WATER QUALITY SURVEY SUMMARY

FOR THE

UPPER RIO GRANDE WATERSHED, PART I

(BETWEEN NEW MEXICO-COLORADO BORDER AND PILAR)

2000

Prepared by

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1.0 EXECUTIVE SUMMARY

Water quality surveys and assessments are completed in fulfillment of Section 106 of the Clean Water Act (CWA), *Work Program for Water Quality Management.* The purpose of the water quality survey is to collect water quality data to identify and prioritize water quality problems within a watershed and to evaluate the effectiveness of water quality based controls. The data collected as part of the survey are compared to current United State Environmental Protection Agency (USEPA) approved water quality standards to determine if waterbodies throughout the watershed are supporting their designated uses, such as the fishable and swimmable goals set forth in the CWA §102(a).

Water Quality Survey Summary Reports focus on information and data collected by the New Mexico Environment Department's (NMED) Surface Water Quality Bureau (SWQB) pertaining to stream reaches that were identified as NOT meeting water quality standards. All data collected as part of a survey are available upon request to the SWQB and can be downloaded from USEPA's computerized environmental data system known as STORET (http://www.epa.gov/storet/). The data collected as part of this study are later combined with all other readily available or submitted data that meet state quality assurance/quality control requirements to form the basis of designated use attainment determinations summarized in the *Integrated CWA §303(d)/305(b) Water Quality Monitoring and Assessment Report.*

The lower portion of the mainstem of the Rio Grande surveyed during this study had no water quality impairments. The water quality in the upper portion of the Rio Grande was impaired due to pH and temperature. The lower tributaries of the Rio Grande around the Taos area were impaired due to conductivity and temperature on the Rio Fernando de Taos; conductivity on the Rio Grande del Rancho; and temperature, stream bottom deposits, and conductivity in various portions of the Rio Pueblo de Taos. The lower part of the Rio Hondo was impaired due to temperature. In the upper tributaries temperature was a cause of impairment for both Comanche Creek and Rio Costilla, and Cordova Creek was impaired due to stream bottom deposits. Finally, in the tributaries close to the Colorado border, temperature was a cause of impairment for both the Rio de los Pinos and the upper portion of the Rio San Antonio.

2.0 INTRODUCTION

From 16 May to 30 October 2000, the Surface Water Quality Bureau (SWQB) of the New Mexico Environment Department (NMED) conducted a series of multiple-day intensive water quality surveys of the upper Rio Grande watershed. The survey included the main stem of the Rio Grande from approximately 12 km above the New Mexico-Colorado border to Pilar, and many tributaries that enter the Rio Grande in that reach and will be referred to as Part I of the upper Rio Grande watershed study. The Red River sub-watershed was excluded from this survey, as that portion of the upper Rio Grande was surveyed in a separate study during 1999. The area of the portion of the watershed that was surveyed is 5038 km^2, of which 280 km^2 (5.5%) is in Rio Arriba County and 4758 km^2 (94.5%) is in Taos County. Historic and current land uses in the upper Rio Grande watershed include agriculture (range, pasture, and croplands), silviculture, recreation, and mining. Land ownership in the surveyed portion of the watershed includes the Carson National Forest, Bureau of Land Management, Pueblo of Taos, State Land Office, and various private parcels.

3.0 NM WATER QUALITY STANDARDS

General standards and standards applicable to attainable or designated uses for portions of the upper Rio Grande watershed that were surveyed in this study are set forth in sections 20.6.4.12 and 20.6.4.900, of *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC, October 11, 2002). Segment specific standards for the upper Rio Grande watershed are set forth in Sections 20.6.4.114, 20.6.4.122, and 20.6.4.123 and read as follows:

20.6.4.114 RIO GRANDE BASIN - The main stem of the Rio Grande from the headwaters of Cochiti reservoir upstream to Taos Junction bridge, Embudo creek from its mouth on the Rio Grande upstream to the junction of the Rio Pueblo and the Rio Santa Barbara, the Santa Cruz river below Santa Cruz dam, the Rio Tesuque below the Santa Fe national forest and the Pojoaque river below Nambe dam.

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

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0, temperature shall not exceed 22°C (71.6°F), and turbidity shall not exceed 50 NTU. The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

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

(3) At mean monthly flows above 100 cfs, the monthly average concentration for: TDS shall not exceed 500 mg/L, sulfate shall not exceed 150 mg/L, and chloride shall not exceed 25 mg/L.

[20.6.4.114 NMAC – Rp 20 NMAC 6.1.2111, 10-12-00]

20.6.4.122 RIO GRANDE BASIN - The main stem of the Rio Grande from Taos Junction bridge upstream to the New Mexico-Colorado line, the Red river from its mouth on the Rio Grande upstream to the mouth of Placer creek, and the Rio Pueblo de Taos from its mouth on the Rio Grande upstream to the mouth of the Rio Grande del Rancho.

A. Designated Uses: coldwater fishery, fish culture, irrigation, livestock watering, wildlife habitat, and primary contact.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20°C (68°F), and turbidity shall not exceed 50 NTU. The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

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

[20.6.4.122 NMAC – Rp 20 NMAC 6.1.2119, 10-12-00]

20.6.4.123 RIO GRANDE BASIN - The Red river upstream of the mouth of Placer creek, all tributaries to the Red river, and all other perennial reaches of tributaries to the Rio Grande in Taos and Rio Arriba counties unless included in other segments.

