

GALLINAS WATERSHED THINNING MONITORING

Preliminary Report



Prepared by
Surface Water Quality Bureau
New Mexico Environment Department
May 2009

This Page Intentionally Left Blank

Acknowledgements

Study Lead: Scott Hopkins

Field Crew

Water Chemistry:

Scott Hopkins

Chris Cudia

Biology/Habitat: Danielle Shurn

Watershed Protection: Chris Cudia

Report Author: Scott Hopkins

GIS/Map: Bill Skinner

Cover: Gallinas River below the USGS gage at Montezuma, NM

This Page Intentionally Left Blank

TABLE OF CONTENTS

| | |
|--|----|
| LIST OF TABLES | 5 |
| LIST OF FIGURES | 5 |
| LIST OF PHOTOS | 6 |
| APPENDIX | 6 |
| LIST OF ACRONYMS | 6 |
| | |
| 1.0 EXECUTIVE SUMMARY | 7 |
| 2.0 INTRODUCTION | 7 |
| 3.0 WATER QUALITY STANDARDS SEGMENTS | 10 |
| 4.0 METHODS | 11 |
| 5.0 SAMPLING SUMMARY | 12 |
| 6.0 WATER QUALITY ASSESSMENT | 13 |
| 7.0 DISCUSSION | 13 |
| 8.0 REFERENCES | 16 |
| 9.0 APPENDIX..... | 19 |

LIST OF TABLES

| | | |
|-----------|--|----|
| Table 1. | Summary of 2006-2008 Integrated List. | 11 |
| Table 2. | Approved TMDLs for the Gallinas Watershed. | 11 |
| Table 3. | Survey Stations and STORET Codes | 12 |
| Table 4. | Sampling Summary | 13 |
| Table 5. | Summary of Thermograph Data | 15 |
| Table 6a. | Summary of DO Data Collected from Sondes | 15 |
| Table 6b. | Summary of pH Data Collected from Sondes | 16 |

LIST OF FIGURES

| | | |
|-----------|---|----|
| Figure 1. | Gallinas Watershed Study Area and Sampling Stations | 8 |
| Figure 2. | Discharge of the Gallinas River near Montezuma, NM | 9 |
| Figure 3 | Water temperature in the Gallinas River at Montezuma, NM | 17 |
| Figure 4. | Comparison of Temperature in the Gallinas River Above and Below Burro Creek | 17 |

List of Photos

| | | |
|----------|---|----|
| Photo 1. | Sampling at Gallinas River below Burro Creek | 9 |
| Photo 2. | Riparian corridor below the Las Vegas municipal diversion | 10 |

Appendix

Table A1. Sensitive Animal Species

Table A2. Sensitive Plant Species

LIST OF ACRONYMS

| | |
|--------|---|
| AP | Assessment Protocol |
| 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 |
| HQCWAL | High Quality Cold Water Aquatic Life |
| NMAC | New Mexico Administrative Code |
| NMED | New Mexico Environment Department |
| OLS | Other Life Stage |
| QAPP | Quality Assurance Project Plan |
| SoC | Species of Concern |
| STORET | EPA's Storage and Retrieval System |
| SWQB | Surface Water Quality Bureau |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WQS | Water Quality Standards |
| WUI | Wildland – Urban Interface |

1.0 Executive Summary

The Gallinas River watershed, located near Las Vegas New Mexico, is currently the focus of a wildland/urban interface forest thinning project undertaken by the Santa Fe National Forest. During 2007 the Monitoring and Assessment Section of the Surface Water Quality Bureau of the New Mexico Environment Department conducted a water quality and biological survey designed to capture the impacts, if any, of thinning activities in the watershed.

Four study sites were established; three stations on the Gallinas River proper and one station on El Porvenir Creek. Sampling at stream stations was conducted on a monthly basis from May through September. Water chemistry sampling at survey stations included total nutrients, and major anions and cations. Temperature was monitored by four water-deployed and three air-deployed recording thermographs. In addition, biological and geomorphological surveys were conducted at selected stations. All sampling methods were in accordance with the *Quality Assurance Project Plan for Water Quality Management Programs* (NMED, 2007).

