WATER QUALITY SURVEY SUMMARY
FOR THE
RIO PEÑASCO WATERSHED
(From Hope, NM to Headwaters)
2003

Prepared by
Surface Water Quality Bureau
New Mexico Environment Department
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Cover: Travertine cliff at Bluff Springs, upper Rio Peñasco

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LIST OF ACRONYMS

Al	Aluminum
C	Celsius
cfs	cubic feet per second
CWA	Clean Water Act
CWAL	Coldwater Aquatic Life
ELS	Early Life Stage
DO	Dissolved Oxygen
GIS	Geographic Information Systems
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OLS	Other Life Stage
QAPP	Quality Assurance Project Plan
STORET	EPA's Storage and Retrieval System
SWQB	Surface Water Quality Bureau
USEPA	United States Environmental Protection Agency

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1.0 EXECUTIVE SUMMARY

The Rio Peñasco rises east of Cloudcroft near the crest of the Sacramento Mountains (elev. 2,552 m [8372 ft]) and runs generally south east to its confluence with the Pecos River south of Artesia. The limestone strata that form the valley walls produce many springs which carry significant loads of dissolved solids to the mainstem. Originally colonized in the mid nineteenth century by Hispanic settlers, the area experienced a second wave of immigration around 1880 as American settlers moved in, establishing the communities of Mayhill, Duncan and Weed. The establishment of small farms and ranches in areas suitable for agriculture, together with intensive logging, probably led to the eroded state of the channel and side slopes found today. Agua Chiquita also rises near the crest (2884 m [9462 ft]) of the Sacramentos, east and a little south of Sunspot.

During 2003 the Monitoring and Assessment Section of the Surface Water Quality Bureau of the New Mexico Environment Department conducted water quality and biological assessment surveys of the Rio Peñasco watershed and selected tributaries from Hope, NM, to the headwaters. Sampling at stream stations was conducted on a monthly basis from March through October when water was present at the stations. Water quality sampling methods were in accordance with the *Quality Assurance Project Plan for Water Quality Management Programs* (NMED 2003).

Water chemistry sampling at survey stations included total nutrients, total and dissolved metals, major anions and cations, radionuclides, and microbiological collections as indicated by previous survey findings and proximity to potential sources. In addition, biological and geomorphological assessments were conducted at selected stations.

This water quality survey was completed in fulfillment of work-plan commitments of the *FY 2003 Section 106 Work Program for Water Quality Management.* This program was funded by a grant from the U.S. Environmental Protection Agency.

2.0 INTRODUCTION

Previously listed for stream bottom deposits (SBD) and turbidity, the Rio Peñasco was re-assessed in 1998 and turbidity was removed as a cause of impairment. SBD was retained. The 1990 survey report stated that the substrate consisted of heavily cemented sand and gravel. The 2003 field notes and photographs indicate a marked increase in unconsolidated fines. This increase is largely due to debris and ash below Cox Canyon, but is exacerbated by the local practice of moving the stream out of its natural channel and diverting it into an artificial conveyance above the valley floor to facilitate flood irrigation.

