SAN ANTONIO AND LOS PINOS WATERSHEDS

WETLANDS ACTION PLAN

2006

New Mexico Environment Department
Surface Water Quality Bureau
Wetlands Program

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1.0 INTRODUCTION

The Conejos River is a tributary to the Rio Grande. It flows from the San Juan Wilderness southern Colorado to the Rio Grande. The Conejos watershed is divided by two states, Colorado and New Mexico. Los Pinos River and San Antonio River are tributaries to Conejos River. The Rio de los Pinos originates in the San Juan Mountains in southern CO. The stream flows south and then east through NM, for about 20 miles then crosses the CO border again near Ortiz, CO (NMED, 2004).

The Rio San Antonio headwaters are located in the Carson National Forest northwest of Tres Piedras and northeast of Tierra Amarilla, NM. The Conejos watershed area is approximately 804 square miles area total, the portion of the Conejos watershed in New Mexico is approximately 234 square miles and in Colorado is approximately 570 square miles. This watershed has an important ecological and economic value due to its history, its geographical location and its potential as a tourist site (NMED, 2004).

The Conejos watershed is an area with a long history where a variety of people have enjoyed its natural resources. Before Spanish settlers arrived at this watershed, the land was frequented by various nomadic Indian groups, mostly Comanche, Apaches and Utes with their own spiritual values and traditions. In the middle of the 16th century, when the first Spanish explorers arrived to the area, they found a land full of wildlife, beautiful wetlands and water resources which guaranteed agriculture production and successful grazing practices (Thomas, 1969) (Wroth, 2000).

It was in the early 1900's when over exploitation of grazing and agriculture caused a reduction in wetlands, wildlife and prairie. Moreover, uncontrolled logging activities caused the loss of important and healthy forests. Ponderosa Pine was used in the construction of railroad. A very aggressive felling of trees was the result of railroad construction. Open Ponderosa Pine forests were replaced by very dense and unhealthy woods. The danger of fire increased due to the closeness of trees. Fire in the Conejos Watershed would destroy forests which are the habitat of hundred of species and would contribute to erosion.

The geographical location of this watershed makes it special because is divided between North Central New Mexico and Southern Colorado. Both states in this area have the same features, such as people, culture, geographic situation, and economic activities. The watershed is situated in the Southern Rocky Mountain ecoregion with similar natural characteristics of wildlife, plants, and wetlands. The Rio de los Pinos starts in San Juan Mountains in southern Colorado and the headwater of Rio San Antonio begins in the Carson National Forest northwest of Tres Piedras. The San Antonio's and Los Pinos' headwaters originate in different States but both have similar geologic formation. Large amounts of volcanic rock were extruded over this region with several cycles of erosion, after several periods of elevation. The predominant rock is Precambrian igneous and metamorphic rocks and Tertiary volcanics related to the Rio Grande Rift tectonic movements (US. Department of Interior, 2006).

These watersheds base their economic activity on grazing, agriculture and recreation. Perrennial streams and big prairies have made possible, development of agriculture business. This situation provides to the community with economic benefits, but excess grazing can destroy the river environment, wetlands areas and open prairie grass lands. The San Antonio River and Los Pinos River hold important economical, cultural, social and spiritual value for present and future generations.

According to the 1997 Clean Water Action Plan, which focuses on the protection of water quality by states and tribes, a Watershed Restoration Action Strategy (WRAS) has been prepared for the Conejos Watershed. The WRAS lists water quality problems, analyzes sources of contamination and recommends actions to address. “NM-SWQB is providing guidance to facilitate watershed groups throughout the State to develop “Wetlands Action Plans” as an additional component of their WRAS. In addition, SWQB completed in 2004 the Total Maximum Daily Loads (TMDLs) which is a parameter of pollutant into a watercourse. The San Antonio and Los Pinos rivers were listed for not meeting High Quality Cold Water Fishery standards (Raimond, 2006).

“Wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (U.S. ACE, 1987).”

“Wetlands generally include swamps, marshes, bogs, fens and similar areas; lands that are transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land and is covered by shallow water. True wetlands must have one or more of the following attributes: (1) at least periodically, the land predominantly supports hydrophytes (plants dependent on saturated soils or a water medium); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year (McGraw, 2006).”

This Draft Wetlands Action Plan analyzes wetlands in the San Antonio and Los Pinos Watershed and addresses the best way to protect and restore wetlands. This initial Draft of the Wetlands Action Plan includes the following categories:

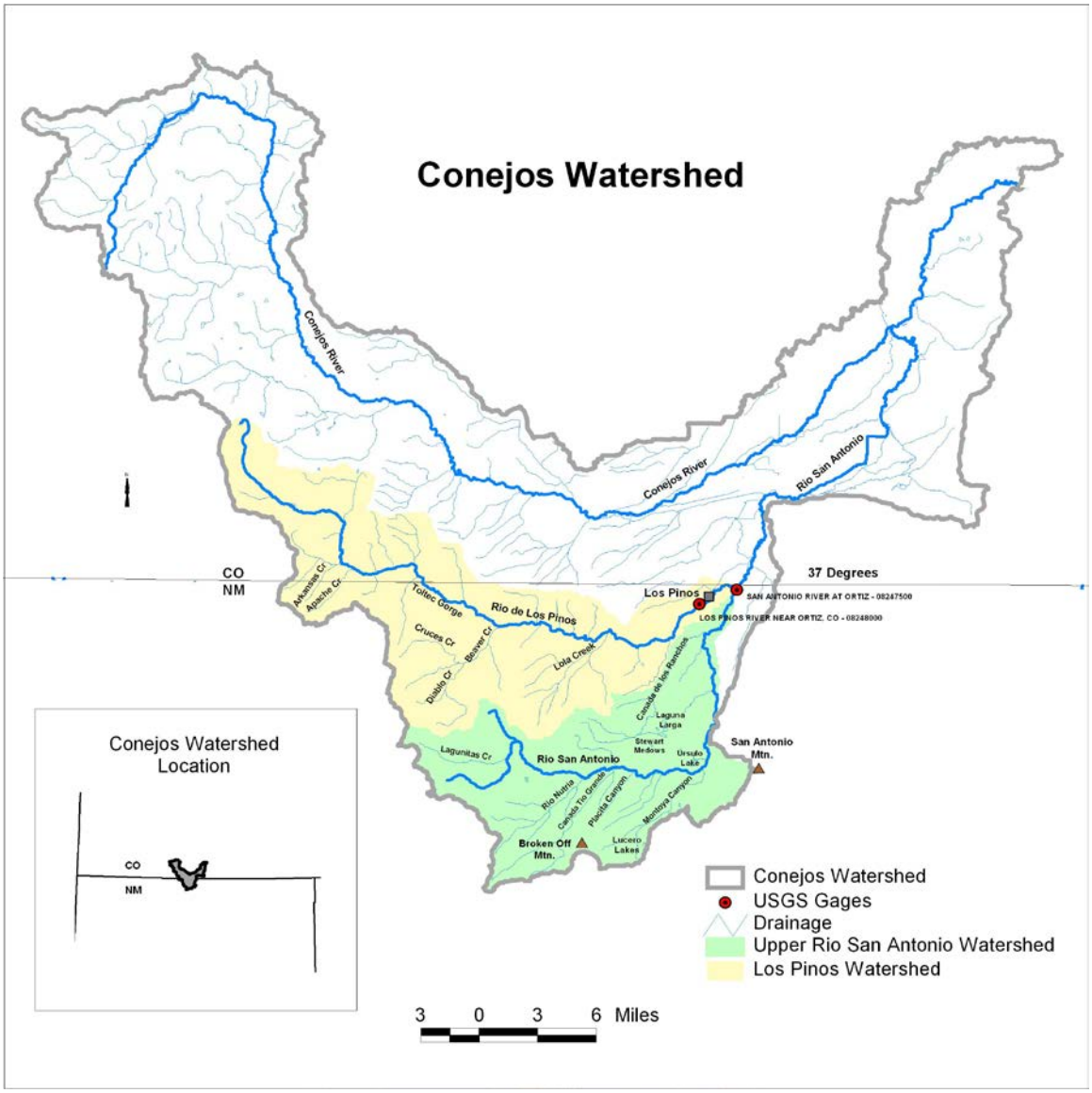
- Geographical Location and Geomorphologic Situation Los Pinos and San Antonio Watersheds.
- Digital Elevation Model Los Pinos and San Antonio Rivers.
- Soil Features.
- Ecological and Biological Diversity in Los Pinos and San Antonio Basins.
- Wetlands Inventory.
- Land cover.
- Wetlands Value.
- Threats and Impairments and Rationale for Restoration.
- Potential projects.

2.0 GEOGRAPHICAL LOCATION LOS PINOS AND SAN ANTONIO WATERSHEDS

The Conejos watershed is located in southern Colorado and northern New Mexico. According to the USGS classification its Hydrologic Unit Area is (HUC) 1301005 for the whole

Conejos watershed. The specific number for the San Antonio River and Los Pinos River is (HUC) 1301005050.

Figure 2.1 Conejos Watershed Location



(Skinner, 2006)

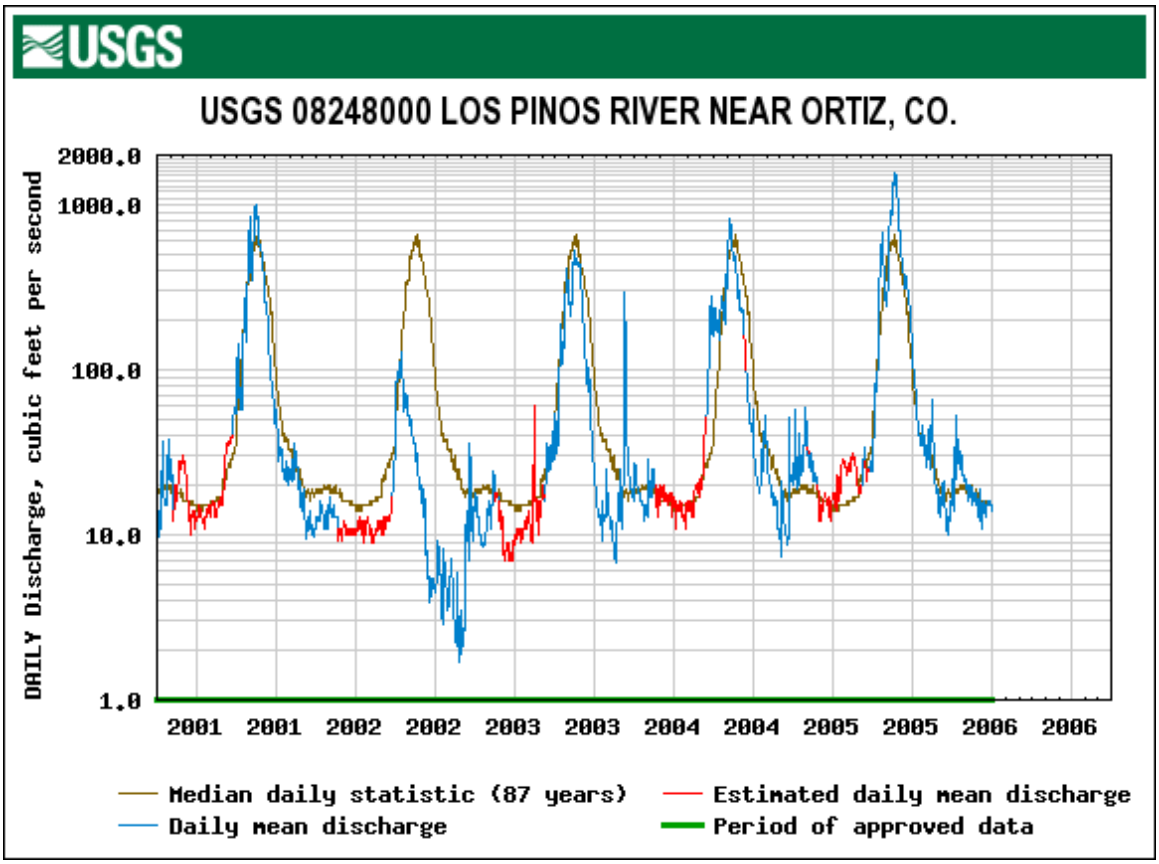
Figure 2.1 shows the Conejos watershed location. The area of study is the upper Rio San Antonio watershed and the whole Los Pinos watershed. Los Pinos River flows into the San Antonio River in the area close to Ortiz and near the boarder between Colorado and New Mexico. The confluent point of the two rivers has been used as closing point of the two watersheds.