This program was funded, in part, by a grant from the U.S. Environmental Protection Agency.

2.0 Introduction

The Gallinas watershed affords a relatively cool summer climate and snowy winter conditions supporting activities such as hiking, mountain biking, camping, fishing, as well as cross country skiing and other winter sports. The City of Las Vegas, NM, relies heavily on the Gallinas River for its drinking water supply. Ranching and irrigated agriculture are additional water users and contributors to the local economies.

Due to the risk of wildfire the City of Las Vegas and the Santa Fe National Forest, Pecos / Las Vegas Ranger District have embarked on programs of forest rehabilitation. These projects involve extensive programs of thinning, burning and logging which have the potential to impact water quality. In an effort to monitor these impacts, if any, the Surface Water Quality Bureau (SWQB) of the New Mexico Environment Department (NMED) has undertaken a multiyear effort to monitor the water quality of the Gallinas River within and below the treatment areas.

The upper Gallinas watershed (US Geological Survey [USGS] Hydrologic Unit Code 13060001) is located in San Miguel County, NM on the east slopes of the Sangre de Cristo Mountains (Figure 1). The upper Gallinas watershed encompasses approximately 84 square miles (218 km²). The Gallinas River originates at about 9800 ft (or ~3,000 m) on the southeast slopes of Elk Mountain. The upper Gallinas watershed includes three smaller, perennial, sub-watersheds, Burro, Trout Springs and El Porvenir Creeks. The

Burro and El Porvenir sub-watersheds join the Gallinas from the northwest and will receive varying degrees of treatment as part of the overall thinning project. Trout Springs joins the Gallinas from the south just below the village of Gallinas. Flows (stream discharge) of the Gallinas River during the survey period are derived from USGS gage number 08380500 (Gallinas Creek near Montezuma, NM), and are graphically represented and compared to long-term mean flows in Figure 2, below.

The upper Gallinas watershed is contained within the “Southern Rockies” Level III Ecoregion 21; it contains the following Level IV Ecoregions: 21b-Crystalline Subalpine Forests, 21c-Crystalline Mid-Elevation Forests, 21e-Sedimentary Subalpine Forests and 21f-Sedimentary Mid-Elevation Forests (Griffith, G.E. et al., 2006). Several species within this watershed are listed as threatened or endangered by either State or Federal agencies, or identified as a species of concern by non-governmental conservation groups. Plant and animal species of concern that potentially reside in this watershed are set forth in an appendix to this document. It should be noted that the inclusion of a species in this appendix does not necessarily mean that species actually occupies this watershed; only that the potential for its presence exists.



Figure 1. Map of Study Area



Photo 1. Gallinas River below Burro Creek sampling location.