Photo 1. Rio Peñasco flowing in a conveyance channel

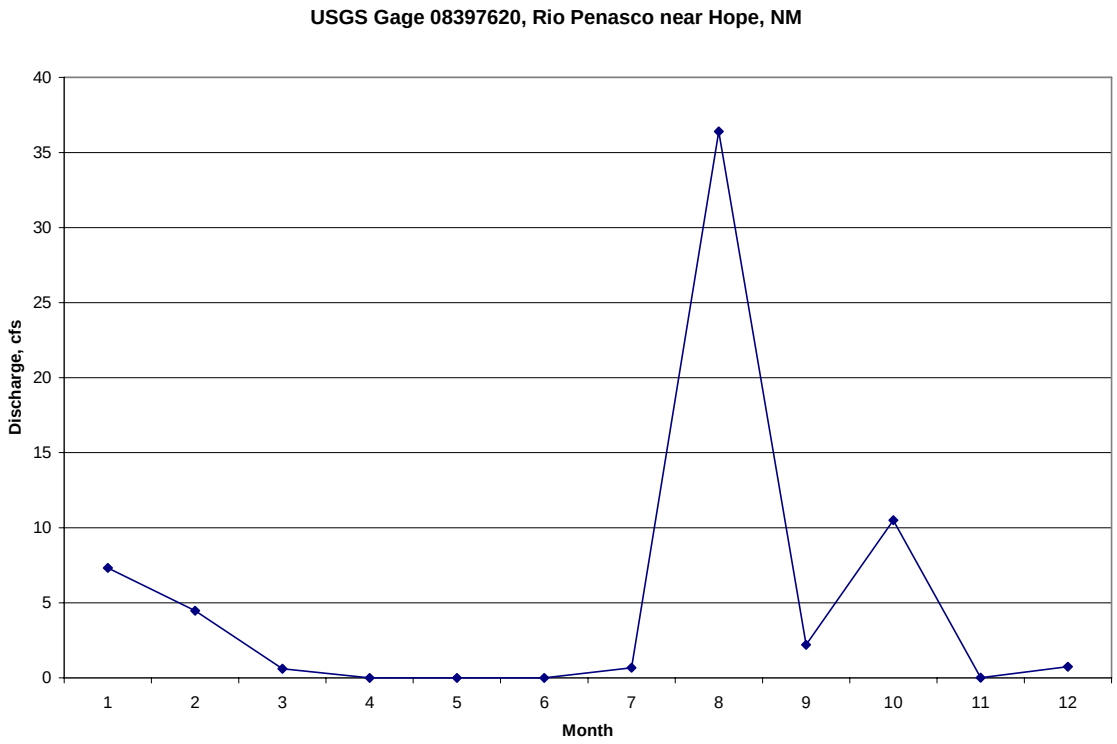

Figure 1. Discharge of the Rio Peñasco, 2003.

Review of field notes and photographs also indicates that, while concentrations of nitrogen and phosphorus species were generally low, algal growth had reached nuisance levels. The lowest nutrient concentrations were found in the Agua Chiquita below the Methodist Assembly waste water treatment plant (NPDES permit number NM0028886). There is no clear pattern to changes seen in the concentrations of nutrients over time.

Sources for nutrients include the local geology, livestock and wildlife. Springs in karst landscapes like the Rio Peñasco watershed can often produce significant quantities of nutrients; it should be noted, however, that large numbers of elk and cattle were observed in or near the channel. Another potential source of nutrient input to waterbodies is runoff from burned areas; though this cannot occur upstream of the burned region.