3.0 FLOW LEVEL AT SAN ANTONIO AND LOS PINOS

Figures 3.1 through 3.14 show the discharge of two U.S. Geological Survey (USGS) stream gages; San Antonio River at Ortiz-08247500 and Los Pinos River near Ortiz-08248000.

This information is critical to prepare future projects and can help to estimate future water discharges. Graphics in Figure 3.1 through Figure 3.6 are plotted in logarithmic scale, the rest are plotted in linear scale. The natural flows of both basins are affected by human diversions for irrigation and return flows from irrigated areas. Data from USGS as shown in these figures covers years 2001 to 2005 (data of 2006 is not complete), but additional search in databases may provide longer historical discharge data for these two basins. Discharge data is presented in terms of a hydrological water year, that is, from October 1st to September 30th of the next calendar year.

Figure 3.1 USGS Los Pinos River Near Ortiz, CO. Daily discharges from 2001 to 2006



From this graph we can say that Rio Los Pinos has base flow, which could be recharge by groundwater. As we can see the daily mean discharge never get zero also in drought situation such as in 2002. The daily mean discharge has a maximum of 1.800 cubic feet per second approximately. The snowmelt is represented by the daily mean discharge picks, which normally is during the spring and/or early summer time. We can see some picks during the monsoon season July and August; in 2003 there is a clear pick representing the monsoon season. In addition, we can see how in 2002 the daily discharge very low approximately 1.5 cubic feet; the interpretation from 2002 data is drought period.

Figure 3.2 USGS Los Pinos River Near Ortiz, CO. Daily discharge, annual water 2001

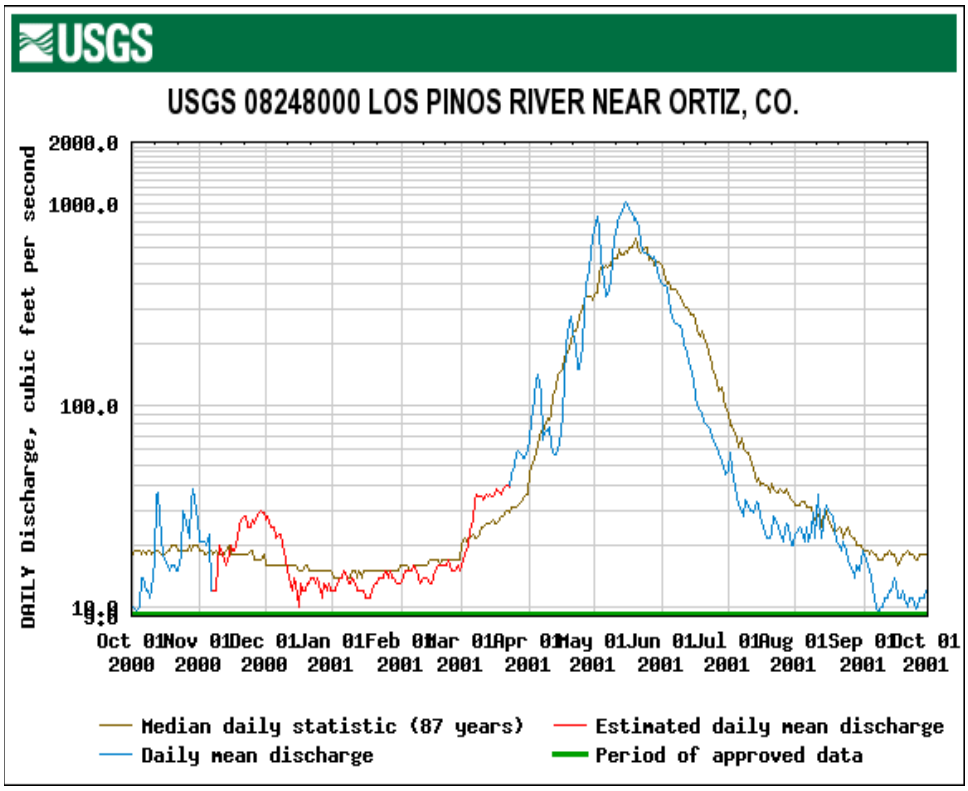


Figure 3.3 USGS Los Pinos River Near Ortiz, CO. Daily discharges, annual water 2002

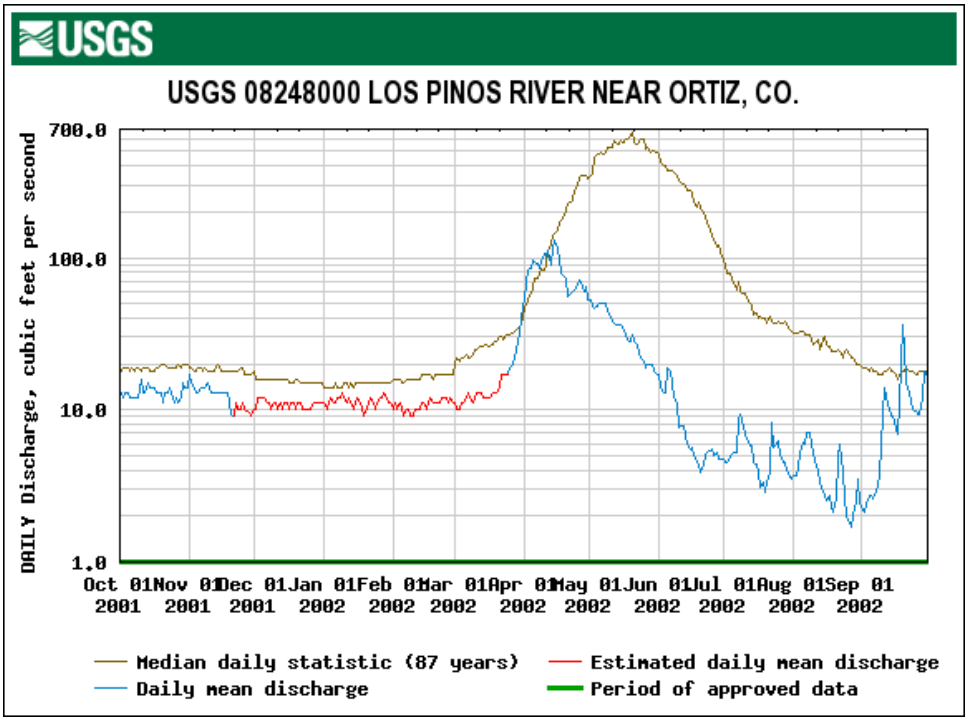


Figure 3.4 USGS Los Pinos River Near Ortiz, CO. Daily discharge, annual water 2003

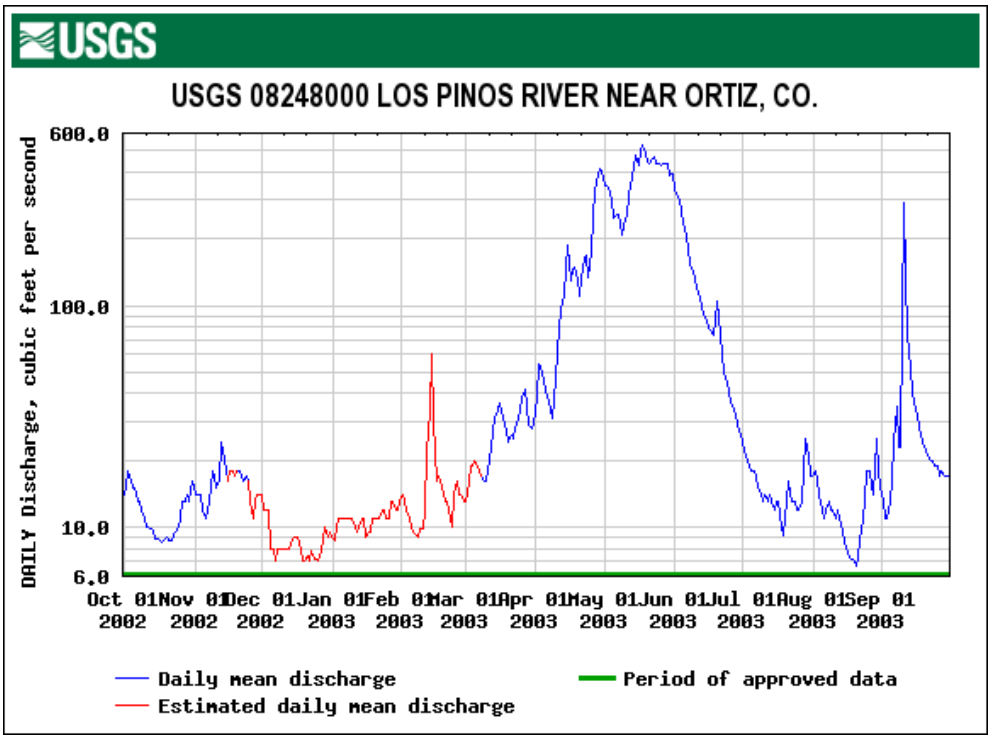


Figure 3.5 USGS Los Pinos River Near Ortiz, CO. Daily discharge, annual water 2004

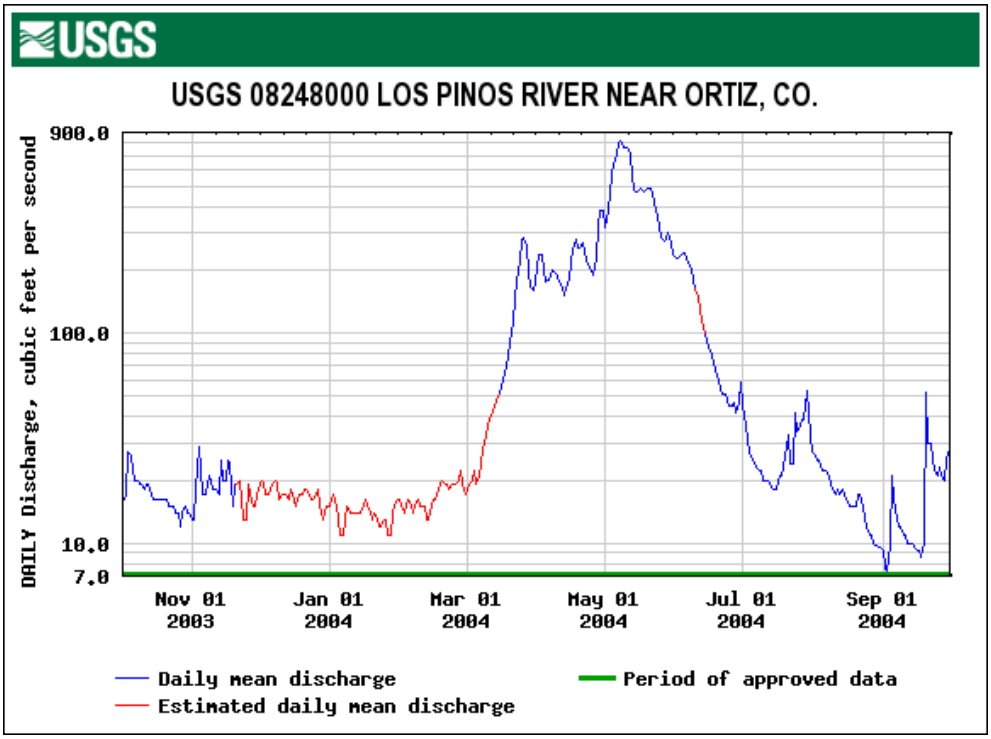


Figure 3.6 USGS Los Pinos River Near Ortiz, CO. Daily discharge, annual water 2005