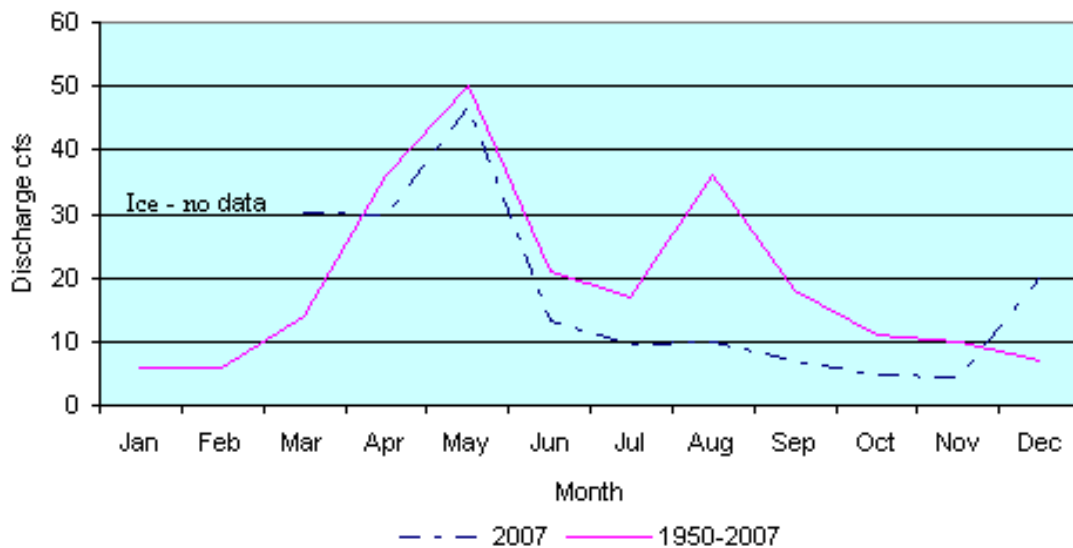


Figure 2. Mean monthly discharge of the Gallinas River in cfs (cubic feet per second). The graph compares long-term historical averages with values from the 2007 sampling period. Data is from USGS Gage 08380500, Gallinas Creek near Montezuma, NM; 2007 data are provisional and subject to change.



Photo 2. Riparian corridor below the Las Vegas municipal diversion.

3.0 Water Quality Standards and Results of Past Assessments

The water quality standards for the upper Gallinas watershed fall within segment 20.6.4.215 NMAC (NMAC, 2007). For this segment, the WQS state:

20.6.4.215 PECOS RIVER BASIN - Perennial reaches of the Gallinas river and all its tributaries above the diversion for the Las Vegas municipal reservoir and perennial reaches of Tecolote creek and its perennial tributaries.

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

B. Criteria:

(1) In any single sample: specific conductance 300 $\mu\text{mhos/cm}$ or less except specific conductance 450 $\mu\text{mhos/cm}$ or less in Wright Canyon 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).
 [20.6.4.215 NMAC - Rp 20 NMAC 6.1.2212, 10-12-00; A, 05-23-05]

A summary of the current status of support or non-support of the designated uses for this watershed is provided in Table 1. Presently the only approved TMDL within the Gallinas River watershed is for temperature (Table2). The TMDL may be found at: <http://www.nmenv.state.nm.us/SWQB/Pecos/Upper/index.html>

Table 1. Summary of water quality assessment from the 2006-2008 Integrated List (NMED/SWQB, 2008a)

| Assessment Unit | H Q Cold Water Aquatic Life Domestic Water Supply | Irrigation | Livestock Watering | Municipal Water Supply | Secondary Contact | Wildlife Habitat |
|--|---|------------|--------------------|------------------------|-------------------|------------------|
| Gallinas River (Las Vegas Diversion to headwaters) | FS NS | FS | FS | FS | NA | FS |

FS: Full Support; NS: Non-Support; NA: Not Assessed.

Table 2. Approved TMDLs for the Gallinas Watershed.

| Waterbody | Watershed | Pollutant TMDL |
|----------------|------------------|--|
| Gallinas River | Pecos Headwaters | Temperature http://www.nmenv.state.nm.us/SWQB/Pecos/Upper/index.html |

4.0 Methods

All water quality sampling, benthic macroinvertebrate collection, riparian habitat analysis, and fluvial geomorphologic measurements were in accordance with relevant portions of the SWQB's Quality Assurance Project Plan for Water Quality Management Programs (QAPP) (NMED/SWQB, 2007) and Standard Operating Procedures for Data Collection (NMED/SWQB, 2007). The macroinvertebrate and habitat methods employed are the same as the USEPA's Environmental Monitoring and Assessment Program (Peck et al., 2003).

5.0 Sampling Summary

Samples were taken at 4 sampling sites during the survey period, three stations on the Gallinas River and one station on El Porvenir Creek. The STORET identification codes and location descriptions of sampling stations selected for this survey are provided in Table 3. Sampling at stream stations was conducted on a monthly basis from May through September. The start of sampling was delayed until May by snow in the upper watershed.