Photo 2. Heavy algal growth in the Rio Peñasco channel

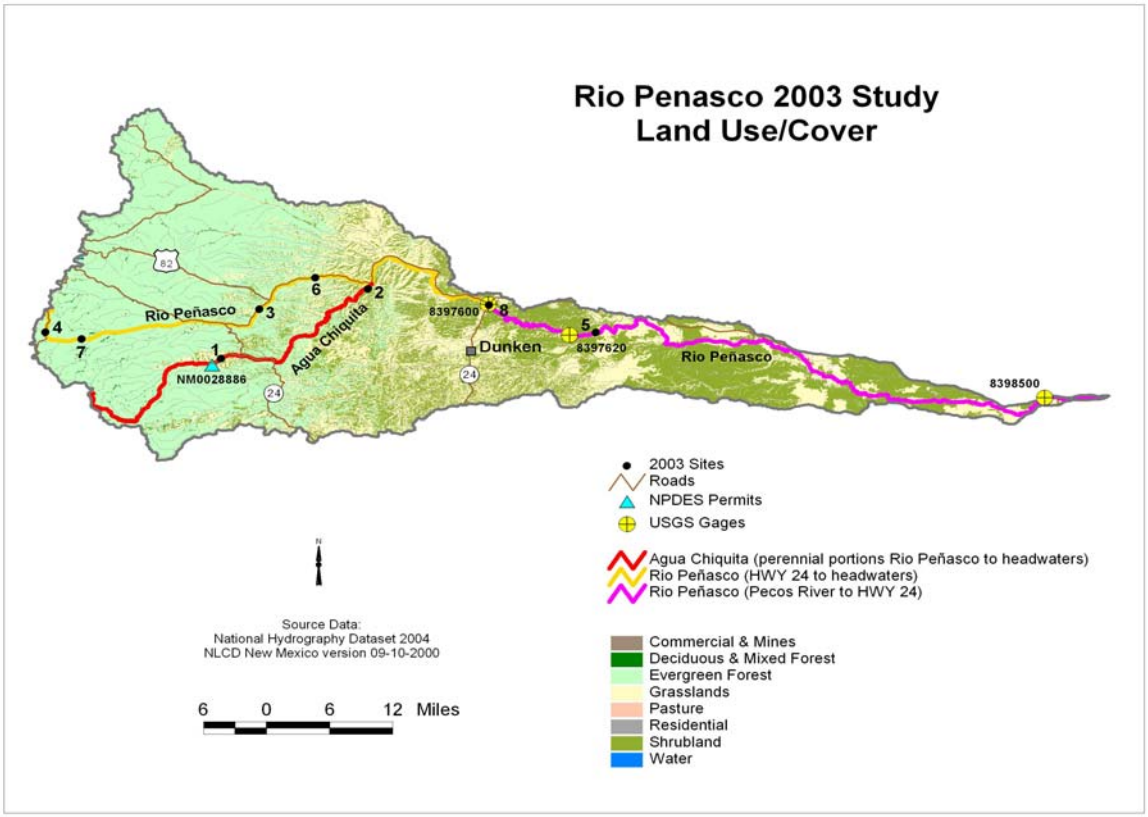

Figure 2. Map of Study Area Drainage area is approximately 675 square miles.

3.0 WATER QUALITY STANDARDS SEGMENTS

As of February 16, 2006, the water quality standards for the subject waters fall within either 20.6.4.206 NMAC or 20.6.4.208 NMAC. For these segments, the WQS state:

20.6.4.206 PECOS RIVER BASIN - The main stem of the Pecos river from the headwaters of Brantley Reservoir upstream to Salt creek (near Acme), perennial reaches of the Rio Peñasco downstream from state highway 24 near Dunken, perennial reaches of the Rio Hondo and its tributaries below Bonney canyon and perennial reaches of the Rio Felix.

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

B. Criteria:

(1) In any single sample: pH within the range of 6.6 to 9.0 and temperature 32.2°C (90°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).

(3) At all flows above 50 cfs: TDS 14,000 mg/L or less, sulfate 3,000 mg/L or less and chloride 6,000 mg/L or less.

[20.6.4.206 NMAC - Rp 20 NMAC 6.1.2206, 10-12-00; A, 05-23-05]

20.6.4.208 PECOS RIVER BASIN - Perennial reaches of the Rio Peñasco and its tributaries above state highway 24 near Dunken, perennial reaches of the Rio Bonito downstream from state highway 48 (near Angus), the Rio Ruidoso downstream of the U.S. highway 70 bridge near Seeping Springs lakes, perennial reaches of the Rio Hondo upstream from Bonney canyon and perennial reaches of Agua Chiquita.

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

B. Criteria:

(1) In any single sample: pH within the range of 6.6 to 8.8, temperature 30°C (86°F) or less and total phosphorus (as P) less than 0.1 mg/L. 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).

[20.6.4.208 NMAC - Rp 20 NMAC 6.1.2208, 10-12-00; A, 05-23-05]

4.0 METHODS

Water quality, benthic macroinvertebrate and fish sampling methods were in accordance with the SWQB's approved Quality Assurance Project Plan for Water Quality Management Programs (QAPP) (NMED/SWQB 2003). Benthic macroinvertebrate and fish sampling methods were in accordance with protocols for EPA's Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (Barbour et al. 1999) and the SWQB QAPP (NMED/SWQB 2003). Fluvial geomorphologic measurements were in accordance with protocols in the SWQB QAPP (NMED/SWQB 2003).

Water chemistry samples were collected at the primary sites monthly from March through October of 2003. Certain sites were sampled on an occasional basis as access and the presence of water allowed.

5.0 SAMPLING SUMMARY

The station STORET identification codes and location descriptions of sampling stations selected for this survey are provided in Table 1.

