NMED/SWQ-03/2

WATER QUALITY ASSESSMENT OF THE GALLINAS RIVER AND TECOLOTE CREEK 2001

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Intensive Water Quality Survey of the Gallinas River and Tecolote Creek in San Miguel County, New Mexico, 2001

EXECUTIVE SUMMARY

Water quality surveys and assessments were completed in fulfillment of work-plan commitments of the *FY 2001 Section 106 Work Program for Water Quality Management.* This program was partially funded by a grant from the U.S. Environmental Protection Agency.

During 2001 the Surveillance and Standards Section of the Surface Water Quality Bureau of the New Mexico Environment Department conducted water quality and biological assessment surveys of the Gallinas River and Tecolote Creek including stations on the Pecos Arroyo and Burro, Blue and Falls Creeks. Sampling was conducted on a seasonal basis, with visits in May, July and October. Water quality sampling methods were in accordance with the "Quality Assurance Project Plan for Water Quality Management Programs" (NMED 2001).

Two stations, Falls Creek and Blue Creek, both tributary to Tecolote Creek, went dry during the course of the survey. Consequently, insufficient data were collected and no assessments were made for these streams.

Water chemistry sampling at survey stations included total nutrients, total and dissolved metals, major ions, total dissolved solids (TDS), hardness, alkalinity, radionuclides, organics scans, and microbiological collections as indicated by previous survey findings and proximity

to potential sources. The following tables include only results specifically related to a criteria exceedence and consequent standard violation. Complete data are available upon request.

Introduction

The Gallinas drainage extends from the eastern slopes of Elk Mountain (elev. 3,554 m/11,661 ft) for over 80 km/50 miles to its confluence with the Pecos River near Dilia, New Mexico. Tecolote Creek rises on the southeast slope of Elk Mountain, running over 65 km/40 miles to its confluence with the Pecos at Tecolotito, NM.

Settlers began moving into the Gallinas watershed after the establishment of San Miguel del Bado in 1794, and in 1823 the grant of Las Vegas Grandes was founded. Early land use was largely centered on sheep ranching, and small communities spread downstream to the Pecos. In the upper watershed the village of Gallinas was founded to exploit the broad montane valley and abundant water there.