Table 3. Survey Stations and STORET Codes

| SITE # | STATION | LATITUDE | LONGITUDE | STORET_ID | RATIONALE |
|--------|---|-----------|-------------|---------------|---|
| 1 | GALLINAS RIVER AT THE END OF FOREST ROUTE 263 | 35.722139 | -105.497333 | 50Gallin141.9 | Below uppermost area of treatment |
| 2 | Gallinas River below Burro Creek | 35.716600 | -105.487400 | 50Gallin140.8 | Burro Cr. (No Access) will receive extensive treatment. Station monitors potential impacts. |
| 3 | El Porvenir Creek at HWY 65 above the Gallinas | 35.690000 | -105.375833 | 50EIPorv000.1 | Subject to treatment on Forest Service lands and logging on private land. |
| 4 | Gallinas River at Montezuma, USGS Gage 08380500 | 35.651944 | -105.318333 | 50Gallin119.7 | Monitors water quality immediately above the Las Vegas municipal diversion. |

A listing of parameter suites sampled at each station in the various assessment units can be found in Table 4. The number of times each parameter (or suite of parameters) was sampled is indicated. Field data include temperature, specific conductance, pH, dissolved oxygen, and turbidity. In the case of stream discharge, some of the data may be estimated or calculated. Due to the 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: <http://www.epa.gov/STORET/>.

Table 4. Sampling Summary.

| Assessment Unit / Stations | Ions | Nutrients | Macroinvertebrates | Thermograph | Discharge | EMAP | Sonde Deployment | Field Data |
|---|------|-----------|--------------------|-------------|-----------|------|------------------|------------|
| Gallinas River (Las Vegas Diversion to headwaters) | | | | | | | | |
| GALLINAS RIVER AT THE END OF FOREST ROUTE 263 | 6 | 6 | | x* | 6 | | | 6 |
| Gallinas River below Burro Creek | 6 | 6 | x | x | 6 | x | | 6 |
| Gallinas River at Montezuma, USGS Gage 08380500 - | 6 | 6 | x | x* | 6 | x | x | 6 |
| El Porvenir Creek at HWY 65 above the Gallinas- | 6 | 6 | | x* | 6 | | | 6 |

* Water plus air thermographs.

6.0 Water Quality Assessment

6.1 Water Quality Standards Exceedences

The following discussion includes information pertaining to all exceedences of water quality standards (NMAC, 2007) found during the watershed survey. The purpose of this section is to provide the reader with information on where within the watershed current water quality standards are not being met. For many water quality parameters, the State of New Mexico has adopted numeric water quality standards. However, some parameters (e.g., plant nutrients, stream bottom deposits) only narrative standards exist.

Water quality standard exceedences are evaluated to determine if the waterbody is impaired, that is to say non-supporting of its designated use. It should be noted that an exceedence of a given criterion may or may not generate an impairment listing. In New Mexico, surface water data are assessed for designated use attainment status for both numeric and narrative water quality standards according to the SWQB [Assessment Protocol](#) (AP) (NMED/SWQB 2008b). The purpose of the AP is to detail the decision process that the SWQB employs to determine whether or not designated uses are being attained in surface waters of the state. Thus, the AP covers the decision making process for both listing and de-listing. The AP is an evolving document and the current protocol may vary from the procedures in place at the time these assessments were performed.

Final assessment determinations depend on the overall amount and type of data available during the assessment process (Refer to the *Assessment Protocol* NMED/SWQB 2008b for additional information on the assessment process). When available, outside sources of data that meet quality assurance requirements are combined with data collected by SWQB during watershed surveys 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 Integrated Clean Water Act §303\(d\)/ §305\(b\) Report](#) (“*Integrated Report*”) (NMED/SWQB 2008a).

6.1.1 Physicochemical Data

Physicochemical water quality samples and sampling frequencies are provided in Table 3. When a survey is completed, all data are checked against Quality Assurance/Quality Control (QA/QC) measures identified in the QAPP before assessing to determine if designated uses are being met.

Extensive sampling for major ions, nutrients, and field parameters (temperature, dissolved oxygen, pH and specific conductance) found exceedences of only the temperature criterion. This temperature exceedence for the high quality aquatic life designated use is consistent with the historical finding of non-support of that use in this assessment unit. Details are discussed in section 7.0.