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

B. Standards:

(1) In any single sample: conductivity shall not exceed 400 µmhos (500 µmhos for the Rio Fernando de Taos), pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20°C (68°F), and turbidity shall not exceed 25 NTU. The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

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

[20.6.4.123 NMAC – Rp 20 NMAC 6.1.2120, 10-12-00]

4.0 METHODS

Water quality sampling methods were in accordance with the approved *Quality Assurance Project Plan for Water Pollution Control Programs* (QAPP) (NMED 2000). Benthic macroinvertebrate and fish sampling methods conformed to protocols in United States Environmental Protection Agency's (EPA) *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour *et al.*, 1999) and the SWQB QAPP (NMED 2000). Fluvial geomorphologic measurements were in accordance with protocols for the SWQB QAPP (NMED 2000).

Water chemistry samples were collected primarily on two consecutive days in spring (16-17 May), and three consecutive days in each of summer (31 July-2 August) and fall (17-19 October).

Fecal coliform samples were collected on 17 May, 1 August, 18 October, and 30 October.

5.0 SAMPLING SUMMARY

Maps of the study area are presented in Figures 1 and 2. The station numbers, STORET identification codes (where available), and location descriptions of sampling stations selected for this survey are provided in Table 1.

Figure 1. Stations 1-4 of the Upper Rio Grande Watershed Survey, Part I

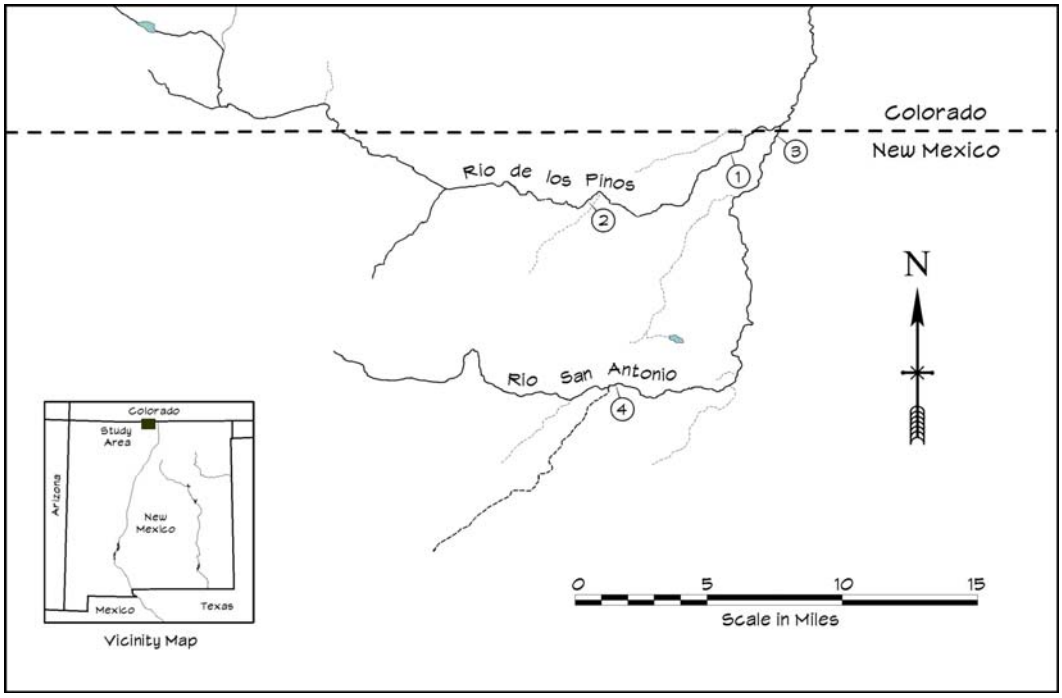

Figure 2. Stations 5-40 of the Upper Rio Grande Watershed Survey, Part I

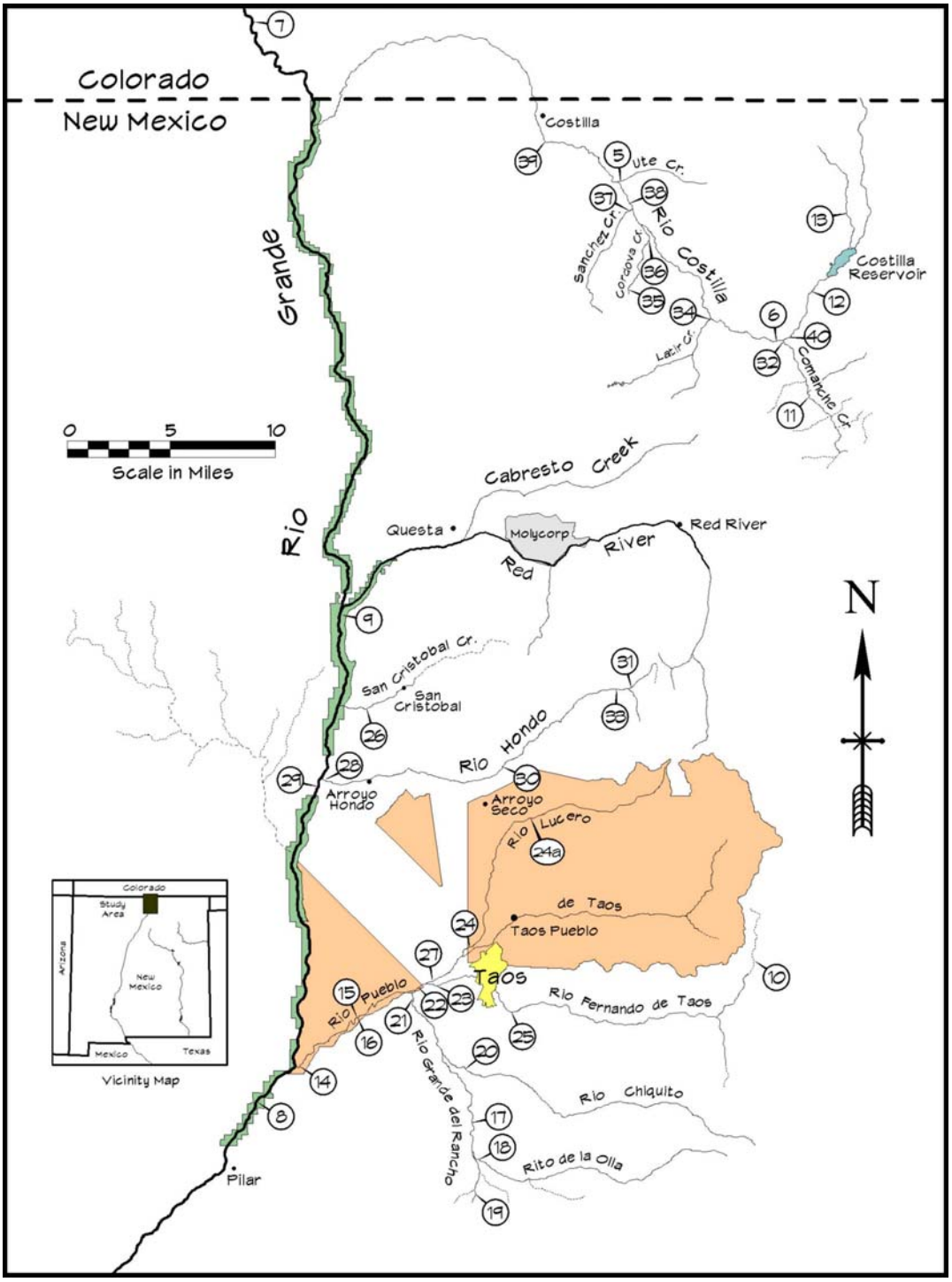

Table 1. Sampling Stations

Station	STORET Code	Location Description
1	URG120.031010	Rio de Los Pinos @ USGS gage
2	URG120.031030	Rio de Los Pinos above NM Game and Fish Area @ Forest Service bridge
3	URG120.032090	Rio San Antonio @ NM-Colorado border in Ortiz
4	URG120.032050	Rio San Antonio @ Forest Road 87 bridge