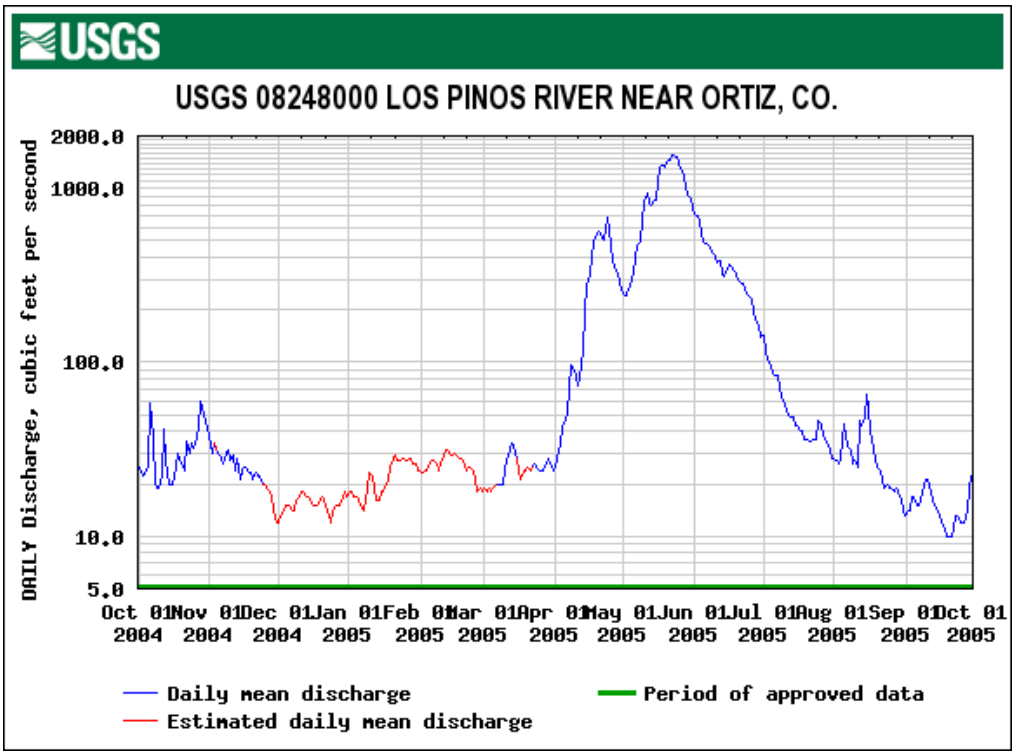


Figure 3.7 USGS Los Pinos River Near Ortiz, CO. Daily discharge, annual water 2006

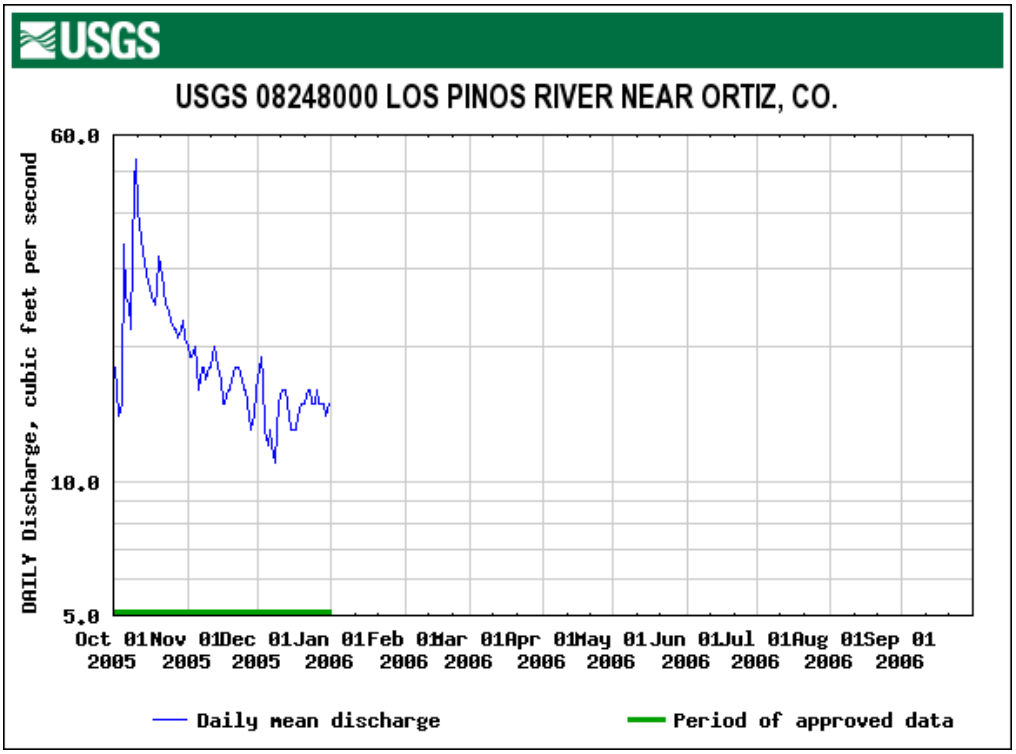
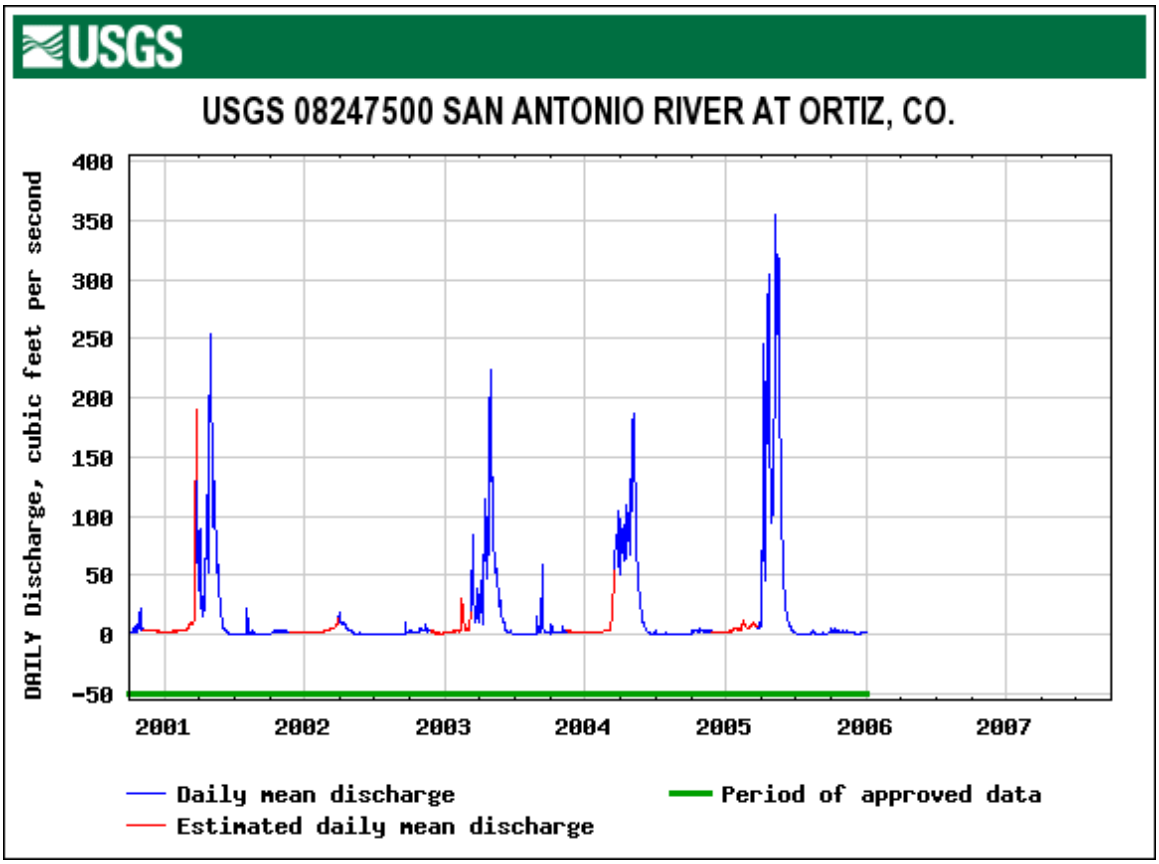


Figure 3.8 San Antonio River at Ortiz, CO. Daily discharge, annual water from 2001 to 2006



From this graph we can say that the San Antonio River does not have base flow. There is no ground water to recharge the river. The daily mean discharge has a maximum of 350 cubic feet per second this means the flow level is not very high and in consequence we have a small river. The snowmelt is represented by the daily mean discharge picks, which normally is during the spring and/or early summer time. We can see how in 2002 the daily discharge was zero this is interpreted as drought; there was not discharge during the snowmelt period.