Table 1. SWQB 2003 Rio Peñasco Sampling Stations

Site	Assessment Unit	STORET ID	Station Description
1	Agua Chiquita (perennial portions Rio Peñasco to headwaters)	59AguaCh029.0	Agua Chiquita between Weed and Sacramento
2	Agua Chiquita (perennial portions Rio Peñasco to headwaters)	59AguaCh001.1	Agua Chiquita near mouth of Rio Peñasco
3	Rio Peñasco (Highway 24 to headwaters)	59RPenas144.3	Rio Peñasco at Miller Flats Road bridge (FR 212)
4	Rio Peñasco (Highway 24 to headwaters)	59RPenas176.0	Rio Peñasco near FR 6563
5	Rio Peñasco (Pecos River to Highway 24)	59RPenas090.0	Rio Peñasco near Helena Road
6	Rio Peñasco (Highway 24 to headwaters)	59RPenas140.2	Rio Peñasco on USFS (below Mayhill)
7	Rio Peñasco (Highway 24 to headwaters)	59RPenas170.4	Rio Peñasco at Bluff Springs
8	Rio Peñasco (Highway 24 to headwaters)	59RPenas108.4	Rio Peñasco at NM Hwy 24 bridge

A summary of the current status of support or non-support of the designated uses for this watershed is provided in Table 2. There are no existing TMDLs for this watershed.

Table 2. Summary of 2004-2006 Integrated List and Existing TMDLs.

Assessment Unit	Coldwater Fishery	Fish Culture	Irrigation	Livestock Watering	Secondary Contact	Wildlife Habitat	Warmwater Fishery
Agua Chiquita Rio Peñasco to headwaters	NS	FS	FS	FS	FS	FS	--
Rio Peñasco Pecos River to hwy 24	--	FS	FS	FS	FS	FS	NS
Rio Peñasco Hwy 24 to headwaters	NS	FS	FS	FS	FS	FS	--

FS: Full Support; NS: Non-Support; --: Not Applicable

A listing of parameter suites sampled at stations in the various assessment units can be found below in Table 3. The rationales for station selection are as listed:

- Agua Chiquita between Weed and Sacramento: the only perennial reach identified on the Agua Chiquita;
- Rio Peñasco near FR 6563: perennial headwater reach;
- Rio Peñasco at Bluff Springs: sampled at the springs, which form a short perennial reach;
- Rio Peñasco at Miller Flats Road bridge (FR 212): established as the upstream bracket for Mayhill, NM;
- Rio Peñasco on USFS (below Mayhill): established as the downstream bracket for Mayhill;
- Rio Peñasco at NM HWY 24 bridge near Duncan: Perennial reach. Serves as upper station for segment 206 and lower station for segment 208. USGS gage number 08397600 (Rio Peñasco near Duncan); and
- Rio Peñasco near Helena Road: near downstream end of perennial reach. USGS gage number 08397620 (Rio Peñasco near Hope).

Table 3 summarizes data collected in each assessment unit and at each station. The number of times each parameter (or suite of parameters) was sampled is indicated (in the case of stream discharge, some of the data are estimated or calculated). Field data include temperature, specific conductance, pH, dissolved oxygen, and turbidity.

Table 3. Sampling Summary

Assessment Unit / Stations	**Ions**	**Nutrients**	**Dissolved Metals**	**Mercury/Selenium**	**Total Metals**	**Bacteria**	**Radionuclides**	**Electro-fished**	**Thermograph**	**Discharge**	**Organics (SVOCs)**	**Geomorph**	**Sonde Deployment**	**Field Data**
Agua Chiquita Rio Peñasco to headwaters														
Agua Chiquita between Weed and Sacramento	8	9	8	5	2	9	4	1	1	8	--	--	--	10
Rio Peñasco Hwy 24 to headwaters														
Rio Peñasco near FR 6563	8	10	8	5	2	9	--	1	1	8	--	1	1	9
Rio Peñasco at Bluff Springs*	1	1	1	--	1	3	--	--	--	--	--	--	--	1
Rio Peñasco at Miller Flats Road bridge (FR 212)	3	2	1	--	1	3	--	--	--	--	--	--	--	3
Rio Peñasco on USFS (below Mayhill)	8	10	8	5	2	9	5	--	--	8	--	2	1	9
Rio Peñasco Pecos River to hwy 24														
Rio Peñasco at NM HWY 24 bridge near Dunken	4	4	4	2	2	3	3	--	2**	--	1	--	--	4
Rio Peñasco near Helena Road	4	4	2	--	2	--	--	--	--	3	--	--	--	4

* Rio Peñasco channel was dry. All samples obtained from Bluff Springs.
** Water plus air thermographs.