5		Ute Creek above Costilla Creek @ Hwy 196 in Amalia
6	URG120.030058	Costilla Creek below Comanche Creek
7		Rio Grande @ NM-Colorado border @ USGS gage in Colorado
8		Rio Grande below Rio Pueblo de Taos @ USGS gage
9	URG119.027090	Rio Grande below Red River @ Lama
10		Rio Fernando de Taos @ US 64 bridge
11		Comanche Creek below upper exclosure
12		Costilla Creek @ Costilla-Vermejo boundary
13		Casias Creek
14		Rio Pueblo de Taos @ Rio Grande
15		Rio Pueblo de Taos 20 m below Taos WWTF effluent channel
16		Rio Pueblo de Taos 20 m above Taos WWTF effluent channel
17	HRG36	Rio Grande del Rancho @ USGS gage
18		Rito de la Olla @ Hwy 518 bridge
19		Rio Grande del Rancho @ Hwy 518 bridge
20	HRG34	Rio Chiquito @ USGS gage
21		Rio Grande del Rancho below Rio Chiquito
22		Rio Pueblo de Taos near Los Cordovas
23	URG120.024015	Rio Fernando de Taos near lower Ranchito
24		Rio Lucero above Rio Pueblo de Taos
24a		Rio Lucero on Taos Pueblo below Wilderness gate
25	HRG32	Rio Fernando de Taos @ USGS gage
26	URG120.027220	San Cristobal Creek
27		Rio Pueblo de Taos near lower Ranchito
28	URG120.026501 (HON20)	Rio Hondo @ Rio Grande confluence
29	URG119.027010	Rio Grande below Rio Hondo
30	URG120.026525	Rio Hondo 1.5 miles above Valdez
31	URG120.026560 (HON3)	North Fork Rio Hondo adjacent to Taos Ski Valley parking lot
32	URG120.030060	Comanche Creek @ mouth on Costilla Creek
33	URG120.026555	Rio Hondo 50 feet above WWTF
34	HRG20.2	Latir Creek @ Costilla Creek
35	URG120.030030	Cordova Creek 300 m upstream from day lodge
36	URG120.030020	Cordova Creek above Costilla Creek @ Hwy 196
37		Sanchez Creek above Costilla Creek

Station	STORET Code	Location Description
38		Costilla Creek above Amalia @ Hwy 196 culvert bridge
39		Costilla Creek above Costilla @ Hwy 196 bridge
40	URG120.030065	Costilla Creek above Comanche Creek

6.0 WATER QUALITY ASSESSMENT (RESULTS AND DISCUSSION)

6.1 Stream Discharge

Stream discharge, measured in spring, summer, and/or fall at twenty stations, is given in Table 2.

