub | Yes | Cool | Yes | Insectivore | Intermediate |
| *Oncorhynchus mykiss* | Rainbow trout | No | Cold | Yes | Insectivore, piscivore | Sensitive |
| *Pimephales promelas* | Fathead minnow | Yes | Warm | No | Omnivore | Tolerant |
| *Rhinichthys cataractae* | Longnose dace | Yes | Cool | Yes | Insectivore | Sensitive |
| *Salmo trutta* | Brown trout | No | Cold | Yes | Insectivore, piscivore | Sensitive |

**Table 11. Fish community data from sites in the Chama River watershed**

| Station: | | | Cecilia Canyon Creek (29Cecili000.1) Sept 10, 2007 | Rio Chamita (29RChami002.7) Sept 6, 2007 | Rio Puerco de Chama (29RPuerc037.5) Sept 12, 2007 | Rio Tusas (29RTusas000.1) Oct 11, 2007 |
|---|---|---|---|---|---|---|
| **Scientific name** | **Common name** | **Temperature** | | | | |
| *Casostomus commersoni* | White sucker | Cool | 0 | 61 | 0 | 53 |
| *Catostomus (Pantosteus) plebeius* | Rio Grande sucker | Cool | 0 | 0 | 0 | 25 |
| *Gila pandora* | Rio Grande chub | Cool | 0 | 40 | 0 | 114 |
| *Oncorhynchus mykiss* | Rainbow trout | Cold | 9 | 18 | 14 | 0 |
| *Pimephales promelas* | Fathead minnow | Warm | 0 | 13 | 0 | 3 |
| *Rhinichthys cataractae* | Longnose dace | Cool | 0 | 10 | 0 | 58 |
| *Salmo trutta* | Brown trout | Cold | 0 | 8 | 51 | 0 |
| | | *# of Individuals* | 9 | 150 | 65 | 253 |
| | | *Total # of Taxa* | 1 | 6 | 2 | 5 |
| | | *% Native* | 0 | 42 | 0 | 79 |
| | | *% Non-native* | 100 | 58 | 100 | 21 |
| | | *% Coldwater* | 100 | 17 | 100 | 0 |
| | | *% Coolwater* | 0 | 74 | 0 | 99 |
| | | *%Warmwater* | 0 | 9 | 0 | 1 |

*Note- Fish surveys at 29ClearC000.1 (September 11, 2007) and 29RResum001.9 (September 12, 2007) yielded no fish.

## *6.0 CONCLUSION*

Selected water quality monitoring stations within the Chama River watershed were sampled during the intensive watershed survey to evaluate ambient water quality conditions. Data collected in the Rio Chama watershed and mentioned in this report are not included due to the large volume. To acquire specific data, contact the SWQB or search EPA's WQX/STORET databases. As a result of assessing data generated primarily during the 2007 SWQB MAS survey the following is a list of water quality concerns for each watershed:

- **Canjilon Creek** – The 2007 data confirms existing impairments for specific conductance, turbidity, and temperature. The Nutrient Level 1 assessment indicated possible nutrient enrichment. In 2010, a thermograph and sonde were deployed and a Level 2 nutrient survey was performed to confirm or refute the potential temperature and nutrient impairments. Benthic macroinvertebrate data are needed to confirm the turbidity listing.
- **Cecilia Canyon Creek –** No water quality impairments were determined based on available data.
- **Clear Creek** – No water quality impairments were determined based on available data.
- **Placer Creek –** No water quality impairments were determined based on available data.
- **Rio Capulin –** This assessment unit is impaired for *E.coli*.
- **Rio Chama –** The El Vado to Rio Brazos portion of the Rio Chama is impaired for aluminum, *E.coli*, temperature, nutrients, and turbidity. The upper portion (Little Willow to CO border) is impaired for aluminum, *E.coli*, and temperature. The temperature impairment on the Rio Brazos to Little Willow portion of the Rio Chama was confirmed and aluminum, *E.coli*, nutrients, and turbidity impairments were added. Benthic macroinvertebrate data are needed to confirm the turbidity listing.
- **Rio Chamita –** The 2007 data confirms existing impairments for ammonia, aluminum, nutrients, and temperature and new impairments for *E.coli* and turbidity were added.
- **Rio Gallina –** No water quality impairments were determined based on available data.
- **Rio Puerco de Chama –** The upper reach (Hwy 96 to headwaters) is no longer impaired for sedimentation. The 2007 data confirms the existing temperature impairment on the lower reach (Abiquiu Reservoir to Hwy 96) and new impairments for aluminum and *E.coli* were identified.
- **Rio Tusas –** The stream is no longer impaired for sedimentation, but a nutrient impairment was added.
- **Rito Resumidero** – The benthic macroinvertebrate community in this creek was determined to be impaired due to unidentified causes.

Total Maximum Daily Load (TMDL) documents will be prepared or updated by the SWQB to address the above noted impairments. Additional water quality data will be collected by the SWQB during the standard rotational period for intensive stream surveys. As a result, targets will be re-examined and potentially revised. When water quality standards have been achieved, the reach will be moved to the appropriate category on the Integrated Clean Water Act §303(d)/§305(b) list of waters.

## *7.0 REFERENCES*


Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. Second Edition. EPA 841/B-99002. Office of Water, Washington, DC. http://www.epa.gov/owow/monitoring/rbp

Chronic, Halka. 1987. Roadside Geology of New Mexico. Mountain Press Publishing, Montana.

Jacobi G.Z., M.D. Jacobi, M.T. Barbour, and E.W. Leppo. 2006. *Benthic macroinvertebrate stream condition indices for New Mexico wadeable streams.* Jacobi and Associates and Tetra Tech, Inc. for New Mexico Environment Department, Surface Water Quality Bureau. Santa Fe, NM.

New Mexico Administrative Code (NMAC). 2007. *State of New Mexico Standards for Interstate and Intrastate Surface Waters*. 20.6.4. New Mexico Water Quality Control Commission. As amended through August 1, 2007.

New Mexico Environment Department/Surface Water Quality Bureau (NMED/SWQB). 2004. *Water Quality Survey Summary for the Lower Rio Chama Watershed*.

**_____.** 2007a. *Quality Assurance Project Plan (QAPP) for Water Quality Management Programs, 2007*.

_____. 2007b. *Standard Operating Procedures for Data Collection*. Santa Fe, NM.

_____. 2009. *Procedures for Assessing Standards Attainment for the Integrated CWA §303(d)/§305(b) Water Quality Monitoring and Assessment Report*. Santa Fe, NM.

_____. 2010. *State of New Mexico Clean Water Act §303(d)/§305(b) Integrated List and Report*. Santa Fe, NM.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughs. 1989. *Rapid bioassessment protocols for use in streams and rivers.* USEPA. Office of Water Regulations and Standards. EPA/444/4-89-001. Washington, D.C.