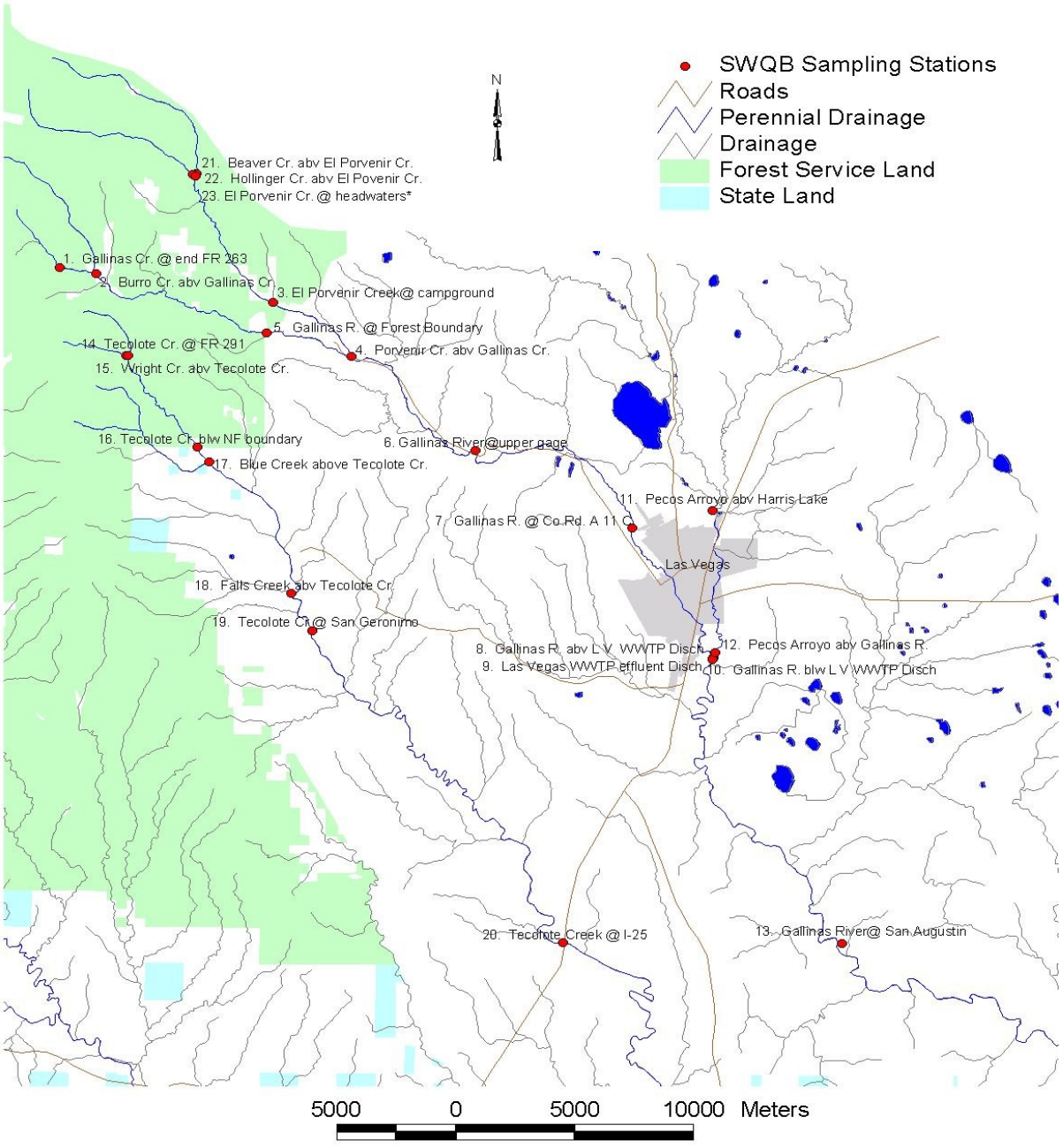
Settlement on Tecolote Creek began in 1824 with the establishment of the village of Tecolote. In 1835 Los Valles de San Geronimo del Tecolote, now San Geronimo, was founded. In 1890 the settlement of Lesperance, now Mineral Hill, was established in an attempt to exploit what turned out to be low-grade mineral deposits.

The long period of settlement, development and irrigation diversions in these watersheds has resulted in varying degrees of impact to water quality, biotic integrity and hydrologic competency.

Water Quality Assessment

The following assessments provide information pertaining to water quality, biological integrity, water quality criteria exceedences and water quality standards specific to existing, attainable or designated uses in the State of New Mexico Standards for Interstate and Intrastate Surface Waters, 1995. Unless otherwise noted in text, exceedences listed here are a subset of a total of eight sampling visits.

Gallinas Watershed
May to October, 2001



Discussion of Exceedences by Assessment Unit

Upper Pecos River (2001) Part 2

Chem/phys exceedences

This excerpted report lists physical/chemical exceedences of standards for a given watershed study. These data are broken out by Assessment Units, then "Citations", then sampling stations. The "citations" are designated uses, with these additions:

- Segment-specific criteria.
- criteria common to various fisheries (cold and warm, acute and chronic).
- Invalid exceedences listed in the original report, *e.g.* flow dependent criteria that were listed even though the flow requirements were not met, have been removed.

Gallinas River (Las Vegas Diversion to headwaters)

20.6.4.215. The Gallinas River and all its tributaries above the diversion for the Las Vegas municipal reservoir. The lower Gallinas River is described in 20.6.4.216. There are no use-specific numeric criteria for municipal or industrial water supplies, nor for secondary contact

segment specific criteria

Temperature

2-06 GALLINAS RIVER AT USGS GAGE

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Temperature	No	22.4	20	C	07/24/2001
Yes	Temperature	No	20.33	20	C	07/25/2001

Turbidity

2-01 GALLINAS RIVER AT THE END OF FOREST ROUTE 263

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Turbidity	No	13.5	10	ntu	07/25/2001

2-05 Gallinas R. at National Forest boundary.