Table 2. Stream Discharge (ft^3/s)

Sampling Station	15-17 May	31 July-1 Aug	16-17 October
4 (Rio San Antonio)	11.3*	0**	2.5*
5 (Ute Creek above Costilla Creek @ Hwy 196 in Amalia)	<1.0**	<0.25**	0.1**
10 (Rio Fernando de Taos)	0.27*	0.1**	0.1**
12 (Costilla Creek @ Costilla-Vermejo boundary	113	111.5	3.84
14 (Rio Pueblo de Taos)	12.7*	4.1*	7.3
17 (Rio Grande del Rancho)	27.3	3.25	3.6*
19 (Rio Grande del Rancho)	15.1*	1.3*	1.9*
22 (Rio Pueblo de Taos)	3.7*	0.98*	2.9
23 (Rio Fernando de Taos)	1.6*	0.23*	0.36*
25 (Rio Fernando de Taos)	3.7*	0.38*	0.29*
26 (San Cristobal Creek)	<1.0**	0.304*	0.26*
27 (Rio Pueblo de Taos)	2.1	1.2*	1.6*
28 (Rio Hondo)	7.7	7.5*	8.6
31 (North Fork Rio Hondo)	4.5**	1.0*	2.6*
32 (Comanche Creek)	5.4*	1.6*	1.4*
33 (Rio Hondo)	18.2	5.1*	5.0
34 (Latir Creek @ Costilla Creek)	9.45*	3.38*	2.08*
36 (Cordova Creek above Costilla Creek @ Hwy 196)	<1.0**	<0.25**	<0.1**

* estimated flow (fewer than 20 measurements across the channel)
** visual estimation (no measurements)
NOTE: Stream discharge data for the following stations are available through the US Geological Survey: 1, 3, 7, 13, 15, 17, 24a, 29, 30, 39

6.2 Assessment Units (Stream Reach)

The following water quality assessment summary is divided into Assessment Units (also known as waterbody or stream reaches). Assessment Units and their associated sampling stations are given in Table 3.

Table 3. Assessment Units and Associated Sampling Stations

Assessment Unit	Sampling Stations
Casias Creek (Costilla Reservoir to headwaters)	13
Comanche Creek (Costilla Creek to Little Costilla Creek)	11, 32
Cordova Creek (Costilla Creek to headwaters)	35, 36
Costilla Creek (Comanche Creek to Costilla Dam)	12, 40
Costilla Creek (diversion above Costilla to Comanche Creek)	6, 38, 39
Latir Creek (Costilla Creek to headwaters)	34
Rio Chiquito (Rio Grande del Rancho to headwaters)	20
Rio de los Pinos (New Mexico Reaches)	1, 2
Rio Fernando de Taos (Rio Pueblo de Taos to headwaters)	10, 23, 25
Rio Grande del Rancho (Rio Pueblo de Taos to Hwy. 518 bridge)	17, 21
Rio Grande del Rancho (Hwy. 518 bridge to headwaters)	19
Rio Grande (Embudo Creek to Rio Pueblo de Taos)	8
Rio Grande (Rio Pueblo de Taos to Red River)	9, 29
Rio Grande (Red River to New Mexico-Colorado border)	7
Rio Hondo (Rio Grande to US Forest Service boundary)	28
Rio Hondo (South Fork Rio Hondo to Lake Fork Creek)	31, 33
Rio Hondo (US Forest Service boundary to South Fork Rio Hondo)	30
Rio Lucero (Rio Pueblo de Taos to headwaters)*	24, 24a
Rio Pueblo de Taos (Arroyo del Alamo to Rio Grande del Rancho)	15, 16
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	14
Rio Pueblo de Taos (Rio Grande del Rancho to Taos Pueblo boundary)	22, 27
Rio San Antonio (Colorado border to Montoya Canyon)	3
Rio San Antonio (Montoya Canyon to headwaters)	4
Rito de la Olla (Rio Grande del Rancho to headwaters)	18
San Cristobal Creek (Rio Grande to headwaters)	26
Sanchez Creek (Costilla Creek to headwaters)	37
Ute Creek (Costilla Creek to headwaters)	5

* This is not an official assessment unit due to the fact that Lucero Creek is located entirely on Taos Pueblo land, however, Taos Pueblo granted the SWQB permission to sample and use the data for the purposes of this study.

6.3 Discussion of Exceedences of Water Quality Standards

For many water quality parameters, the State of New Mexico maintains numeric water quality standards. However, for several parameters (e.g., plant nutrients, stream bottom deposits), only narrative standards exist. Data are assessed for designated use attainment status for both numeric and narrative water quality standards by application of the *Assessment Protocol* and associated appendices (NMED/SWQB, 2004a).

The following discussion includes information pertaining to all exceedences of water quality standards found during the intensive watershed survey. The purpose of this section of the report is to provide the reader with information on where current water quality standards are being exceeded within the watershed. These exceedences are used to determine designated use impairment status. Final assessment determinations as to whether or not a stream reach is considered to be meeting its designated uses depend on the overall amount and type of data available during the assessment process (Refer to NMED/SWQB's *Assessment Protocol* for additional information on the assessment process, NMED/SWQB 2004a). When available, outside sources of data that meet quality assurance requirements are combined with data collected by SWQB during intensive watershed survey to determine final impairment status. Final designated use impairment status is housed in the Assessment Database (ADB) and is reported in *Appendix B* of the *Integrated Clean Water Act §303(d)/ §305(b) Report* (NMED/SWQB, 2004b).

6.3.1 Casias Creek (Costilla Reservoir to headwaters)

No exceedences of water quality criteria were detected during this survey.

Benthic macroinvertebrate data from this assessment unit indicate full support for stream bottom deposits, but impacts have been observed that warrant close attention during future surveys.