Figure 3.9 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2001

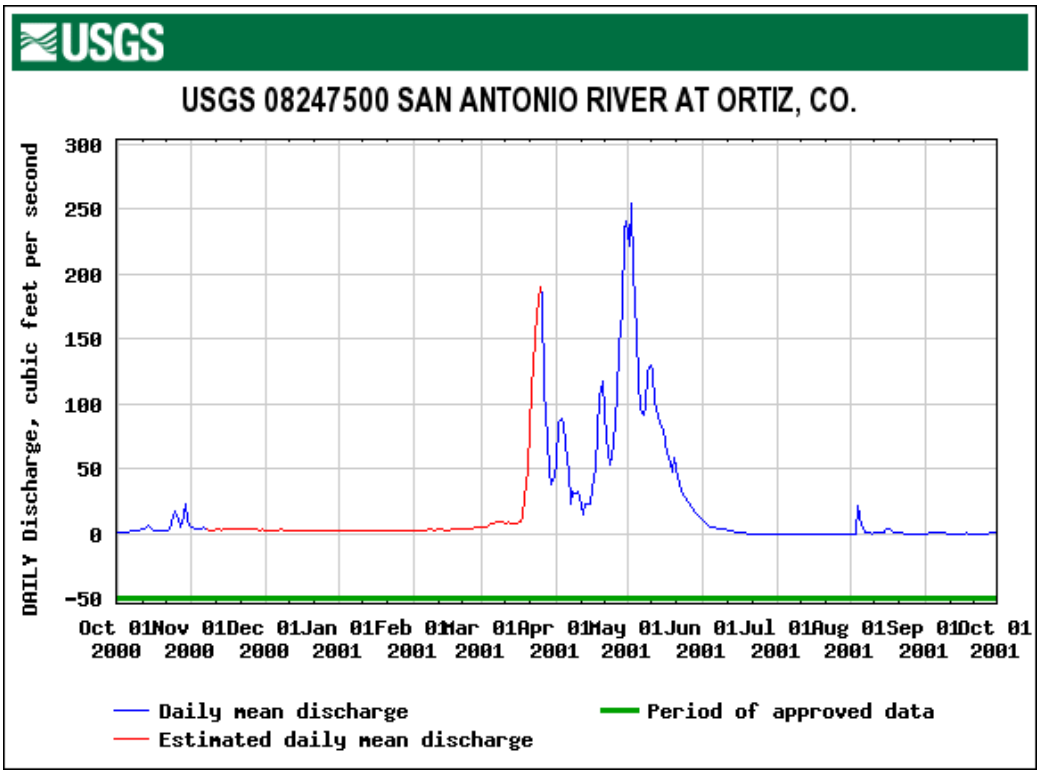


Figure 3.10 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2002

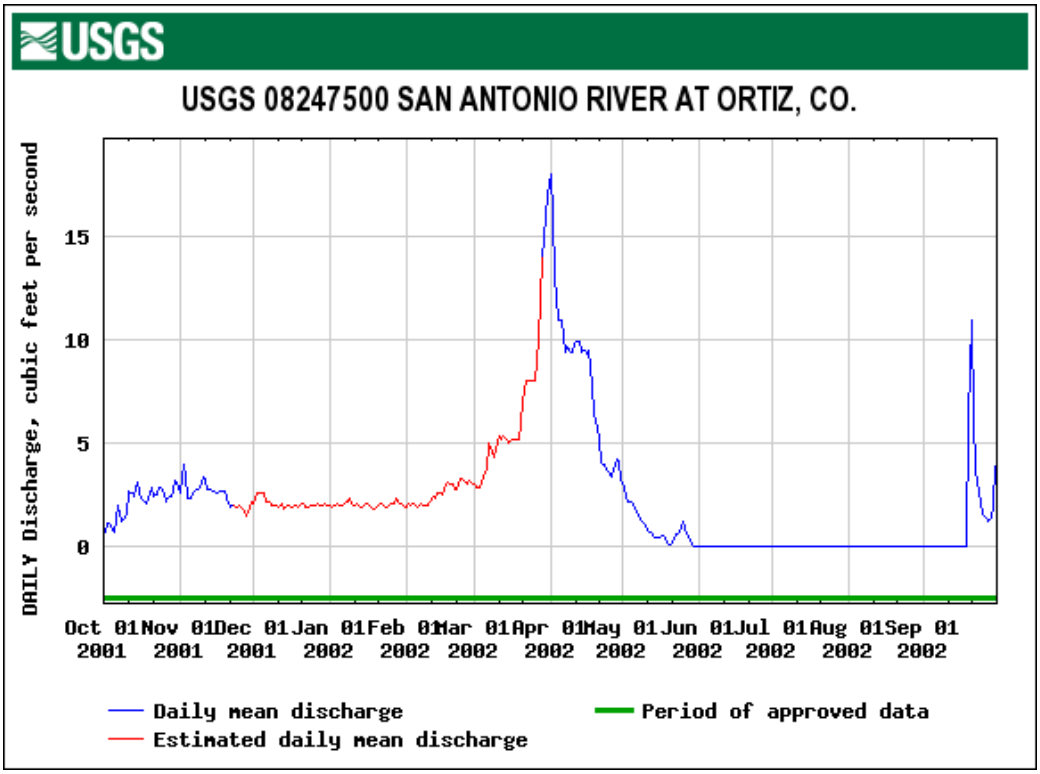


Figure 3.11 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2003

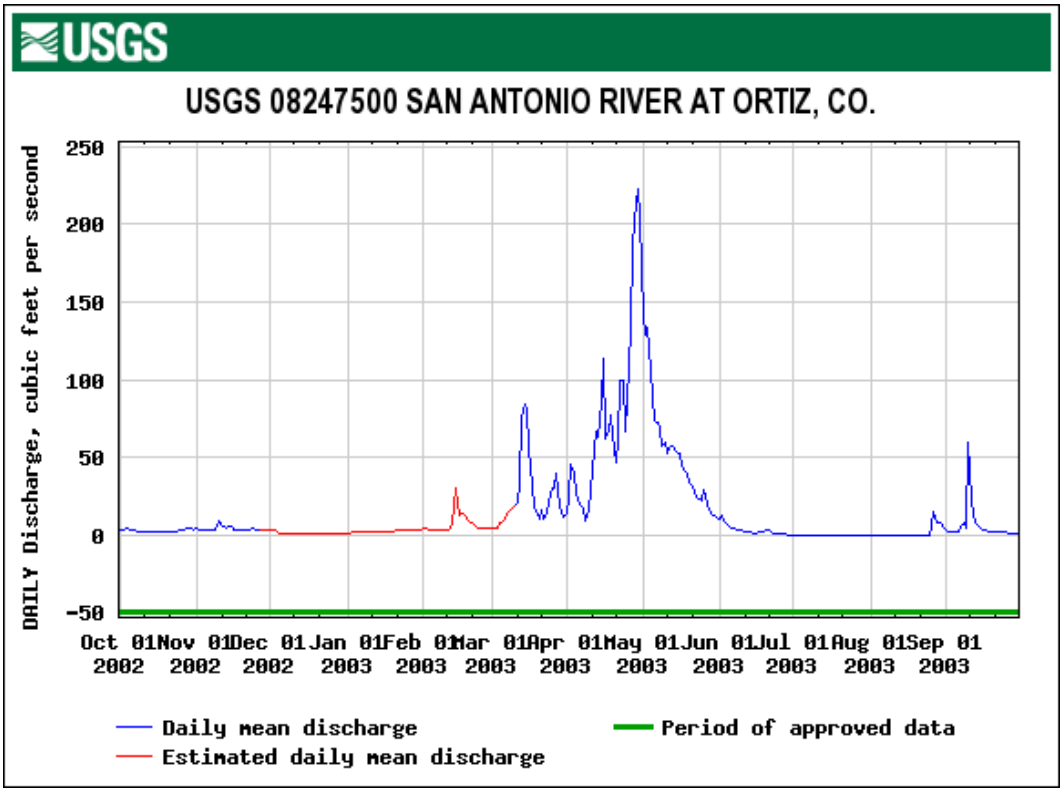


Figure 3.12 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2004

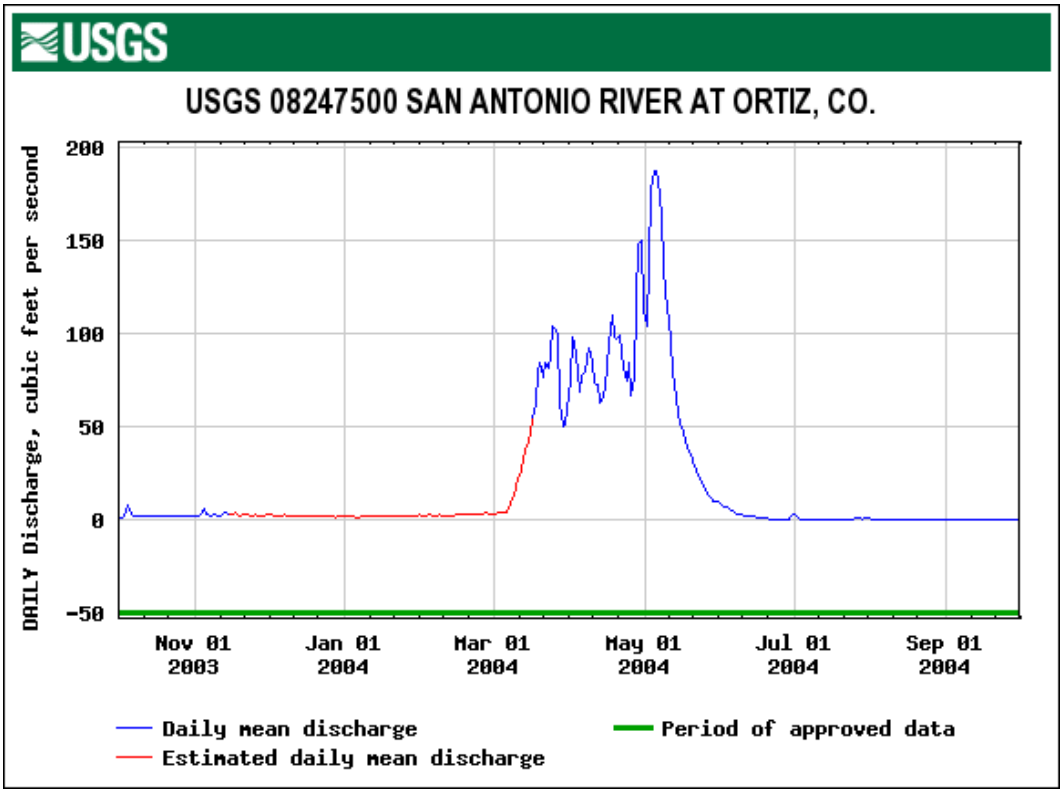


Figure 3.13 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2005

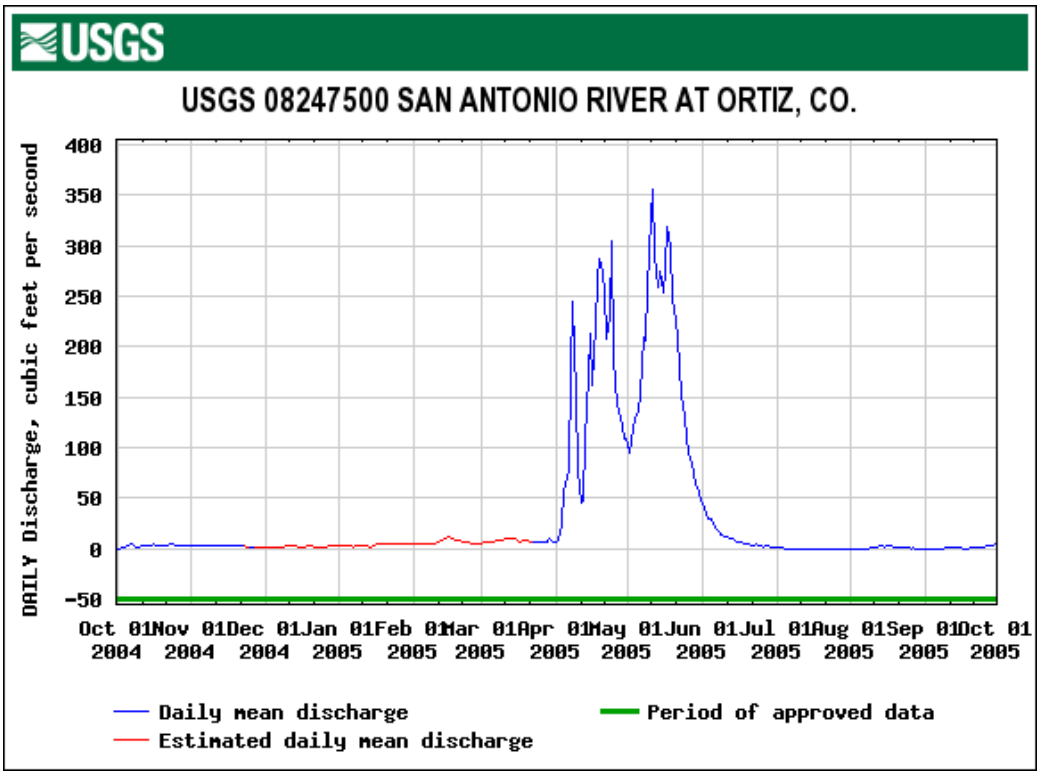
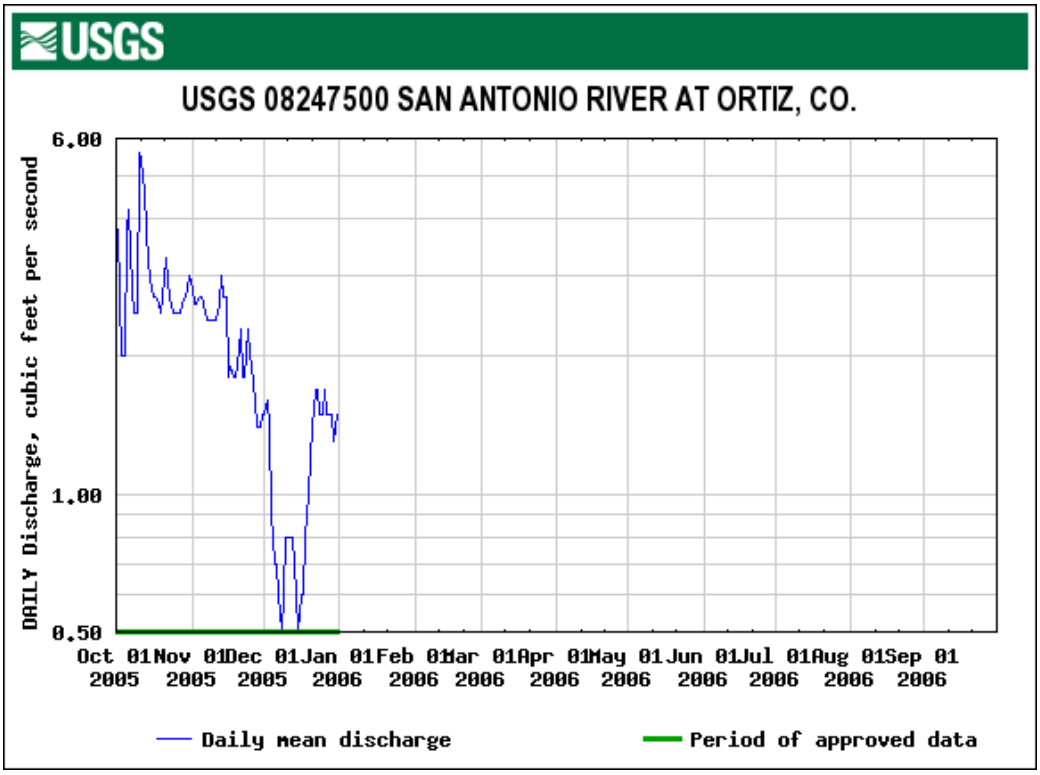


Figure 3.14 USGS San Antonio River at Ortiz, CO. Daily discharge, annual water 2006