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Turbidity	No	12.4	10	ntu	07/24/2001
Yes	Turbidity	No	19	10	ntu	07/25/2001

Gallinas River (San Augustin to Las Vegas Diversion)

20.6.4.216. Perennial reaches of the Gallinas River from its mouth upstream to the diversion for the Las Vegas municipal reservoir. The upper Gallinas River is described in 20.6.4.215. There are no use-specific numeric criteria for secondary contact (20.6.4.900.I).

cold fishery (chronic)

Ammonia

2-10 GALLINAS R. 1/4 MI. BELOW LAS VEGAS WWTP OUTFALL

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Ammonia	No	2.04	1.190809	mg/L as	05/29/2001
Yes	Ammonia	No	2.8	2.101298	mg/L as	05/30/2001
Yes	Ammonia	No	3.3	1.268146	mg/L as	07/24/2001
Yes	Ammonia	No	2.14	1.24082	mg/L as	07/25/2001

2-13 Gallinas River @ San Augustin

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Ammonia	No	0.1	9.314563E-02	mg/L as	05/29/2001

fishery (acute)

Dissolved aluminum

2-13 Gallinas River @ San Augustin

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	aluminum	No	1.3	0.75	mg/L	08/15/2001
Yes	aluminum	No	1.4	0.75	mg/L	08/15/2001

fishery (chronic)

Dissolved aluminum

2-08 GALLINAS RIVER ABOVE LAS VEGAS, NM WWTP

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	aluminum	No	0.14	0.087	mg/L	05/30/2001
Yes	aluminum	No	0.09	0.087	mg/L	05/31/2001
Yes	aluminum	No	0.11	0.087	mg/L	07/24/2001
Yes	aluminum	No	0.09	0.087	mg/L	07/25/2001

2-13 Gallinas River @ San Augustin

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	aluminum	No	0.1	0.087	mg/L	08/14/2001
Yes	aluminum	No	1.3	0.087	mg/L	08/15/2001
Yes	aluminum	No	1.4	0.087	mg/L	08/15/2001
Yes	aluminum	No	0.1	0.087	mg/L	08/15/2001

marginal coldwater fishery

Dissolved oxygen

2-13 Gallinas River @ San Augustin

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Dissolved oxygen	No	5.82	6	mg/L	07/24/2003

Fecal coliform, single sample

2-09 CITY OF LAS VEGAS, NM WWTP OUTFALL PIPE (This is exhibited to demonstrate the relationship to the exceedences of the criterion below the WWTP plant. It does not constitute a water quality *standards* exceedence)

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	fecals	No	28000	2000	/100 mL	09/19/2001
Yes	fecals	No	8000	2000	/100 mL	07/09/2002
Yes	fecals	No	9000	2000	/100 mL	07/24/2002

2-10 GALLINAS R. 1/4 MI. BELOW LAS VEGAS WWTP OUTFALL

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	fecals	No	23000	2000	/100 mL	09/19/2001
Yes	fecals	No	8800	2000	/100 mL	06/12/2002
Yes	fecals	No	8000	2000	/100 mL	07/09/2002
Yes	fecals	No	3800	2000	/100 mL	07/24/2002

2-13 Gallinas River @ San Augustin

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	fecals	No	11000	2000	/100 mL	07/24/2003

warm fishery (chronic)

Ammonia

2-09 CITY OF LAS VEGAS, NM WWTP OUTFALL PIPE (This is exhibited to demonstrate the relationship to the exceedences of the criterion below the WWTP plant. It does not constitute a water quality *standards* exceedence)

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Ammonia	No	5.68	1.337663	mg/L	07/24/2001
Yes	Ammonia	No	5.36	1.341072	mg/L	07/25/2001

2-10 GALLINAS R. 1/4 MI. BELOW LAS VEGAS WWTP OUTFALL

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Ammonia	No	2.04	1.680175	mg/L	05/29/2001
Yes	Ammonia	No	2.8	2.101298	mg/L	05/30/2001
Yes	Ammonia	No	3.3	1.791167	mg/L	07/24/2001
Yes	Ammonia	No	2.14	1.752571	mg/L	07/25/2001

Pecos Arroyo (Gallinas River to headwaters)

20.6.4.216. Perennial reaches of the Gallinas River from its mouth upstream to the diversion for the Las Vegas municipal reservoir. The upper Gallinas River is described in 20.6.4.215. There are no use-specific numeric criteria for secondary contact (20.6.4.900.I).