6.1.2 Data from Continuous Monitoring Devices

Large data sets generated from continuous monitoring devices attached to data loggers (e.g., sondes and thermographs) are assessed according to protocols developed specifically for such datasets. This is because, unlike grab sample data, it is not reasonable to list as not supporting on the basis of one or a few exceedences out of several hundred or thousand data points. The pH and temperature assessment protocol 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 season (i.e., if early life stages of fish are likely present) and designated use (coldwater or warmwater aquatic life use). Further details of large data set assessment procedures are available in the appendices of the *Assessment Protocol*. (NMED/SWQB 2008a)

Temperature data loggers (thermographs) were deployed at four stations in the upper Gallinas watershed. Additionally, three thermographs were deployed in the air to determine the effect of air temperature on water temperature. The thermographs were programmed to record hourly. Table 5 summarizes these datasets. In addition, a single multi-parameter data logger (sonde) was deployed at station Gallinas River at Montezuma, USGS Gage 08380500 to evaluate pH and DO. Tables 6a and 6b summarize these data.

Table 5. Summary of Thermograph Data.

| Assessment Unit / Station Name | Data Collection Interval | WQS Temperature Criterion (°C) | Maximum Recorded Temperature (°C) | Total # of Data Points | # / % of Exceedences |
|--|--------------------------|--------------------------------|-----------------------------------|------------------------|----------------------|
| Gallinas River (Las Vegas Diversion to headwaters) GALLINAS RIVER AT THE END OF FOREST ROUTE 263 | 07/03/2007 – 11/01/2007 | 20 | 15.915 | 2014 | 0 / 0 |
| Gallinas River (Las Vegas Diversion to headwaters) Gallinas R. blw Burro Cr | 07/03/2007 – 11/01/2007 | 20 | 19.508 | 2015 | 0 / 0 |
| Gallinas River (Las Vegas Diversion to headwaters) Gallinas River at Montezuma, USGS Gage 08380500 | 07/03/2007 – 11/01/2007 | 20 | 26.207 | 2015 | 16 / 0.79 |
| Gallinas River (Las Vegas Diversion to headwaters) El Porvenir Creek at HWY 65 above the Gallinas | 07/03/2007 – 11/01/2007 | 20 | 24.581 | 2014 | 10 / 0.50 |

Table 6a. Summary of pH Data Collected from Sondes.

| Assessment Unit Station Name | Designated Use | Criterion SU | Deployment Dates (2007) | Min/Max SU | Number/% Exceedences | Magnitude Exceedence | Frequency Exceedence |
|--|----------------|--------------|-------------------------|-------------------|----------------------|----------------------|----------------------|
| Gallinas River (Las Vegas Diversion to headwaters) / Gallinas River at Montezuma, USGS Gage 08380500 | HQCW AL | 6.6 – 8.8 | 8/16 – 8/23 | 8.23 – 8.90 | 0 / 0 | 0 | 0 |

Table 6b. Summary of DO Data Collected from Sondes.

| Assessment Unit Station Name | Designated Use | WQS Criterion (mg/L) | Deployment Dates (2007) | Min/Max Conc. (mg/L) | Min Sat. (% local) | Water Quality Criterion | Combined Conc./Sat. Exceedences (# / % / >3 hrs) | % Sat Exceedences (# / % / >3 hrs) |
|--|----------------|----------------------------|----------------------------|-------------------------|-----------------------|----------------------------|---|--|
| Gallinas River (Las Vegas Diversion to headwaters) / Gallinas River at Montezuma, USGS Gage 08380500 | HQC WAL | 6.0 | 8/16 – 8/23 | 7.18 – 9.44 | 103.2 | 6.0 mg/l – 90% | 0/0/0 | 0/0/0 |

7.0 Discussion

As noted above, extensive sampling for major ions, nutrients, biological indicators (aquatic invertebrates, and algae/periphyton) and field parameters found exceedences only for temperature. Elevated water temperature not only stresses aquatic communities directly by increasing the metabolic rates of fish, particularly salmonids, thereby increasing food requirements; but indirectly, by decreasing dissolved oxygen saturation in the water.

Stations El Porvenir Creek at HWY 65 above the Gallinas and Gallinas River at Montezuma, USGS Gage 08380500, see Figure 3, consistently exceeded the temperature criterion. This finding is consistent with historical data and a previous assessment of non-support of the high quality cold water aquatic life designated use due to elevated temperature (Hopkins, 2002). A TMDL for temperature was approved by EPA for these assessment units in September of 2005 (see Table 4).