4.0 DIGITAL ELEVATION MODEL LOS PINOS AND SAN ANTONIO RIVERS

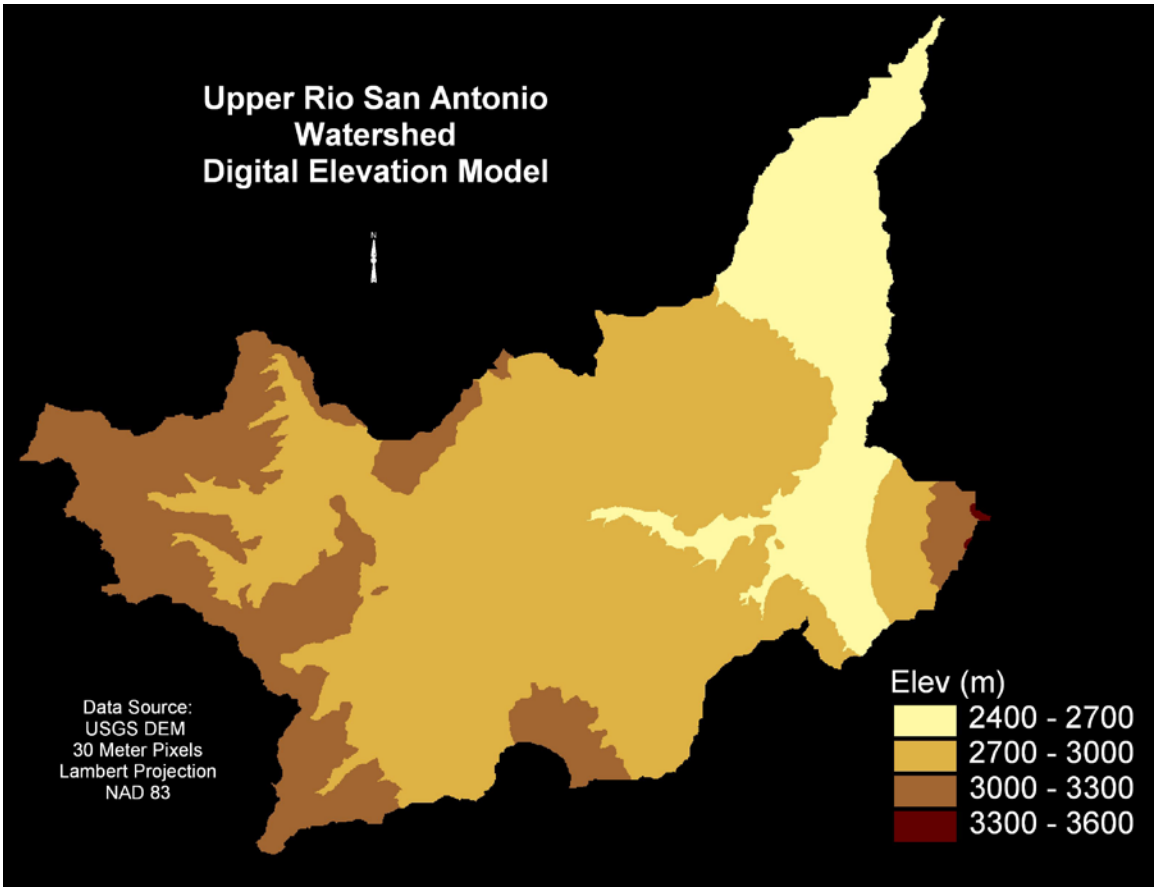
The closing point has been selected as the natural confluent of the two rivers for the close of gauges stations which provide information about streamflow data, both in real time and historical/statistical series. The coordinates of this closing point are given in latitude/longitude. Latitude and longitude are expressed in decimal degrees (d.d.).

Elevations of the highest point and the lowest point of the basins are in meters above sea level, commonly written as m.a.s.l. The precision of these values derived from the DEM is 30 m, due to the altitude resolution of the file. More precise values of the extreme altitudes can be obtained from a topographic map.

The Lambert projection's scale varies from north to south. This is used for areas that extend in an east-west direction. The National Geodetic Survey in the 1980's developed the North American Datum of 1983 (NAD 83). SPC 83 uses meters, rather than feet. Moreover, SPC 83 and SPC 27 can easily be differentiated due to a different false easting. NAD 83 datum shows a redefinition and readjustment and also the removal of geodetic network errors (Sco,2006).

Digital Elevation Model (DEM) allows to delineate discrete watersheds. When the watershed model element interacts with soil and land cover data we are able to identify potential problem areas where mitigation activities can be focused (Goodrich, Canfield, Burns, Semmens, Miller, Hernandez, Levick, Guertin and Kepner, 2005).

Figure 4.1 Upper Rio San Antonio Watershed Digital Elevation Model

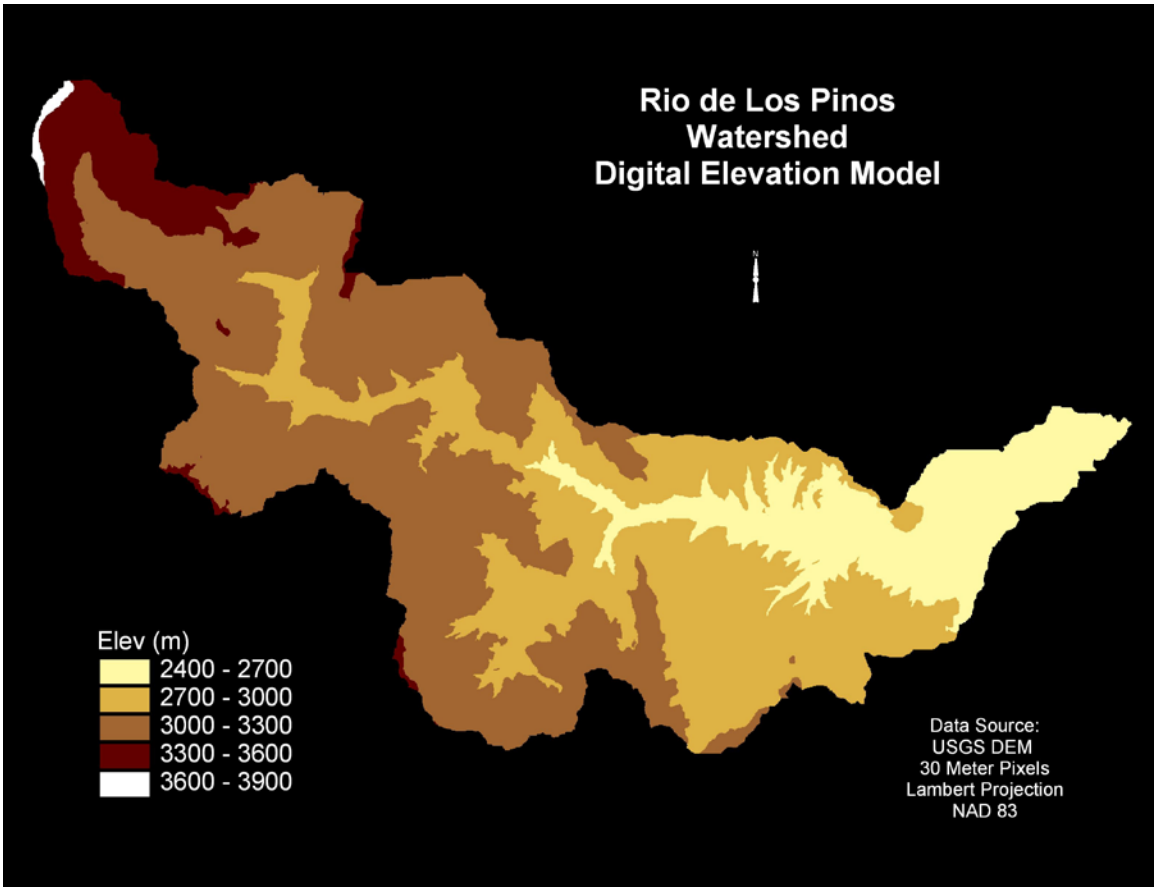


(Skinner, 2006)

Table 4.1 Upper Rio San Antonio Area

Closing point	Latitude: 36.7667 to 36.995 d.d.
	Longitude: -106.019 to -106.35 d.d.
Area	**114.86 sq miles**
Grid resolution	30 m.
Elevation resolution	30 m.
Highest point	3,325 m.a.s.l.
Lowest point	2,430 m.a.s.l.

Figure 4.2 Rio de Los Pinos Watershed Digital Elevation Model



(Skinner, 2006)

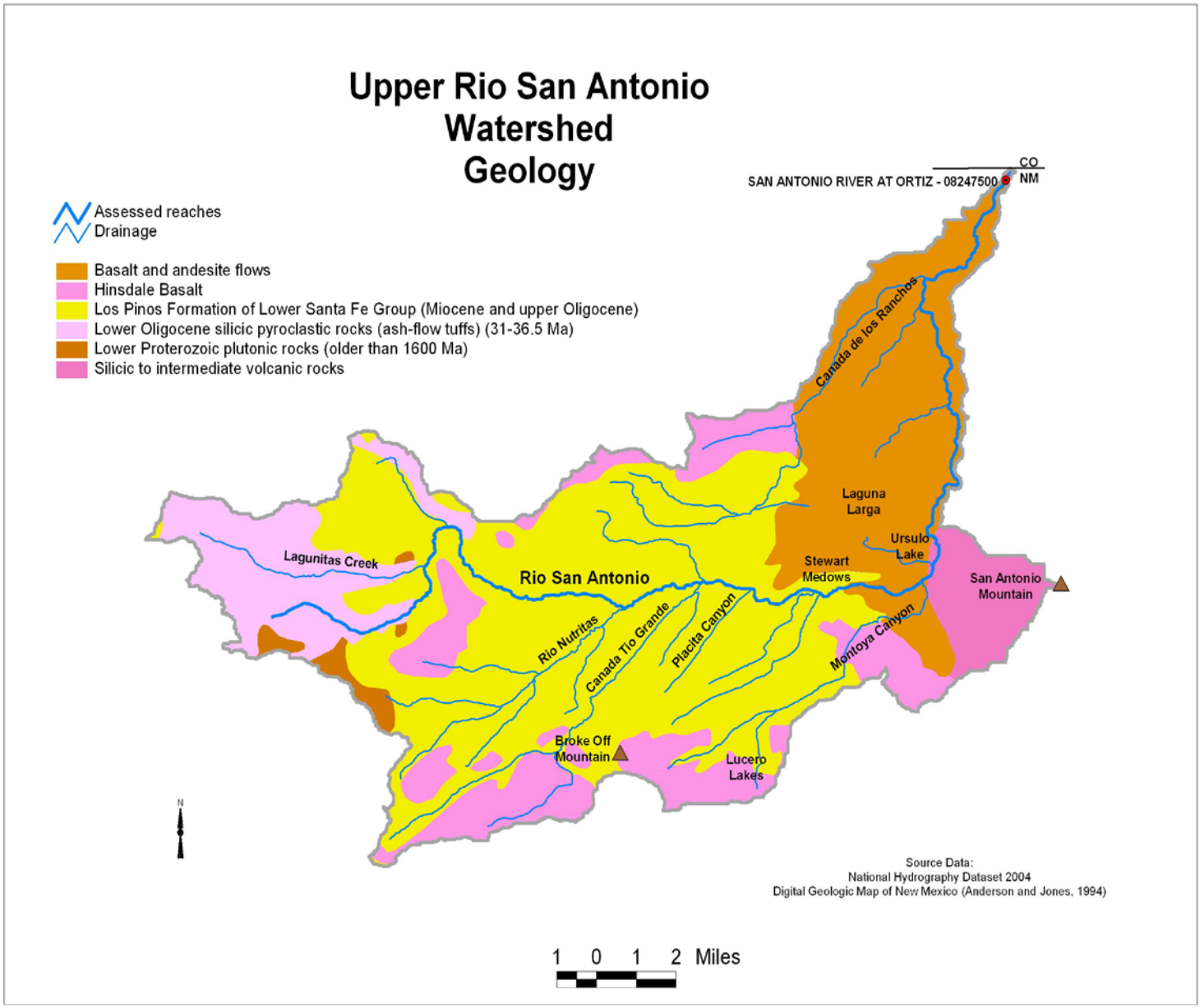
Table 4.2 Rio de Los Pinos Watershed Areas