fishery (chronic)

Dissolved aluminum

2-12 PECOS ARROYO ABOVE THE GALLINAS RIVER

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	aluminum	No	0.12	0.087	mg/L	05/29/2001
Yes	aluminum	No	0.13	0.087	mg/L	05/30/2001
Yes	aluminum	No	0.09	0.087	mg/L	05/31/2001

marginal coldwater fishery

Dissolved oxygen

2-11 Pecos Arroyo @ Harris Lk. abv. Spring Arroyo

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Dissolved oxygen	No	5.74	6	mg/L	07/24/2001
Yes	Dissolved oxygen	No	5.1	6	mg/L	07/25/2001

Tecolote Creek (Pecos River to headwaters)

20.6.4.215. Perennial reaches of Tecolote Creek and its perennial tributaries. There are no use-specific numeric criteria for municipal or industrial water supplies, nor for secondary contact (20.6.4.900.I).

fishery (chronic)

Dissolved aluminum

2-20 TECOLOTE CREEK AT I-25 NEAR TECOLOTE

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	aluminum	No	0.5	0.087	mg/L	05/30/2001

segment specific criteria

Conductivity

2-19 TECOLOTE CR AT BRIDGE NEAR SAN GERONIMO

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Specific conductance	No	319	300	umhos	05/29/2001
Yes	Specific conductance	No	324	300	umhos	05/30/2001
Yes	Specific conductance	No	313	300	umhos	07/24/2001
Yes	Specific conductance	No	317	300	umhos	07/25/2001
Yes	Specific conductance	No	401	300	umhos	10/16/2001
Yes	Specific conductance	No	396	300	umhos	10/17/2001

Yes	Specific conductance	No	388	300	umhos	10/18/2001

2-20 TECOLOTE CREEK AT I-25 NEAR TECOLOTE

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Specific conductance	No	330	300	umhos	05/29/2001
Yes	Specific conductance	No	355	300	umhos	05/30/2001
Yes	Specific conductance	No	330	300	umhos	05/31/2001
Yes	Specific conductance	No	346	300	umhos	07/24/2001
Yes	Specific conductance	No	360	300	umhos	07/25/2001
Yes	Specific conductance	No	362	300	umhos	10/16/2001
Yes	Specific conductance	No	361	300	umhos	10/17/2001
Yes	Specific conductance	No	379	300	umhos	10/18/2001

Temperature

2-19 TECOLOTE CR AT BRIDGE NEAR SAN GERONIMO

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Temperature	No	21.04	20	C	05/29/2001
Yes	Temperature	No	21.14	20	C	05/31/2001
Yes	Temperature	No	23.7	20	C	07/24/2001
Yes	Temperature	No	22.1	20	C	07/25/2001

2-20 TECOLOTE CREEK AT I-25 NEAR TECOLOTE

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Temperature	No	25.05	20	C	05/29/2001
Yes	Temperature	No	24.23	20	C	05/30/2001
Yes	Temperature	No	25.94	20	C	05/31/2001
Yes	Temperature	No	29.33	20	C	07/24/2001
Yes	Temperature	No	27.41	20	C	07/25/2001

Turbidity

2-20 TECOLOTE CREEK AT I-25 NEAR TECOLOTE

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Turbidity	No	11.6	10	ntu	07/24/2001
Yes	Turbidity	No	35.8	10	ntu	10/17/2001

Wright Canyon Creek (Tecolote Creek to headwaters)

20.6.4.215. Perennial reaches of Tecolote Creek and its perennial tributaries. There are no use-specific numeric criteria for municipal or industrial water supplies, nor for secondary contact (20.6.4.900.I).

segment specific criteria

Conductivity

2-15 Wright Cr. abv Tecolote Cr.