6.3.2 Comanche Creek (Costilla Creek to Little Costilla Creek)

Thermograph data from Station 11 (maximum = 27.1°C) indicate non-support for temperature as instantaneous readings exceeded 23°C. Thus, this assessment unit is in non-support of the temperature standard. Thermograph data from this station were collected during 2002 as the thermograph data from 2000 were inadvertently compromised.

Combined geomorphological and benthic macroinvertebrate data from this assessment unit indicate non-support for stream bottom deposits.

6.3.3 Cordova Creek (Costilla Creek to headwaters)

The dissolved oxygen criterion (≥6.0 mg/L) was exceeded for two samples (5.88 mg/L on 01 August; 5.82 mg/L on 02 August) out of eight at Station 35. No exceedences out of eight samples were detected at Station 36. Thus, this assessment unit is in full support of the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

This assessment unit is also impaired due to stream bottom deposits. A total maximum daily load was developed for this stream reach in 1999.

6.3.4 Costilla Creek (Comanche Creek to Costilla Dam)

No exceedences of the acute criterion for aluminum were detected out of a total of fifteen samples collected at two stations. One exceedence (0.09 mg/L) of the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 02 August out of eight samples collected at Station 40. One exceedence (0.09 mg/L) above the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 01 August out of seven samples collected at Station 12. In both cases, the mean value for samples collected during the summer run at each station for this parameter was below the chronic criterion, thus no violation of water quality standards is recognized.

One exceedence (0.004 mg/L) above the hardness-dependent chronic criterion (0.001 mg/L) for dissolved lead was detected on 17 May out of eight samples collected at Station 40. The mean value for samples collected during the spring run at this station for this parameter was above the chronic criterion. However, the proportion of exceedences was such that this assessment unit is in full support of the chronic dissolved lead standard, but impacts have been observed that warrant close attention during future surveys.

One exceedence (0.03 mg/L) above the hardness-dependent chronic criterion (0.028 mg/L) for dissolved nickel was detected on 17 May out of eight samples collected at Station 40. The mean value for samples collected during the spring run at this station for this parameter was below the chronic criterion, thus no violation of water quality standards is recognized.

One exceedence (0.09 mg/L) above the hardness-dependent acute criterion (0.062 mg/L) and chronic criterion (0.063 mg/L) for dissolved zinc was detected on 17 May out of eight samples collected at Station 40. The mean value for samples collected during the spring run at this station for this parameter was below the chronic criterion, thus only an exceedence of the acute criterion is recognized. However, the proportion of exceedences was such that this assessment unit is in full support of the acute dissolved zinc standard, but impacts have been observed that warrant close attention during future surveys.

6.3.5 Costilla Creek (diversion above Costilla to Comanche Creek)

The turbidity criterion (25 NTU) was exceeded for both spring samples (87.7 NTU on 16 May; 44.7 NTU on 17 May) at Station 39. One exceedence (32.3 NTU) above the criterion for turbidity (25 NTU) was detected on 16 May out of eight samples collected at Station 38. These values may be attributable to natural causes (i.e., spring runoff) or the operation of irrigation or flood control facilities (flows were at bankfull on weekdays from spring to fall due to dam operations). However, benthic macroinvertebrate data indicate suboptimal habitat conditions at Station 39 (likely due to the flow regime that results from dam operations).

No exceedences of the acute criterion for dissolved aluminum (0.75 mg/L) were detected in this assessment unit during this survey. One exceedence (0.1 mg/L) above the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 02 August out of eight samples collected at Station 39. One exceedence (0.17 mg/L) above the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 02 August out of eight samples collected at Station 38. One exceedence (0.09 mg/L) above the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 16 May out of eight samples collected at Station 6. At Station 39, the mean value (0.063 mg/L) for samples collected during the summer run for this parameter was below the chronic criterion. At Station 38, the mean value (0.097 mg/L) for samples collected during the summer run for this parameter was above the chronic criterion. At Station 6, the mean value (0.080 mg/L) for samples collected during the spring run for this parameter was below the chronic criterion. Thus, this reach is considered to be in full support of the chronic dissolved aluminum standard, but impacts have been observed that warrant close attention during future surveys.

Thermograph data from Station 39 indicate non-support for temperature as instantaneous readings exceeded 23°C (maximum = 25.81°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 8 days) consecutive days. Thus, this assessment unit is in non-support of the temperature standard. Thermograph data from this station were collected during 2002 as the thermograph data from 2000 were inadvertently compromised.

Combined geomorphological and benthic macroinvertebrate data from this assessment unit indicate full support for stream bottom deposits, but impacts have been observed that warrant close attention during future surveys. These impacts are likely due to the flow regime resulting from dam operations.

6.3.6 Latir Creek (Costilla Creek to headwaters)

No exceedences of water quality criteria were detected during this survey.

6.3.7 Rio Chiquito (Rio Grande del Rancho to headwaters)

One exceedence (5.41 mg/L) of the criterion for dissolved oxygen (≥6.0 mg/L) was detected on 01 August out of eight samples collected at Station 20. Thus, this assessment unit is in full support for the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

6.3.8 Rio de los Pinos (New Mexico Reaches)

The dissolved oxygen criterion (≥6.0 mg/L) was exceeded on 17 May at Station 1 (5.32 mg/L) and at Station 2 (5.68 mg/L). Eight samples were collected at each station. However, the proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

Thermograph data from Station 1 (maximum = 29.8°C) and Station 2 (maximum = 27.7°C) indicate non-support for temperature as instantaneous readings exceeded 23°C. Grab samples at both Station 1 and Station 2 also exceeded 23°C. Thus, this assessment unit is in non-support of the temperature standard. Thermograph data from these stations were collected during 2002 as the thermograph data from 2000 were inadvertently compromised.