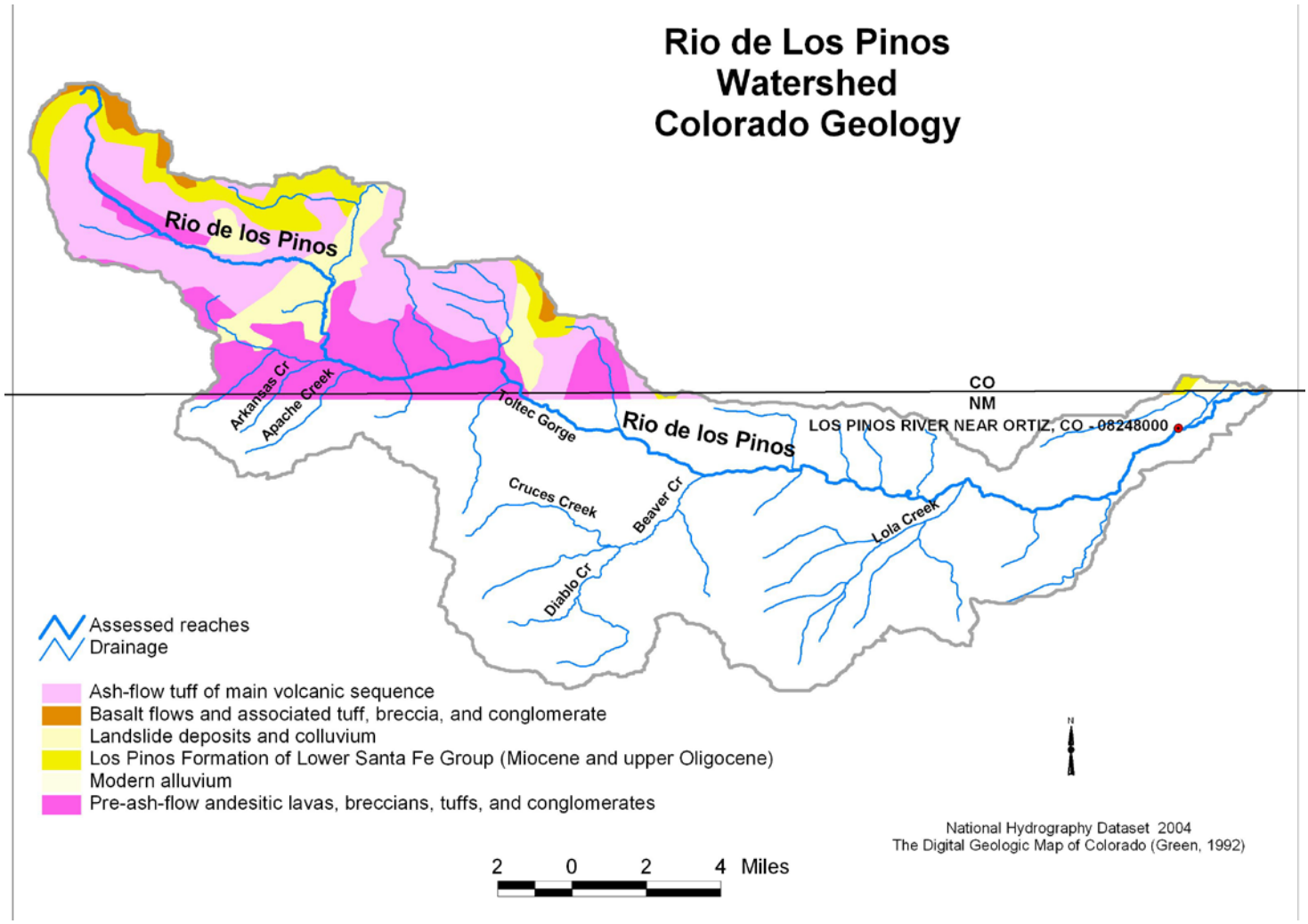
Closing point	Latitude: 36.8804 to 37.1163 d.d.
	Longitude: -106.039 to -106.52
Area	**114.86 sq miles**
Grid resolution	30 m.
Elevation resolution	30 m.
Highest point	3,712 m.
Lowest point	2,430 m.

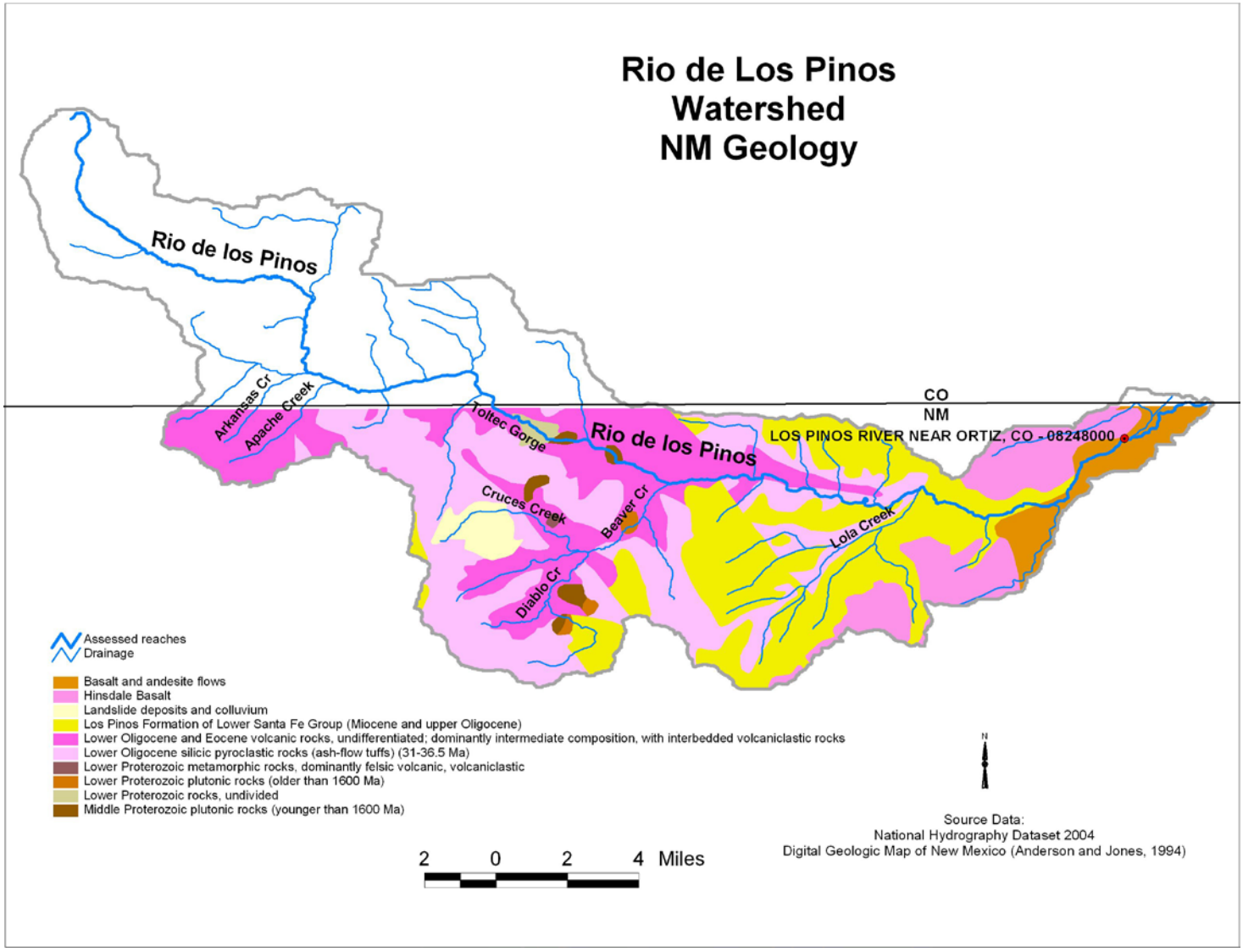
5.0 SOIL FEATURES AND GEOLOGY

The San Antonio and Los Pinos Watersheds are made up of a variety of soil types. The analysis of the land gives us information to determine where erosion will be higher in the future and how to avoid it. In addition, this analysis shows the landform, the major uses of the soil, the kind of vegetation in the area, the wildlife and the more profitable production of the land. According to a study made by the US Forest (Tres Piedras District) and following the Terrestrial Ecosystems survey of the Carson National Forest, it is possible to determine the features of soil in Los Pinos and San Antonio Watersheds. Appendix 1 presents the map Carson National Forest Tres Piedras Ranger District HUC-6th Order Watershed Rio de Los Pinos – Rio San Antonio Terrestrial Ecosystem Units.

The principal geology in the Rio de los Pinos and Rio San Antonio watersheds is Precambrian igneous and metamorphic rocks and Tertiary volcanic related to the Rio Grande Rift tectonic events. The headwaters are basically formed by Precambrian rocks, which consist of gneiss, schist and amphibolite intruded by granite and aplite. Tertiary volcanic unit is one of the oldest rocks after the Precambrian. Tertiatary is composed by breccias, mudflows, tuffs and basaltic andesites. The erosion of volcanic rocks is the cause of this composition. Another type of rock is sandstone and conglomerate, which consist of various volcanic rocks. Three primary basalt flows can be identified within the Tertiary units. Many mesas in the area originate from basalt flows. The Hinsdale Volcanic Series is composed of lithologies of the two youngest basalt flows. These watersheds also have Quaternary deposits, which include fan and talus deposits (NMED, 2004).


Upper Rio San Antonio
Watershed
Geology
Assessed reaches
Drainage
Basalt and andesite flows
Hinsdale Basalt
Los Pinos Formation of Lower Santa Fe Group (Miocene and upper Oligocene)
Lower Oligocene silicic pyroclastic rocks (ash-flow tuffs) (31-36.5 Ma)
Lower Proterozoic plutonic rocks (older than 1600 Ma)
Silicic to intermediate volcanic rocks
SAN ANTONIO RIVER AT ORTIZ - 08247500
CO
NM
Canada de los Ranchos
Laguna
Larga
Ursulo
Lake
Stewart
Medows
San Antonio
Mountain
Lagunitas Creek
Rio San Antonio
Rio Nutritas
Canada Tio Grande
Placita Canyon
Montoya Canyon
Broke Off
Mountain
Lucero
Lakes
N
Source Data:
National Hydrography Dataset 2004
Digital Geologic Map of New Mexico (Anderson and Jones, 1994)
1 0 1 2 Miles


Rio de Los Pinos
Watershed
Colorado Geology
Rio de los Pinos
Arkansas Cr
Apache Creek
Toltec Gorge
Rio de los Pinos
CO
NM
LOS PINOS RIVER NEAR ORTIZ, CO - 08248000
Cruces Creek
Beaver Cr
Diablo Cr
Lola Creek
Assessed reaches
Drainage
Ash-flow tuff of main volcanic sequence
Basalt flows and associated tuff, breccia, and conglomerate
Landslide deposits and colluvium
Los Pinos Formation of Lower Santa Fe Group (Miocene and upper Oligocene)
Modern alluvium
Pre-ash-flow andesitic lavas, breccians, tuffs, and conglomerates
N
National Hydrography Dataset 2004
The Digital Geologic Map of Colorado (Green, 1992)
2 0 2 4 Miles


Rio de Los Pinos
Watershed
NM Geology
Rio de los Pinos
Arkansas Cr
Apache Creek
Toltec Gorge
Rio de los Pinos
CO
NM
LOS PINOS RIVER NEAR ORTIZ, CO - 08248000
Cruces Creek
Beaver Cr
Lola Creek
Diablo Cr
Assessed reaches
Drainage
Basalt and andesite flows
Hinsdale Basalt
Landslide deposits and colluvium
Los Pinos Formation of Lower Santa Fe Group (Miocene and upper Oligocene)
Lower Oligocene and Eocene volcanic rocks, undifferentiated; dominantly intermediate composition, with interbedded volcaniclastic rocks
Lower Oligocene silicic pyroclastic rocks (ash-flow tuffs) (31-36.5 Ma)
Lower Proterozoic metamorphic rocks, dominantly felsic volcanic, volcaniclastic
Lower Proterozoic plutonic rocks (older than 1600 Ma)
Lower Proterozoic rocks, undivided
Middle Proterozoic plutonic rocks (younger than 1600 Ma)
N
Source Data:
National Hydrography Dataset 2004
Digital Geologic Map of New Mexico (Anderson and Jones, 1994)
2 0 2 4 Miles

6.0 ECOLOGICAL AND BIOLOGICAL DIVERSITY IN LOS PINOS AND SAN ANTONIO BASINS

The Ecological and Biological Diversity in the Conejos Watershed is rich and varied in animals and plants. Wetlands in this area provide habitat for many different species. Wetlands habitat is essential for the survival of waterfowl and other water birds. This section is focused in the most characteristic animals in Los Pinos and San Antonio Watersheds. Special emphasis is on migratory birds due to the fragile habitat of these avian species and the high number of waterfowl using these watersheds. In addition, a fish survey provides an analysis of the quantity of fish and the habitat situation of the area. Finally, endangered and threatened species will be listed under species of concern. This list shows species categorized by The Bureau Land Management (BLM), the New Mexico State Government (NMS), Fish and Wild Life Service (USFWS) and The US Forest Service (USFS) as sensitive, endangered and threatened.

6.1 Most Characteristic Animals

In this section we listed the most characteristic species to be found in the area of study. A complete list of species can be seen in Appendix 2.

6.1.1 Mammals:

Table 6.1 shows the most common mammals in San Antonio and Los Pinos Watersheds.

Table 6.1 Mammals Los Pinos and San Antonio Rivers

Common name	Scientific name	Comment
Badger	*Taxidea taxus*	
Beaver	*Castor canadensis*	Special role
Black Bear	*Ursus americanus*	It is native and the mascot of New Mexico.
Black-Tailed Jackrabbit	*Lepus californiacus gray*	
Bobcat	*Lynx rufus*	
Eastern Cottontail	*Sylvilagus floridanus*	
Elk	*Cervus canadensis*	(see note below)
Kit Fox	*Vulpes macrotis*	It is the smallest fox in USA.
Mountain Lion	*Felis concolor Linnaaeus*	It is native
Mule Deer	*Odocoileus hemionus*	It is native
Pronghorn Antelope	*Antilocapra americana*	It is native

Note: As a historical remark, elk were practically exterminated in 1800. This animal was an important source of meat and leather for the pioneers of the area. It was nearly extirpated, after that, it was protected and in the last century the State of N.M. introduced elk into the San Antonio and Los Pinos watersheds. Nowadays, the population of elk is abundant and there is sometime conflict for resources between domestic animals, basically cows, and elk.