While neither stations Gallinas River at end of Forest Road 263 or Gallinas River below Burro Creek exceeded the HQCWAL temperature criterion of 20° C, a noticeable and consistent increase in temperature was observed below Burro Creek (Figure 4). This observed increase was 2.10° C or 14.75% of the average temperature and 3.59° C or 22.6% of the maximum temperature). This increase in temperature is, possibly, due to the fact that Burro Creek and the Gallinas River above their confluence pass through a series of small, shallow impoundments (including those related to a beaver colony on the Gallinas) where long retention times and a lack of shade allows for increased solar heating. The diurnal swing in water temperature from coldest (early morning) to warmest (mid afternoon) at the two stations demonstrates the sensitivity of streams to inputs of solar energy. Excessive thinning of riparian areas could trigger temperature exceedences that would impair the aquatic life use.

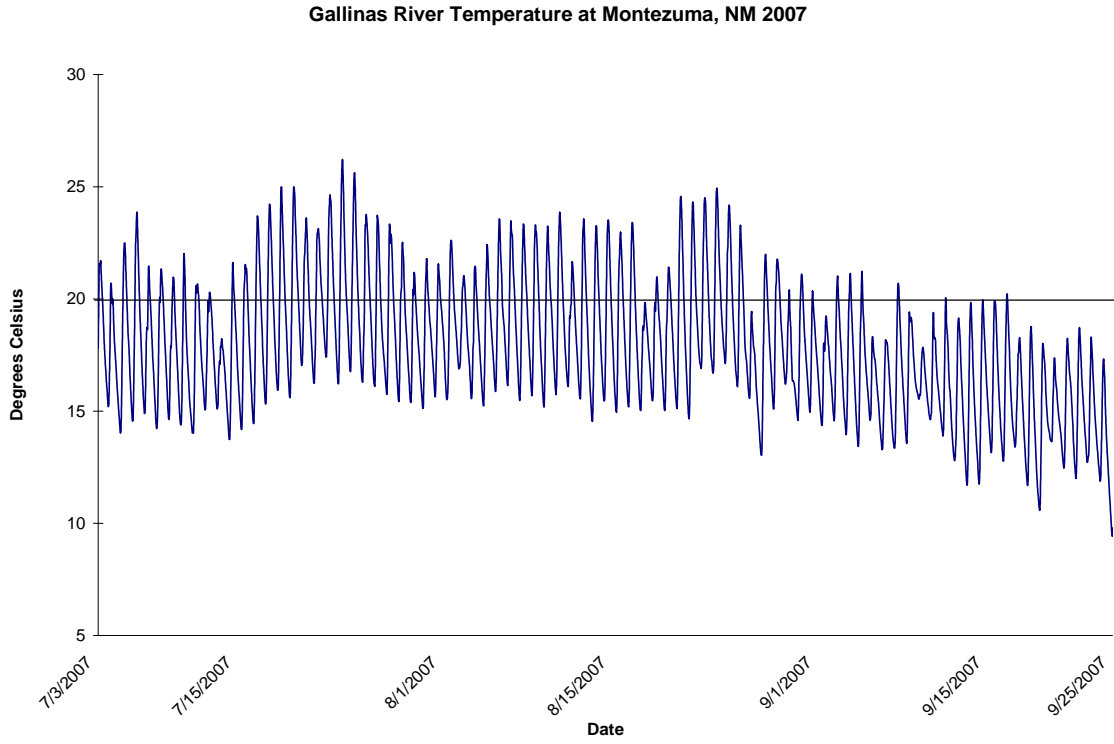


Figure 3. Water temperature in the Gallinas River at Montezuma, NM.