6.3.9 Rio Fernando de Taos (Rio Pueblo de Taos to headwaters)

One exceedence (5.37 mg/L) of the dissolved oxygen criterion (≥6.0 mg/L) was detected on 01 August out of eight samples collected at Station 25. However, the proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard.

The conductivity criterion (400 μS/cm) was exceeded twice out of eight samples collected at Station 10, five out of eight samples collected at Station 25, and seven out of eight samples collected at Station 23. The maximum recorded conductivity was 558 μS/cm at Station 10 (31 July), 707 at Station 25 (31 July), and 856 μS/cm at Station 23 (19 October). Thus, this assessment unit is in non-support of the conductivity standard.

Thermograph data from Station 10 indicate full support for temperature at that location. Grab samples for temperature at Station 25 also indicate full support. However, thermograph data from Station 23 indicate non-support for temperature as instantaneous readings exceeded 23°C (maximum = 24.51°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 22) consecutive days. Thus, this assessment unit is in non-support of the temperature standard. Thermograph data from Station 10 were collected during 2002 as the 2000 data from that station were inadvertently compromised.

One exceedence (29.7 NTU) above the turbidity criterion (25 NTU) was detected on 15 May out of eight samples collected at Station 23. No exceedences of the turbidity criterion were detected out of eight samples collected at each of the two other stations. Thus, the proportion of exceedences was such that this assessment unit is in full support of the turbidity standard.

6.3.10 Rio Grande del Rancho (Rio Pueblo de Taos to Hwy. 518 bridge)

Combined geomorphological and benthic macroinvertebrate data from this assessment unit indicate full support for stream bottom deposits, but impacts have been observed that warrant close attention during future surveys.

The conductivity criterion (400 μS/cm) was exceeded eight out of eight samples at Station 21 (maximum = 710 μS/cm). It was not exceeded at either of the other two stations, each of which was sampled eight times. Thus, this assessment unit is in non-support for the conductivity standard.

One exceedence (210/100 mL) of the fecal coliform criterion (200/100 mL) was detected on 01 August out of three samples collected at Station 21. Thus this assessment unit is in full support for the fecal coliform standard, but impacts have been observed that warrant close attention during future surveys.

Thermograph data at Station 17 indicates full support for temperature at those locations. One exceedence (22.2°C) of the temperature criterion was detected in a grab sample on 31 July at Station 21. However, the proportion of exceedences was such that this assessment unit is in full support for temperature.

6.3.11 Rio Grande del Rancho (Hwy. 518 bridge to headwaters)

One exceedence (40.2 NTU) above the turbidity criterion (25 NTU) was detected on 17 May out of eight samples collected at Station 19. However, the proportion of exceedences was such that this assessment unit is in full support of the turbidity standard, but impacts have been observed that warrant close attention during future surveys.

6.3.12 Rio Grande (Embudo Creek to Rio Pueblo de Taos)

One exceedence (5.1 mg/L) of the dissolved oxygen standard (≥6.0 mg/L) was detected on 01 August out of eight samples collected at Station 8.

One exceedence (23.6°C) of the temperature standard (22°C) was detected on 02 August out of eight samples collected at Station 8.

One exceedence (0.1 mg/L) of the chronic criterion for dissolved aluminum (0.087 mg/L) was detected on 17 October out of eight samples collected at Station 8.

6.3.13 Rio Grande (Rio Pueblo de Taos to Red River)

One exceedence (5.75 mg/L) of the dissolved oxygen standard (≥6.0 mg/L) was detected on 17 May at Station 9 out of eight samples collected at each of two stations in this assessment unit. Thus, the proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard.

One value for pH (6.19) on 17 May at Station 9 was outside the allowable range (6.6-8.8). Considering that the Rio Grande near the Colorado border registered a pH of 9.0 on the same day, this reading is suspect. In any case, the proportion of exceedences was such that this assessment unit is in full support of the pH standard.

The temperature standard was exceeded twice at Station 29 (20.7°C on 31 July; 21.3°C on 01 August) out of eight samples collected at each of two stations in this assessment unit. Thus, the proportion of exceedences was such that this assessment unit is in full support for temperature, but impacts have been observed that warrant close attention during future surveys.

6.3.14 Rio Grande (Red River to New Mexico-Colorado border)

One exceedence (5.5 mg/L) of the dissolved oxygen standard (≥6.0 mg/L) was detected on 16 May out of seven samples collected at Station 7. However, the proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

Seven of eight samples (maximum = 9.36) were outside the allowable pH range (6.6-8.8) at Station 7. Thus, this assessment unit is in non-support of the pH standard.

Three of eight samples (maximum = 28.3°C) were above the criterion for temperature at Station 7. All three exceedences occurred during the summer sampling effort. Thus, this assessment unit is in non-support of the temperature standard.

6.3.15 Rio Hondo (Rio Grande to US Forest Service boundary)

One value for pH (8.92) was outside the allowable range (6.6-8.8) on 19 October out of eight samples collected at Station 28. However, the proportion of exceedences was such that this assessment unit is in full support of the pH standard, but impacts have been observed that warrant close attention during future surveys.

The temperature criterion (20°C) was exceeded twice (21.7°C on 31 July; 21.9°C on 01 August) out of eight samples collected at Station 28.