6.1.1.1 Rodents:

Table 6.2 shows the most common rodents in Los Pinos and San Antonio watersheds. These animals are typical of riparian areas, where they find the perfect habitat to feed and to construct their burrows.

Table 6. 2 Rodents Los Pinos and San Antonio Rivers

Common name	Scientific name
Deer Mice	*Peromyscus maniculatus*
Pocket Gopher	*Geomys bursarius* shaw
Porcupine	*Erethizon dorsatum* linnaeus
Rock Squirrel	*Spermophilus variegates*
Western Spotted Skunk	*Spilogale gracilis* (merriam)

6.1.2 Birds:

Table 6.3 presents a list of the most common birds in Los Pinos and San Antonio watersheds. The third column of the table shows the season where is more likely to find the species with a gray fill in the corresponding cell. For a complete list of birds and waterfowl (see appendix 2).

Table 6.3 Most common Birds in Los Pinos and San Antonio Rivers

Common name	Scientific name	Season			
		spr	sum	aut	win
Black-Billed Magpie	*Pica hudsonia*				
Blue Grouse	*Aegolius funereu*				
Boreal Owl	*Aegolius funereus*				
Common Raven	*Corvus corax*				

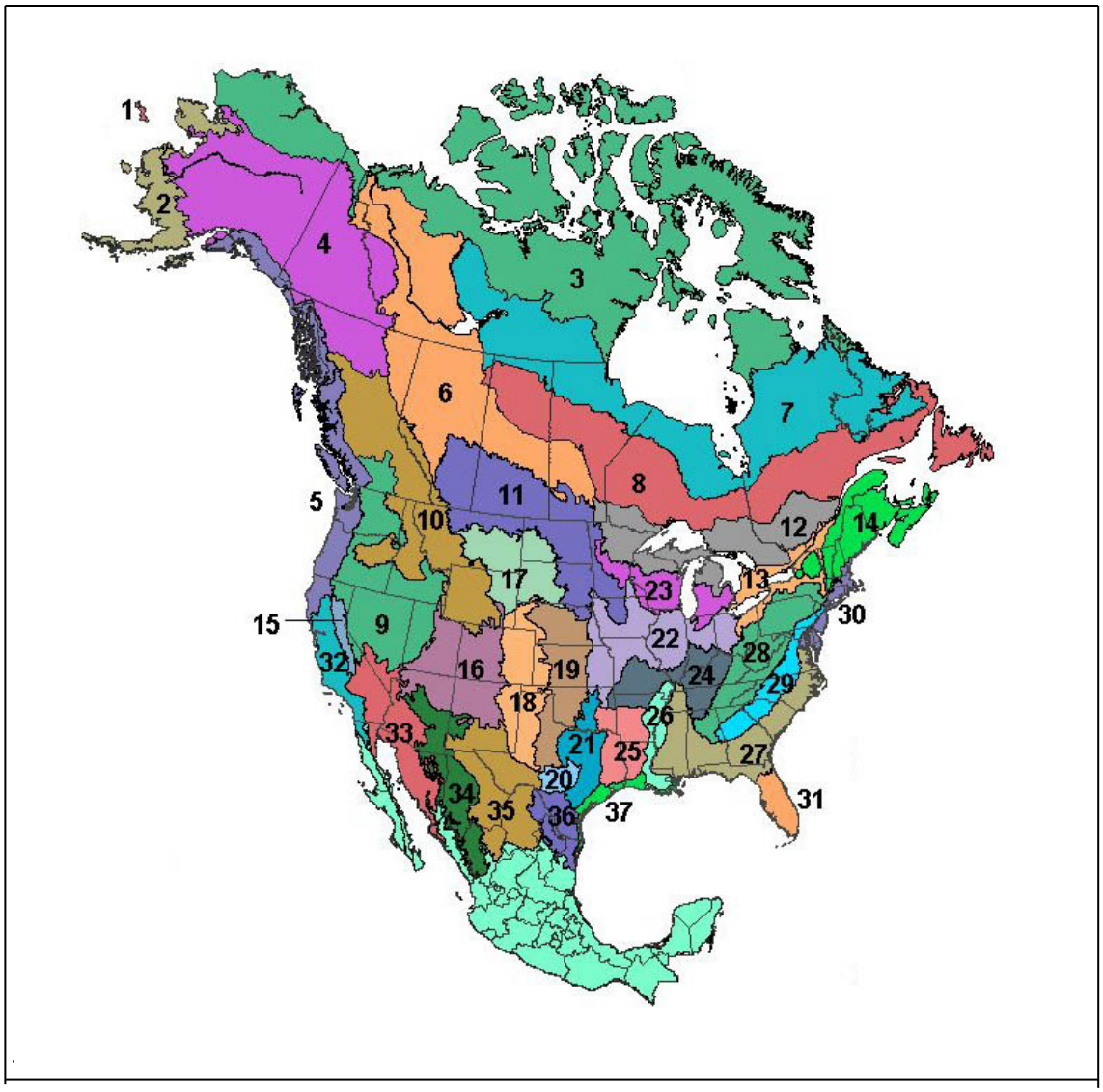
Great Horned Owl	*Bubo virginianus*				
Golden Eagle	*Aquila chrysaetos*				
Hummingbirds	*Archilochus colubris*				
Mountain Chickadee	*Poecile gambeli*				
Mourning Dove	*Zenaida macroura*				
Northern Flicker	*Colaptes auratus*				
Pinon Jay	*Gymnorhinus cyanocephalus*				
Steller's Jay	*Cyanocitta stelleri*				
Swainson's Hawk	*Buteo swainsoni*				
Turkey Vulture	*Cathartes aura*				
Western Bluebird	*Sialia mexicana*				
Western Meadowlark	*Sturnella neglecta*				
Wild Turkey	*Meleagris gallopavo*				

6.1.2.1 Waterfowl

The Conejos Watershed provides habitat for a wide variety of waterfowl and other water birds (Liptak, 1991). Wetlands in the San Antonio River and Los Pinos River are riverine and in some areas we find special combination of wetlands, such as in Stewart Meadows where there are freshwater marshes, riverine, wet meadows and riparian wetlands. These natural scenes provide the habitat for the survival of hundreds of different kind of birds such as: Grebes, Bitterns, Herons, Egrets, Ibises, Spoonbills, Swans, Geese, Ducks, Cranes, Stilts, Avocets, and a large list of birds which appear in the Bird Conservation Region 16 (BCR 16), Southern Rockies/Colorado Plateau (see map 6.1).

"Bird Conservation Regions (BCRs) are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. BCRs are a single application of the scale-flexible hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC)" (nabci, 2006).

Map 6.1 Bird Conservation Regions



(nabci, 2006)

The Alamosa and Monte Vista National Wildlife Refuges List shows the large number of waterfowl along the whole area BCR 16 (see appendix 3). Many species of waterfowl birds are endangered today due to the modification of their original land habitats by human activity. The conservation and development of new wetland habitats are essential for the future of all these birds.

Waterfowl, as we saw, is a huge group of birds where there are different kinds of birds with different habitats needs. Due to wetland losses geese sometimes are able to find migratory and wintertime habitats in other land areas, while other birds such as ducks need wetlands for their survival. Los Pinos and San Antonio watersheds have special characteristics in quality and size of wetlands to provide refuge to hundreds of birds. Successful management of waterfowl requires enough water

depth and shallow water, being the optimum foraging depth 2-10 in. (Fredrickson and Reid, 1988).

San Antonio and Los Pinos Rivers are habitats rich in food for waterfowl but "food macroinvertebrate is only reached if there are special conditions:

1- appropriate water depths maintained during critical time periods
2- habitats protected from disturbance
3- habitats that provide protein and energy close to one another" (Fredrickson and Reid, 1988).

SWQB is working in the New Mexico Macroinvertebrate Stream Conditions Indices (M-SCI), which are used to evaluate the biological conditions for cold water aquatic life for New Mexico streams. Table 6.4 prepared for SWQB shows the M-SCI in the Ecoregions Southern Rocky Mountain and Arizona/New Mexico Mountains. They combine two parameters elevation and watershed site to determine the condition level.

Elevation is divided in:

- High > 7,500'
- Low < 7,500'

Watershed site is divided in:

- Large > 200 sq. mi
- Small < 200 sq. mi

The combinations of those two parameters result in the following categories:

- High Small
- Low Small
- Low Large

Table 6.5 shows the M-SCI scores obtain in 2000 in the Rio de Los Pinos and Rio San Antonio. As we can see the M-SCI is different in both rivers. Los Pinos River is in good conditions with an M-SCI score 64.9331, which is between 56.70 and 78.35 in the M-SCI scale table 5.4. Los Pinos River shows healthy conditions, while San Antonio River is in fair conditions with an M-SCI score 42.2111, which is between 37.20 and 56.70 in the M-SCI scale table 6.4 (Jacobi, G., Jacobi, M., Barbaour, M., Leppo, E., and SWQB, 2006).

Table 6.4 Macroinvertebrate Stream Conditions Index in the Ecoregions Southern Rocky Mountain and Arizona/New Mexico Mountains Percent Comparison to Reference

Rating	Very Good	Good	Fair	Poor	Very Poor
Low Small NMMSCI	>56.45	43.55-56.45	29.03-43.55	14.52-29.03	<14.52
Low Large NMMSCI	>75.82	51.64-75.82	34.43-51.64	17.21-34.43	<17.21
High Small NMMSCI	>78.35	56.70-78.35	37.20-56.70	18.90-37.20	<18.90

(Jacobi, G., Jacobi, M., Barbaour, M., Leppo, E.,and SWQB. 2006 draft)

Table 6.5 Macroinvertebrate Stream Conditions in Los Pinos and San Antonio in 2000

Location	M-SCI Score
Rio de Los Pinos at FS Boundary	64.9331
Rio de Los Pinos 0.5 mi CO border at DG&F area	65.2939
Rio San Antonio at FR 87	42.2111

(SWQB, 2000)

The big problem that faces waterfowl is quantity of water. Los Pinos River and San Antonio have periods where there is not enough water to guarantee the special conditions in wetlands and to protect waterfowl and other birds. The correct management of wetland, developing new areas to migratory birds and protecting riparian vegetation is the way to preserve a healthy ecosystem in Northern New Mexico.

6.1.2.2 Wild Turkey and Riparian Areas

Riparian areas are the habitat of wild turkey. This animal needs water every day and can travel approximately only ½ mile to get it. The habitat for wild turkey requires 90% of forestland, variety of timber and mature hardwoods. In addition, 10% of the area should be grassy openings. At the time to build a nest, turkey look for dense brush, tall grass and fallen tree tops. Poults need woodlands and fallow field with abundance of healthy insects to feed them. Riparian areas are very important for the survival of wild turkey and these ecosystems represent significant wildlife value for the community (NRCS, 2006).

Healthy riparian areas are critical to prevent streambank erosion. The wild turkey is a health indicator species, if this animal is in good condition and can reproduce easily it means that the riparian area is healthy. Riparian areas in width 75 to 300 feet along a river, stream or creek are the perfect habitat for wild turkey and ensure the future of many other species such as small mammals (NRCS, 2006).

Los Pinos and San Antonio Rivers are the potential habitat for the wild turkey due to the possibilities of food. Currently, both rivers have wide zones, where riparian areas are poor and it is difficult to find wild turkey due to the bad conditions of riparian vegetation. The two watersheds should be restored to provide better conditions for the wildlife.

6.1.3 Reptiles and Amphibians:

Table 5.6 shows the most significant reptiles and amphibians in two watersheds, Los Pinos and San Antonio.

Table 6.6 Reptiles and Amphibians

Common name	Scientific name	Origin
Tiger Salamander	*Ambystoma tigrinum*	Native
American Toad (note below)	*Bufo americanus*	Non-native
Gopher Snake	*Pituophis melanoleucus*	Native
Horned Lizard	*Phrynosoma sp.*	Native
New Mexico Spadefoot Toad	*Spea multiplicata*	Native
Western Rattlesnake	*Crotalus viridis*	Native

Note: The American Toad is an invasive species in New Mexico. This toad is originally native from the mid-Atlantic states. It negatively impacts native species such as Western Boreal Toad, which is a species of concern, because it uses the same habitat and displaces it.