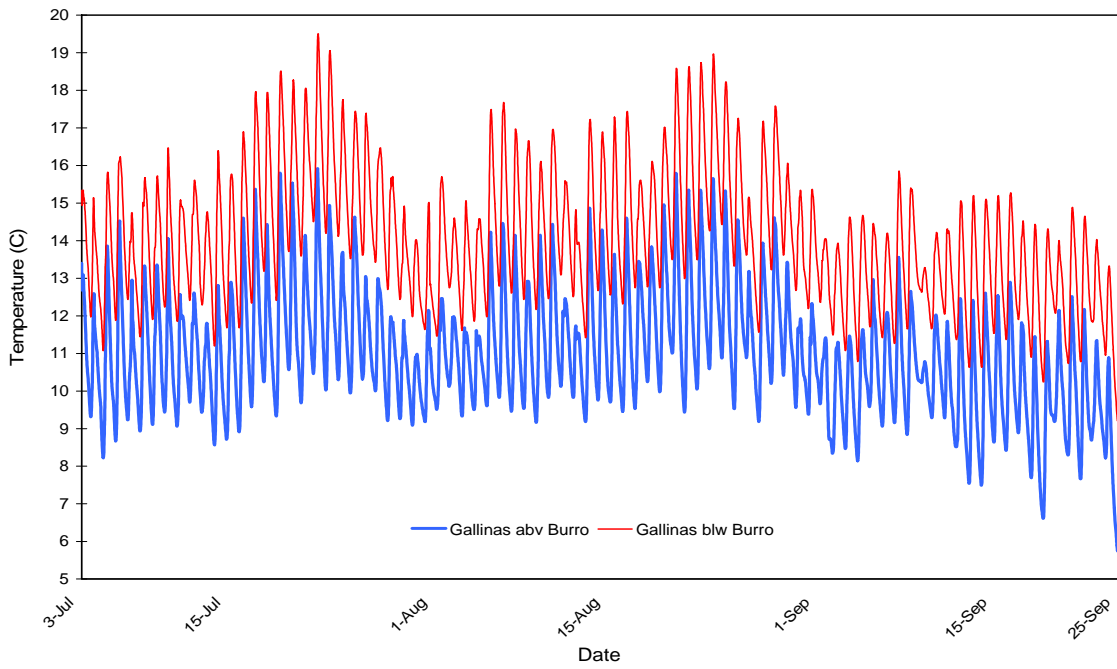


Figure 4. Comparison of water temperature in the Gallinas River above and below Burro Creek.

8.0 REFERENCES

- Hopkins, J. Scott, 2002. Water Quality Assessment of the Gallinas River and Tecolote Creek, 2001. New Mexico Environment Department – Surface Water Quality Bureau. <http://www.nmenv.state.nm.us/swqb/Surveys/UpperPecosPartII-2001.pdf>
- Griffith, G.E. et al., 2006. Ecoregions of New Mexico. U.S. Geological Survey, Reston, Virginia.
- New Mexico Administrative Code (NMAC). 2007. *State of New Mexico Standards for Interstate and Intrastate Streams*. 20.6.4. New Mexico Water Quality Control Commission. August 1, 2007
<http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.pdf>
- New Mexico Environment Department Surface Water Quality Bureau (NMED/SWQB). Quality Assurance Project Plan for Water Quality Management Programs, 2007 (QAPP). <http://www.nmenv.state.nm.us/swqb/QAPP/index.html>
- New Mexico Environment Department Surface Water Quality Bureau (NMED/SWQB). 2007. Standard Operating Procedures for Data collection. Santa Fe, NM.
- New Mexico Environment Department - Surface Water Quality Bureau (NMED/SWQB). 2008a. 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated Report. Santa Fe, NM. <http://www.nmenv.state.nm.us/swqb/303d-305b/2008-2010/>
- New Mexico Environment Department - Surface Water Quality Bureau (NMED/SWQB)-2008b. Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d) /§305(b) Water Quality Monitoring and Assessment Report: Assessment Protocol
- Peck, D.V., J.M. Lazorchak, and D.J. Klemm (editors). 2003. Environmental Monitoring and Assessment Program -Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. U.S. Environmental Protection Agency, Washington, D.C. <http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/fomws.html>