Exceeds:	Analyte:	Less Than:	Result:	Standard:	Units:	Sampling date:
Yes	Specific conductance	No	302	300	umhos	05/30/2001
Yes	Specific conductance	No	352	300	umhos	05/31/2001
Yes	Specific conductance	No	391	300	umhos	10/16/2001
Yes	Specific conductance	No	404	300	umhos	10/17/2001
Yes	Specific conductance	No	394	300	umhos	10/18/2001

Pesticides, Pharmaceuticals and Xenobiotics

Analyses for a broad spectrum of hydrocarbons, chlorinated hydrocarbons, insecticides and herbicides were conducted in the Gallinas River and the Pecos Arroyo in and below the City of Las Vegas. None were found at detection limits in the low ng/l (parts per trillion) range. Similarly, analyses were performed for a suite of pharmaceuticals and personal care products, some of which have hormonal effects on aquatic biota. Again, nothing was found at a detection limit of 10 ng/l.

As an adjunct to pharmaceuticals sampling, a sample of Las Vegas wastewater effluent was sent to EPA's Molecular Ecology Research Branch in Cincinnati, OH, for determination of the ability of the effluent to induce hormonal effects in test organisms. No effects were found.

Samples of wastewater were examined for the presence of antibiotics (tetracyclines and macrolides) at a detection limit of 5.0 ug/l (parts per billion). While no target analytes were seen at this level, it should be noted that other effluent samples, submitted after an improvement in the analytical method which returned a detection limit of 0.5 ug/l, resolved oxytetracycline at all other stations. The presence of low levels of antibiotics in the environment raises the possibility of the development of bacterial resistance to these important medicines.

Conclusions and Recommendations

There were few exceedences of any kind in the segment of the Gallinas extending from the Las Vegas municipal diversion to the headwaters. The temperature criterion (20^0 C) was exceeded routinely during the summer at the USGS gage above the diversion. These excursions beyond the criterion are, at least in part, an artifact of the location chosen for deployment of a recording thermograph: the canyon at the gage is solid bedrock, and shade was unavailable.

Tecolote Creek at San Geronimo

The turbidity criterion (10 NTU) was exceeded during the summer sampling effort at stations at the top and bottom of Forest Road 263 following a rainstorm. Portions of this road have been paved in recent years and storm induced turbidity exceedences have been greatly reduced in both number and intensity as a consequence. This station, being above the road, can only have received turbid inputs from the trail that runs up the canyon, crossing the channel a number of times.

While the State of New Mexico does not have criteria in place for impacts of land management on channel morphology, it should be noted that numerous instances of channel degradation were observed on private lands in this Assessment Unit. Impacts to channel morphology such as bank cutting and excessive widening or steepening can have serious effects on such factors as temperature, turbidity, instream habitat and stream bottom deposits, for which criteria have

been established. This channel degradation was exacerbated somewhat when landowners expanded their cultivation and irrigation activities following receipt of notification from the Office of the State Engineer that their water rights would be re-evaluated and adjusted if they were found to have insufficient acreage under irrigation.

Two permanent stations were established on El Porvenir Creek. While some bank and channel degradation associated with the construction of a bridge on state road 65 were noted, there were no exceedences at these locations. With the help of staff and resources of the Santa Fe National Forest, three stations in the Pecos Wilderness were visited in late August, 2001. These stations, Hollinger Creek, Beaver Creek and El Porvenir Creek below the confluence of Beaver and Hollinger yielded no exceedences, though fish numbers and biomass were lower in Beaver Creek relative to both Hollinger and El Porvenir Creeks. This situation was attributed to an excess of stream bottom sediment caused by the failure of, and subsequent bank erosion by, improperly constructed cross-log fish habitat structures further upstream. This was documented during a Surface Water Quality Bureau geomorphological survey in the late 1990s. It was also noted at that time that bank condition was being further degraded by grazing activity.

Beaver Creek showing sedimentation and bank damage.

Burro Creek was added to this study not only because it is a major tributary in the upper watershed, but also because the May 2000 Viveash fire did not reach that drainage, as it did that of the Gallinas. Differences between these sites that might reasonably be attributed to the effects of wild fire, *e.g.* elevated suspended solids, turbidity, nutrients and total organic carbon, were minimal. The one exception was cyanide. A cyanide containing compound, sodium ferrocyanide, is used in some fire retardant formulations as an anticorrosive agent. Cyanide was detected at twice the chronic criterion (0.005 mg/l) during the spring sampling effort. Subsequent sampling failed to verify this finding. The fish communities at both stations Gal-01, Gallinas R. at the end of Forest Road 263, and Gal-02, Burro Creek, were healthy. Fish numbers and biomass were greater at Gal-01, indicating that the cyanide was not significantly harming the fishery.