Details of assessment procedures are available in the *Assessment Protocol* (NMED/SWQB 2006). A complete data set can be obtained by contacting the SWQB.

6.0 WATER QUALITY ASSESSMENT

6.1 Water Quality Standards Exceedences

For many water quality parameters, the State of New Mexico has adopted 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, 2006).

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 supporting 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 2006). 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, 2004).

6.1.1 Physicochemical Data

Physicochemical water quality samples and sampling frequencies are provided in Table 3. Results of analyses of water samples are compared to their respective criteria and evaluated according to the SWQB Assessment Protocol to determine if a waterbody should be listed for non-support of a given designated use. It should be noted that exceedence of a given criterion may not generate a violation of standards, triggering a listing on the 303d list. Actual listings are generated through the Assessment Protocol that is available on the Surface Water Quality Bureau's website (NMED/SWQB 2006).

This section of this report does not include data from continuous monitoring devices, such as sondes and thermographs. Those persons requiring a complete data set should contact the SWQB.

Extensive sampling for major ions, nutrients, total and dissolved metals, radionuclides and field parameters found no exceedences of water quality criteria. However, the extensive accumulations of fine sediment in the channels of both the Rio Peñasco and the Agua Chiquita triggered a determination of non-support of the aquatic life uses for both streams. These stream bottom deposits are largely derived from runoff from burned areas, but contributions from stream bank destabilization and road runoff were noted.

6.1.2 Data from Continuous Monitoring Devices

As it is not reasonable to list a waterbody as not supporting on the basis of a few exceedences out of several hundred, or several thousand, data points, consequently SWQB has developed special protocols to handle large data sets. The pH and temperature protocols are tied to *State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC as amended through February 16, 2006).* The DO large data set assessment protocol is linked to the presence of sensitive, *i.e.* early life stages, of aquatic organisms.

Temperature data loggers (thermographs) were deployed at stations Rio Peñasco near FR 6563 and Rio Peñasco at NM HWY 24 bridge near Dunken to assess attainment of the aquatic life designated use. Additionally, a thermograph was deployed in the air at station NM HWY 24 bridge near Dunken to determine the effect of air temperature on water temperature. The thermographs were programmed to record hourly. Table 4 summarizes these data sets.

Sondes were deployed at stations Rio Peñasco near FR 6563 and Rio Peñasco on USFS (below Mayhill) to examine pH and DO. Tables 5a and 5b summarize these data.

Table 4. Summary of Thermograph Data.

Station Name	Data Collection Interval	WQS Temperature Criterion (°C)	Maximum Recorded Temperature (°C)	Total # of Data Points	# / % of Exceedences
Agua Chiquita btw Weed and Sacramento	5/30/30 to 10/28/03	30	23.256	3619	0 / 0
Rio Peñasco near FR 6563	5/30/30 to 10/28/03	30	19.888	3619	0 / 0
NM HWY 24 bridge near Dunken	5/30/30 to 10/28/03	30	30.016	3619	0 / 0

Table 5a. Summary of pH Data Collected from Sondes.

Assessment Unit Station (Station ID)	Designated Use	Criterion SU	Deployment Dates (2005)	Min/Max SU	Number/% Exceedences	Magnitude Violation	Frequency Violation
Rio Peñasco Hwy 24 to headwaters Rio Peñasco near FR 6563	CWAL	6.6 to 8.8	10/14/03 / 10/16/03	7.99 / 8.12	0/0	N	N
Rio Peñasco Hwy 24 to headwaters Rio Peñasco on USFS (below Mayhill)	CWAL	6.6 to 8.8	10/14/03 / 10/16/03	8.19 / 8.32	0/0	N	N

Table 5b. Summary of DO Data Collected from Sondes.