Appendix A. Sensitive Plant and Animal Species

Table A1. Sensitive Animal Species

| Common Name | Status | Comments/Habitat |
|-------------------------------|---|---|
| Mexican spotted owl | Federal: Threatened State: Sensitive | Multi-layered, moderately closed or closed canopy comprised of mixed conifer and hardwood trees and shrubs. Large trees, 12 inches in diameter or greater that are mid-aged and older, or of late-successional stage make up the bulk of the stand, which also has standing dead trees, shrubs, and downed logs. Approximately 7 PACs occur within the entire Gallinas watershed. |
| Northern goshawk | Federal: SoC State: Sensitive | Forested areas with moderate space between trees (for foraging) such as ponderosa pine, aspen, white and Douglas fir. |
| Boreal owl | State: Threatened | Spruce-fir forest. |
| Yellow-billed cuckoo | Federal: Candidate State: Sensitive | Riparian woodland. |
| Pale Townsend's big-eared bat | Federal: SoC State: Sensitive | Xeric to mesic habitats, including desert scrub, deciduous and coniferous forests (including spruce-fir, mixed conifer, and oak woodlands). |
| Snowshoe hare | Nat Her, NM: Rare | Inhabitant of dense spruce-fir forest. |
| Southern red-backed vole | NM Delisted Nat Her, NM: Rare | Good indicator of cool, mesic sites with high elevation old growth, spruce fir forests; requires abundance of surface litter including stumps and logs. |
| Western heather vole | State: Sensitive | Occurs at high elevations in the Sangre de Cristo mountains. They occupy stands of spruce-fir, aspen, grassy meadows in montane forests, Subalpine forests and alpine tundra. Eats grasses and forbs. |
| Long tailed vole | Nat Her, NM: Apparently Secure | Occurs in high elevation mixed forest on sheltered slopes and in riparian spruce, willow and alder communities. Usually associated with meadows and forest edge. See discussion below. |
| Masked shrew | | Confined primarily to riparian habitats in subalpine coniferous forest in the Sangre de Cristo, Jemez and San Juan Mountains, usually above 9,500'. |
| Dwarf shrew | Natureserve.org Imperiled | This shrew lives in white fir-Douglas fir zone from about 7,000' to 9,000'. Preferred habitats are rocky areas primarily in subalpine coniferous forest. |
| Water shrew | Natureserve.org: Vulnerable | Water shrews are confined to the Sangre de Cristo, San Juan and Jemez Mountains. They occur near permanent streams, seldom descending below 8,000' in altitude. |
| American marten | State: Threatened | Optimum habitat- mature old-growth spruce-fir with more than 30% canopy cover, abundant fallen logs and stumps, and lush shrub and forb vegetation to support prey species. |
| Ermine | Natureserve.org: Vulnerable | Habitat includes forest-edge, grassland, shrub, wet meadows, and riparian areas. |
| Mink | Natureserve.org: Vulnerable | Obligate riparian animals, never found far from permanent streams, wetlands, or other surface water. |
| Northern leopard frog | Natureserv.org: Critically imperiled | Riparian areas such as slow moving streams, marshy areas, wet meadows. |

Table A2. Sensitive Plant Species

| Common Name | Scientific Name | Status | Habitat / Species present | Comments/Habitat |
|-------------------------------|--|------------------------------------|---------------------------|---|
| Greater yellow lady's-slipper | <i>Cypripedium parviflorum</i> var. <i>pubescens</i> (=C. <i>calceolus</i> var. <i>pubescens</i> , C. <i>pubescens</i>) | Natureserve.org: Imperiled | Yes / Yes | Grows in boggy areas, swamps, damp woods (decaying leaf litter), and near rivers/streams. Also associated with rocky wooded hillsides on north or east facing slopes in spruce-fir habitats (Kershaw et al 1998, Natureserve 2007). Occurs in the understory of mixed-conifer forests out of direct sunlight. Wooded sites in foothills in montane-subalpine habitats (Kershaw et al 1998). Also occurs in facultative wetlands in the southwest (USDA NRCS 2007). |
| Wood Lily | <i>Lilium philadelphicum</i> | Natureserve.org: Vulnerable | Yes / Yes | Habitat consists of meadows and aspen glades in upper montane coniferous forest; 9,500-11,200 ft. |
| Pecos mariposa lily | <i>Calochortus gunnisonii</i> var. <i>perpulcher</i> | Natureserve.org: Apparently secure | Yes / Yes | |

Data courtesy of Santa Fe National Forest.