Gallinas River a San Augustin

In the lower Assessment Unit, extending down stream from the Las Vegas diversion to the Village of San Augustin, numerous exceedences were found for aluminum, ammonia and fecal coliform bacteria. As ammonia and fecal coliforms only exceeded criteria below the Las Vegas WWTP, these exceedences can be attributed to the plant. A significant flaw

in the design of the chlorination/dechlorination system at the plant was identified as a result of this survey and corrected. Bacterial exceedences stopped after this correction.

High levels of ammonia in sediment collected below the WWTP and submitted to the EPA for ambient toxicity testing are the most probable cause of a finding of significant toxicity to fathead minnows (*Pimephales promelas*) but not water fleas (*Ceriodaphnia dubia*). Most fish are sensitive to low levels of ammonia, while water fleas are less so.

Aluminum exceedences appear to be associated with inputs to the Gallinas River from the Pecos Arroyo and, to a lesser extent, with storm water runoff entering the river from Las Vegas.

A multi-parameter data logger deployed at the lower station (Gal-13, Gallinas R. at San Augustin) from August 15 to August 23 recorded 32% exceedence of the dissolved oxygen criterion, indicating non-support of the marginal cold water fishery use. These exceedences all occurred during the late night and early morning hours. Daytime oxygen levels frequently reached very high values. The wide variation in oxygen concentrations between day and night is indicative of excessive enrichment, in this case exacerbated by lack of flow.

The Pecos Arroyo is a significant tributary to the Gallinas, entering just below the developed urban area of Las Vegas. At the time of this survey the Pecos Arroyo was unclassified, meaning that exceedences of standards criteria do not indicate a violation of stream standards. In recent years, due to withdrawals for city drinking water resulting in the dewatering of the Gallinas channel, the receiving water at the WWTP is, essentially, Pecos Arroyo water. Soils forming the drainage of the Pecos Arroyo are very saline; consequently, total dissolved solids concentrations in the Pecos Arroyo are naturally high. Aluminum was found to exceed the chronic criterion at the lower station during the spring sampling effort. Due to a station location misunderstanding, no data are available for the summer effort but aluminum was found in the Gallinas below the Pecos Arroyo.

The Pecos Arrovo

The dissolved oxygen criterion was exceeded on both days of the summer sampling effort at the upper Pecos Arroyo station. Dissolved oxygen concentrations at this station were lower than expected throughout the entire survey and may be attributable to seepage of hypoxic ground water into the channel.

It is recommended that the Pecos Arroyo be classified, assigned appropriate designated uses and that site specific criteria, if applied, be set at levels that reflect the natural conditions of that system.

No exceedences of standards criteria were identified in Tecolote Creek on or immediately below the Santa Fe National Forest. By the time this water body reaches the village of San Geronimo however, exceedences of the criteria for specific conductance and temperature were commonplace. The channel in this reach is typically broad, shallow and exposed, and the temperature and conductance exceedences may be attributed to this exposure and subsequent evaporative concentration of dissolved solids, respectively.

Tecolote Creek below the Forest boundarv

There were two exceedences of the turbidity criterion in Tecolote Creek at Interstate 25. Tecolote Creek becomes increasingly degraded as it flows down stream from the Santa Fe National Forest boundary. In light of this fact, it is recommended that a segment break be made at the confluence with Blue Creek. Such a segment break allows for management of water quality issues taking land use, valley type and channel morphology changes into account.

Falls Creek, included in this survey based on anecdotal accounts that it was perennial, went dry after the spring sampling effort. However, the temperature criterion was exceeded on all three of those visits.

Blue Creek went dry after the spring sampling effort as well, but no exceedences were identified from the data that were collected.

Wright Canyon Creek, tributary to Tecolote Creek on Santa Fe National Forest property, could not be accessed during the summer sampling effort due to road conditions. During the spring and fall visits, however, the segment specific criterion for conductivity (300 umhos) was consistently exceeded. There are no reasonable explanations for these exceedences other than natural causes. No other exceedences were identified in Wright Creek.