6.3.16 Rio Hondo (South Fork Rio Hondo to Lake Fork Creek)

No exceedences of water quality criteria were detected during this survey.

6.3.17 Rio Hondo (US Forest Service boundary to South Fork Rio Hondo)

No exceedences of water quality criteria were detected during this survey.

6.3.18 Rio Lucero (Rio Pueblo de Taos to headwaters)

This is not an official assessment unit due to the fact that Lucero Creek is located entirely on Taos Pueblo land, however, Taos Pueblo granted the SWQB permission to sample and use the data for the purposes of this study.

One exceedence (5.15 mg/L) of the dissolved oxygen standard (≥6.0 mg/L) was detected on 01 August out of eight samples collected at Station 24. No exceedences were detected out of four samples collected at Station 24a. The proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

Two exceedences (20.4°C on 31 July; 22.6°C on 01 August) of the temperature criterion (20°C) were detected out of eight samples collected at Station 24. No exceedences were detected out of four samples collected at Station 24a.

6.3.19 Rio Pueblo de Taos (Arroyo del Alamo to Rio Grande del Rancho)

Thermograph data from Station 15 indicate non-support for temperature for this assessment unit, as instantaneous temperature readings exceeded 23°C (maximum = 28.26°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 48) consecutive days.

One exceedence (310/100 mL) of the fecal coliform criterion (200/100 mL) was detected on 30 October at Station 15 out of three samples collected at each of two stations in this assessment unit. The number of exceedences was such that this assessment unit is in full support of the fecal coliform standard, but impacts have been observed that warrant close attention during future surveys.

One exceedence (5.95 mg/L) of the dissolved oxygen criterion (≥6.0 mg/L) was detected on 01 August at Station 16 out of eight samples collected at each of two stations in this assessment unit. The proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard.

Combined geomorphological and benthic macroinvertebrate data from this assessment unit indicate non-support for stream bottom deposits due to sediment inputs observed from 1998 through 2000.

6.3.20 Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)

Thermograph data from Station 14 indicate non-support for temperature for this assessment unit, as instantaneous temperature readings exceeded 23°C (maximum = 25.06°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 38) consecutive days.

One value (8.85) outside the allowable pH range (6.6-8.8) was detected on 01 August out of eight samples collected at Station 14. The proportion of exceedences was such that this assessment unit is in full support of the pH standard, but impacts have been observed that warrant close attention during future surveys.

One exceedence (55.8 NTU) of the turbidity criterion (50 NTU) was detected on 18 October out of eight samples collected at Station 14. The proportion of exceedences was such that this assessment unit is in full support of the turbidity standard, but impacts have been observed that warrant close attention during future surveys.

6.3.21 Rio Pueblo de Taos (Rio Grande del Rancho to Taos Pueblo boundary)

The conductivity criterion (400 μS/cm) was exceeded for seven of seven samples (maximum = 490.3 μS/cm) at Station 22. No exceedences were detected out of eight samples collected at Station 27. Thus, this assessment unit is in non-support of the conductivity standard.

Thermograph data from Station 22 indicate non-support for temperature for this assessment unit, as instantaneous temperature readings exceeded 23°C (maximum = 30.09°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 84) consecutive days. Thermograph data from Station 27 indicate non-support for temperature for this assessment unit, as instantaneous temperature readings exceeded 23°C (maximum = 27.23°C) and temperature exceeded 20°C for more than six consecutive hours in a 24-hour cycle for more than three (maximum interval = 11) consecutive days. Thermograph data from Station 22 were collected during 2002 as the 2000 data from that station were inadvertently compromised.

One exceedence (270/100 mL) of the fecal coliform criterion (200/100 mL) was detected on 30 October out of two samples collected at Station 22. No exceedence was detected in one sample collected at Station 27. The number of exceedences was such that this assessment unit is in full support of the fecal coliform standard, but impacts have been observed that warrant close attention during future surveys.

6.3.22 Rio San Antonio (Colorado border to Montoya Canyon)

Combined geomorphological and benthic macroinvertebrate data from this assessment unit indicate full support for stream bottom deposits, but impacts have been observed that warrant close attention during future surveys. These impacts are likely the result of very low to no flow during summer and fall.

6.3.23 Rio San Antonio (Montoya Canyon to headwaters)

One exceedence (5.15 mg/L) of the dissolved oxygen criterion (≥6.0 mg/L) was detected on 18 October out of five samples collected at Station 4. Samples were not taken in summer due to drying of the channel. The proportion of exceedences was such that this assessment unit is in full support of the dissolved oxygen standard, but impacts have been observed that warrant close attention during future surveys.

Thermograph data from Station 4 indicate non-support for temperature for this assessment unit, as instantaneous temperature readings exceeded 23°C (maximum = 26.97°C). Thermograph data were collected during 2002 as the 2000 data were inadvertently compromised.

6.3.24 Rito de la Olla (Rio Grande del Rancho to headwaters)

No exceedences of water quality standards were detected during this survey.

6.3.25 San Cristobal Creek (Rio Grande to headwaters)

One value (6.42) outside the allowable pH range (6.6-8.8) was detected on 17 October out of three samples collected at Station 26. The number of exceedences was such that this assessment unit is in full support of the pH standard, but impacts have been observed that warrant close attention during future surveys.

6.3.26 Sanchez Creek (Costilla Creek to headwaters)

No exceedences of water quality criteria were detected during this survey. The creek was dry on 02 August.

6.3.27 Ute Creek (Costilla Creek to headwaters)

No exceedences of water quality criteria were detected during this survey.