Assessment Unit Station (Station ID)	**Designated Use**	**WQS Criterion (mg/L)**	**Deployment Dates (2005)**	**Min/Max Conc. (mg/L)**	**Min Sat. (% local)**	**Assessment Criterion**	**Combined Conc./Sat. Exceedences (# / % / >3 hrs)**	**% Sat Exceedences (# / % / >3 hrs)**
Rio Peñasco Hwy 24 to headwaters Rio Peñasco near FR 6563	**CWAL**	6.0	10/14/03 / 10/16/03	7.67/9.35	95.4	OLS	0/0	0/0
Rio Peñasco Hwy 24 to headwaters Rio Peñasco on USFS (below Mayhill)	**CWAL**	6.0	10/14/03 / 10/16/03	7.73/9.58	97.2	OLS	0/0	0/0

***** OLS refers to Other Life Stages, as opposed to the more sensitive ELS, Early life stages.

6.2 Stream Channel Morphology

Two stations, Rio Peñasco near FR 6563 and Rio Peñasco on USFS (below Mayhill), were subjected to Rosgen level two geomorphological assessment.

Rio Peñasco near FR 6563 was determined to be an E6 type channel with a bankfull width of 7.8 feet and a mean bankfull depth of 0.8 feet. Channel materials as determined by Wolman pebble counts were found to be 80 percent fines (< 2.0 mm), 14 percent gravel, and 3 percent each of cobble and boulder.

Rio Peñasco on USFS (below Mayhill) was determined to be a C6 channel with a bankfull width of 22.7 feet and a mean bankfull depth of 1.3 feet. Channel materials as determined by Wolman pebble counts were found to be 96 percent fines (<2.0 mm) and four percent gravel.

Staff reports up to two feet of indurated *Chara* sp. mixed with ash covering the streambed below Mayhill. Staff also reported up to 18 inches of unconsolidated sediment or ash at the Hwy 24 bridge near Dunken and at FR 6563. Field notes also indicate a debris dam of felled timber at the station below Mayhill.

Table 6a. Site-specific stream channel morphology.

Station Name	Watershed Area sq mi	X-Sectional Area sq ft	Channel Width ft	Mean Depth ft	Max Depth ft	Width/Depth Ratio	Flood Prone Width ft*	Entrenchment Ratio	Slope %	Sinuosity
Rio Peñasco near FR 6563	3.0	6.24	7.8	0.8	1.6	9.75	27.0	3.461	1.7	1.1
Rio Peñasco on USFS (below Mayhill)	212	29.51	22.7	1.3	2.6	17.461	52	2.291	0.9	1.1

Table 6b. Site-specific stream channel particle characteristics.

Station Name	D84 mm	D95 mm	% Bedrock	% Boulder	% Cobble	% Gravel	% Sand	Silt/Clay	% Shaded	Stream Type
Rio Peñasco near FR 6563	4	153	--	3	3	14	14	66	20	E6
Rio Peñasco on USFS (below Mayhill)	--	2	--	--	--	4	19	77	27	C6

* Flood Prone Width is that elevation on the flood plain equal to the elevation of the water surface at twice the mean depth at bank full.

7.0 RESULTS

Due to the large volume of data collected during this survey, it will not be included in this report. Those persons requiring a complete dataset or data from a specific site should contact the Surface Water Quality Bureau or search EPA's STORET database at www.epa.gov/STORET/.

In 2003 the criteria for bacterial levels were written in terms of fecal coliforms; current criteria, under which assessments were conducted for this survey, are written in terms of *E. coli*. The single *E. coli* sample taken from Agua Chiquita returned a result more than three times the current single sample criterion. NMED's current Assessment Protocol does not provide for a finding of non-support based on a single sample.

Despite sometimes heavy growth of both filamentous algae and emergent macrophytes, data generated by long term sonde deployments do not indicate excessive diurnal DO swings. It should be kept in mind, however, that the October deployment date missed the critical warm weather seasons where extreme DO swings would be most likely to occur.

This survey found no exceedences of any numeric criterion that lead to a finding of non-support of a designated use. However, biological and habitat assessments determined that no segments in the watershed support the aquatic life use due to an excess of stream bottom deposits. While the sharp increases in stream bottom deposits noted in 2003 as compared to 1990 are probably due to burned area runoff, stream bank modifications, channel manipulation and land management practices can also contribute significant quantities of sediment to stream channels.

8.0 REFERENCES

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