6.4 Biological Assessment

Results of the benthic macroinvertebrate survey along with analysis using EPA's *Rapid Bioassessment Protocol* (Barbour *et al*., 1999) are listed in Table 4. Samples for the 2000 Upper Rio Grande Watershed Survey, Part I were collected from twenty study sites located on twelve separate streams. Collection of benthic macroinvertebrates involved compositing two individual kick samples taken from a riffle unit at each sampling site. Each kick sample involved the disturbance of approximately 0.5 m^2 of substrate for one minute. The rapid bioassessment protocols for picking, identification, and analysis were applied to approximately 300 organisms obtained from subsamples of composites at each site.

Taxa lists from the twenty study sites were placed in six separate groups along with a respective reference site for each group. Selection of reference sites for comparison and analyses was performed according to EPA's *Rapid Bioassessment Protocol* guidelines (Barbour *et al*., 1996; Barbour *et al*., 1999). Separation of study and reference sites into each group was based on a combination of similarities in ecoregion (Omernik, 1987; Omernik, 2000; Jacobi *et al*., 1997), altitude, Rosgen stream type, watershed size, substrate, cross sectional area, geology, and local geography. Criteria for determination of biological condition category and/or aquatic life use support category for a study site as a percentage comparability to a reference site can be found in *Rapid Bioassessment Protocols* (Barbour *et al*., 1999) and the *Assessment Protocol* (NMED, 2004), respectively.

Table 4. Summary of Biological Analyses

			Condition Category	
Group	**Site name**	**Percent of Reference**	**Biological**	**Aquatic Life Use**
1	**Rio Hondo 1.5 miles above Valdez**	**Reference**	**Non-impaired**	**Full support**
1-a	Costilla Creek above Costilla @ Hwy 196 bridge	56%	Slightly impaired	Non-support
1-b	Rio Lucero on Taos Pueblo below Wilderness gate	90%	Non-impaired	Full support
1-c	Rito de la Olla @ bridge on Hwy. 518	81%	Non-impaired	Full support
1-d	Costilla Creek below Comanche Creek	81%	Non-impaired	Full support
1-e	Rio Pueblo de Taos below Taos WWTF	43%	Moderately impaired	Non-support
1-f	Rio Fernando de Taos @ USGS gage	71%	Slightly impaired	Non-support
1-g	Rio Grande del Rancho @ USGS gage	71%	Slightly impaired	Non-support
2	**Rio de Los Pinos above NMDGF area**	**Reference**	**Non-impaired**	**Full support**
2-a	Rio San Antonio @ Forest	73%	Slightly	Non-support

			Condition Category	
Group	**Site name**	**Percent of Reference**	**Biological**	**Aquatic Life Use**
	Road 87 bridge		impaired	
2-b	Rio de Los Pinos @ NMDGF area	86%	Non-impaired	Full support
3	**Rio Grande @ NM-CO border**	**Reference**	**Non-impaired**	**Full support**
3-a	Rio Grande below Rio Pueblo de Taos @ USGS gage	93%	Non-impaired	Full support
4	**Red River below hatchery**	**Reference**	**Non-impaired**	**Full support**
4-a	Rio Pueblo de Taos above Rio Grande	100%	Non-impaired	Full support
4-b	Rio Hondo above Rio Grande	96%	Non-impaired	Full support
5	**Casias Creek**	**Reference**	**Non-impaired**	**Full support**
5-a	Comanche Creek above Costilla Creek	71%	Slightly impaired	Non-support
5-b	Comanche Creek below upper exclosure	62%	Slightly impaired	Non-support
5-c	Rio Grande del Rancho @ bridge on Hwy 518	71%	Slightly impaired	Non-support
6	**Cieneguilla Creek below Crooked Creek**	**Reference**	**Non-impaired**	**Full support**
6-a	Rio Fernando de Taos @ US 64	96%	Non-impaired	Full support

Fourteen of twenty sites scored high enough to be rated fully supporting (non-impaired) at greater than 83% of reference. The Rio Pueblo de Taos below the Taos wastewater treatment facility scored 43% of the reference and was subsequently rated non-supporting (moderately impaired). This impairment was most likely caused by increased nutrient inputs from the Taos wastewater treatment facility resulting in increased overall standing crop and altered quality of the macroinvertebrate community, as shown by substantial increases in both the Hilsenhoff Biotic Index (HBI) and the Community Tolerance Quotient - dominance (CTQd) indices. Further downstream, near the confluence with the Rio Grande, the Rio Pueblo de Taos returned to a fully supporting (non-impaired) status due to a reduction in standing crop (11790/m^2 to 1320/m^2) and decreases in both the HBI and CTQd metrics.

7.0 CONCLUSIONS

The lower portion of the mainstem of the Rio Grande surveyed during this study had no water quality impairments. The water quality in the upper portion of the Rio Grande was impaired due to pH and temperature. The lower tributaries of the Rio Grande around the Taos area were impaired due to conductivity and temperature on the Rio Fernando de Taos; conductivity on the

Rio Grande del Rancho; and temperature, stream bottom deposits, and conductivity in various portions of the Rio Pueblo de Taos. The lower part of the Rio Hondo was impaired due to temperature. In the upper tributaries temperature was a cause of impairment for both Comanche Creek and Rio Costilla, and Cordova Creek was impaired due to stream bottom deposits. Finally, in the tributaries close to the Colorado border, temperature was a cause of impairment for both the Rio de los Pinos and the upper portion of the Rio San Antonio.

8.0 REFERENCES

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