6.1.4 Fishes:

Table 6.7 shows the most common fishes in Los Pinos and San Antonio watersheds. The third column shows if the species is native in the watershed or was introduced.

Table 6.7 Most Common Fishes in San Antonio and Los Pinos Rivers.

Common name	Scientific name	Origin
Brook Stickleback	*Culea inconstans*	Non-native
Brook Trout	*Salvelinus fontinalis*	Non-native
Brown Trout	*Salmo truta*	Non-native
Common Carp	*Cyprinus carpio*	Non-native
Fathead Minnow	*Pimephales promelas*	Native
Longnose Dace	*Rhinichthys cataractae*	Native
Northern Pike	*Esox lucius*	Non-native
Rainbow Trout	*Oncorhynchus mykiss*	Non-native
Red Shiner	*Cyprinella lutrensis*	Native
Rio Grande Chub	*Gila pandora*	Native

Rio Grande Cutthroat Trout	*Oncorhynchus clarki virginalis*	Native
Rio Grande Sucker	*Catostomus plebeius*	Native
White Sucker	*Catostomus commersoni*	Non-native

The autochthonous species of the area, i.e., the Rio Grande Cutthroat Trout, has been jeopardized since the introduction of non native species of trout, such as the brook trout, brown trout and rainbow trout. Native species are at risk because of habitat alteration and loss. This situation is due to non-native fish introductions, inappropriate land management activities, water harvesting, and natural events such as flooding, drought, and wildfire.

6.1.4.1 Fish survey

The New Mexico Department Game and Fish completed a multi-pass electrofishing survey in June 2006 on the San Antonio and Los Pinos rivers in New Mexico. During the survey they used block nets to isolate a 100 meter section of stream and made three passes with backpack electroshockers through the section. Electrofishing or shocking is a method used by researchers to immobilize and collect freshwater fishes. Multiple pass means the number of times they took samples in a given section. In each pass they analyze the kind of species, number, size and weight of each fish captured. Table 6.8 shows the stream and location of the survey, the species and the population estimate of species in fish per hectare and in fish per 100 meters. The yellow fill represents the preponderant species in the area. This survey is a good indicator of the population of each species, which is very important information to manage wildlife and help to determine the biological condition of the area.

Survey results revealed a fishery dominated by *Salmo trutta a* non native species, *Oncorhynchus clarki virginalis* a *native* specie and *Oncorhynchus mykiss a* non native species. One of the biggest threats is the loss of native species such as *Catostomus plebeius* through competition with non native species.

After the survey and an examination of the region, researchers were able to estimate habitat conditions. The basic conclusion for Los Pinos is unhealthy in the lower river due to extremely high width to depth ratio in pools and high temperatures caused by the wide shallow areas. San Antonio River is also considered in poor to fair conditions because of high silt load in the river and wide, shallow areas. The researchers consider both rivers have poor habitat, for a cold water fishery. For more detail about this survey see appendix 4.

Table 6.8 Fish Survey of Los Pinos and San Antonio Basins in New Mexico June 2006 in hectares and meters

Dominant species

Stream survey	Location	Scientific name	Population estimate fish/hectare	Population estimate fish/100 m.
Nutrias Creek	100 m. above private land	***Salmo trutta***	**3719.51**	**61**
		Salvelinus fontinalis	121.95	2
Tio Grande	Between private land and barrier	***Oncorhynchus clarki virginalis***	1825.40	23
		Salmo trutta	1428.57	18
	Above barrier	***Oncorhynchus clarki virginalis***	**707.07**	**7**
		Salmo trutta	101.01	1
San Antonio	Below bridge	***Oncorhynchus clarki virginalis***	**75.90**	**4**
Tanques Creek	Above Barrier Above 1st Beaver Dam	***Oncorhynchus clarki virginalis***	**1919.94**	**15.30**
Los Pinos	USFS lower site STW	***Salmo trutta***	**48.50**	**6**
		Oncorhynchus mykiss	8.08	1
	USFS upper site STW	***Salmo trutta***	**91.68**	**13**
		Oncorhynchus mykiss	7.05	1
	Game and Fish property	***Oncorhynchus mykiss***	**142.97**	**18**
		Salmo trutta	7.94	1

Table 6.8 Fish Survey Los Pinos and San Antonio Basins in New Mexico June 2006 in percent of abundance.

Preponderant species * Native

Stream survey	Location	Common and Scientific name	Percent abundance
Nutrias Creek	100 m. above private land	**Brown Trout** ***(Salmo trutta)***	**80.30%**
		White Sucker *(Catostomus commersoni)*	15.15%
		Brook Trout *(Salvelinus fontinalis)*	3%
		Rio Grande Cutthroat Trout *(Oncorhynchus clarki virginalis)**	1.51%
Tio Grande	Between private land and barrier	**Rio Grande Cutthroat Trout** ***(Oncorhynchus clarki virginalis)****	**63.93%**
		Brown Trout *(Salmo trutta)*	36.06%
	Above barrier	**Rio Grande Cutthroat Trout** ***(Oncorhynchus clarki virginalis)****	**95%**
		Brown Trout *(Salmo trutta)*	5%
San Antonio	Below bridge	**White Sucker** ***(Catostomus commersoni)***	**80.95%**
		Rio Grande Cutthroat Trout *(Oncorhynchus clarki virginalis)**	19.04%
Tanques Creek	Above Barrier Above 1st Beaver Dam	***Rio Grande Cutthroat Trout (Oncorhynchus clarki virginalis)****	**100%**

Stream survey	Location	Common and Scientific name	Percent abundance
Los Pinos	USFS lower site	**Longnose Dace *(Rhinichthys cataractae)****	**75%**
		Brown Trout *(Salmo trutta)*	10%
		Rio Grande Chub *(Gila pandora)**	8.33%
		White Sucker *(Catostomus commersoni)*	5%
		Rainbow Trout *(Oncorhynchus mykiss)*	1.66%
	USFS upper site	**Longnose Dace *(Rhinichthys cataractae)****	**79.68%**
		Brown Trout *(Salmo trutta)*	18.75%
		Rainbow Trout *(Oncorhynchus mykiss)*	1.56%
	Game and Fish property	**Longnose Dace *(Rhinichthys cataractae)****	**33.3%**
		Rio Grande Chub *(Gila pandora)**	31.57%
		Rainbow Trout *(Oncorhynchus mykiss)*	26.3%
		White Sucker *(Catostomus commersoni)*	7.01%
		Brown Trout *(Salmo truta)*	1.75%

The Colorado Division of Wildlife (John Alves) provided us with the following information: lake and stream survey reports for waters within the Rio de Los Pinos and Rio San Antonio watersheds in Colorado. The reports inform about species composition relative abundance, biomass, density lengths and weights. Some of the reports may have length frequency histograms and trend graphs.

Federally endangered fish species are not found in the Rio de Los Pinos watershed of Colorado. However, Rio Grande sucker, a Colorado state endangered species was transplanted to Cascade Creek and Osier Creek. Native fish, such as Rio Grande cutthroat trout and Rio Grande chub, inhabit the upper and lower reaches of

Rio de Los Pinos, respectively. Rio Grande cutthroat trout, Rio Grande chub, brook trout, and rainbow trout are documented in the Rio de los Pinos watershed.

Federally endangered fish species are not found in the Rio San Antonio watershed of Colorado. Four native fish inhabit Rio San Antonio: Rio Grande chub, longnose dace, red shiner, and fathead minnow. Other fish species documented in the watershed include northern pike, brown trout, brook stickleback, white sucker, and common carp.

Table 6.9 Fish Survey San Antonio Basins in Colorado September 1997

Stream Survey	Location	Common and Scientific name	Percent abundance
San Antonio	SW Sego springs	**White Sucker** ***(Catostomus commersoni)***	**53.5%**
		Rio Grande Chub *(Gila Pandora)**	42.1%
		Northern Pike *(Esox lucieus)*	1.1%
		Fathead Minnow *(Pimephales promelas)**	3.3%
		Brook Stickleback *(Culaea inconstans)*	
		Longnose Dace *(Rhinichthys cataractae)**	
	SE Sego springs	**White Sucker** ***(Catostomus commersoni)***	**49.4%**
		Red Shiner *(Cyprinella lutrensis)*	31.8%
		Fathead Minnow *(Pimephales promelas)**	16.5%
		Longnose Dace *(Rhinichthys cataractae)**	1.2%
		Common Carp *(Cyprinus carpio)*	1.2%
	At 285 Bridge	**White Sucker** ***(Catostomus commersoni)***	**56.8%**
		Rio Grande Chub *(Gila pandora)**	24.2%
		Longnose Dace *(Rhinichthys cataractae)**	11.4%
		Fathead Minnow *(Pimephales promelas)**	6.1%
		Brown Trout *(Salmo trutta)*	1.5%

In San Antonio River (Colorado) survey results revealed a fishery dominated by *Catostomus commersoni,* a non native species followed by *Gila pandora* and *Cyprinella lutrensis,* both native species. Catostomus commersoni has displaced native species such as *Pimephales promelas* to some extent.

Table 6.10 Fish Survey of Los Pinos Basin in Colorado July 2000

Stream Survey	Location	Common and Scientific name	Percent abundance
Cascade Creek	Upstream of confluence w/ Rio de los Pinos	**Rio Grande Cutthroat Trout** ***(Oncorhynchus clarki virginalis)****	**97.0%**
		White Sucker *(Catostomus commersoni)*	3.0%
Osier Creek	Upstream from Osier station	**Rio Grande Cutthroat Trout** ***(Oncorhynchus clarki virginalis)****	**100%**

Table 6.11 Fish of Survey Los Pinos Basins in Colorado July 2005

Stream Survey	Location	Common and Scientific name	Percent abundance
Rio de Los Pinos	Above waterfalls	**Rio Grande Cutthroat Trout** ***(Oncorhynchus clarki virginalis)***	**100%**
	Trujillo Meadows Reservoir	***Brown Trout (Salmo trutta)***	**80.52%**
		Brook Trout *(Salvelinus fontinalis)*	8.99%
		Rio Grande Cutthroat Trout *(Oncorhynchus clarki virginalis)**	3.00%
		Rainbow Trout *(Oncorhynchus mykiss)*	7.49%

6.2 Endangered and Threatened Species in Los Pinos and San Antonio Rivers

Table 6.12 shows species of concern in Los Pinos and San Antonio watersheds according to three different criteria of three institutions: Fish and Wildlife Service, State of New Mexico and Bureau of Land Management.

Most of these species are threatened or endangered due to forest fires and a poor land management of the area. One clear example is the Mexican Spotted Owl which is a victim of fires and nowadays is practically extinct. In addition, species such as the Rio Grande cutthroat trout are considered sensitive due to the threat posed by introduction of non-native species. There are projects to protect the Rio Grande cutthroat trout and to avoid the extirpation of this trout. All species listed in table 7 should be protected. One way to accomplish this goal is preservation of wetlands which provide habitat for most of them.

Table 6.12 Species of Concern Los Pinos and San Antonio watersheds

Species of Concerr Los Pinos and San Antonio Watershed

Common Name	Scientific Name	FWS ESA	NM WCA	FS R3	BLM NM	NM Sen	FWS Soc
Fish							
Rio Grande Cutthroat Trout	Oncorhynchus clarki virginalis	_	_	s	_	s m	s
Rio Grande Sucker	Catostomus plebeius	_	_	s	_	_	s
Rio Grande chub	Gila pandora	_	_	_	_	s	_
Amphibians							
Western Boreal Toad	Bufo boreas boreas	C m	E	s	_	_	_
Birds in Riparian areas							
Clark's Grebe	Aechmophorus clarkii	_	_	s	_	_	_
American Bittern	Botaurus lentiginosus	_	_	s	_	_	_
Osprey	Pandion haliaetus carolinensis	_	_	s	_	_	_
Yellow-billed Cuckoo	Coccyzus americanus occidentalis	C	_	s	_	s	_
Belted Kingfisher	Ceryle alcyon	_	_	s	_	_	_
Rodent in Riparian areas							
New Mexican Jumping Mouse	Zapus hudsonius luteus	_	T	s	s	_	s
Birds							
Bald Eagle	Haliaeetus leucocephalus	AD, T mg	T	s	_	_	_
Northern Goshawk	Accipiter gentilis	_	_	s	s	s	s
American Perigrine Falcon	Falco peregrinus anatum	DM m	T	s	_	_	s
Mountain Plover	Charadrius montanus	PT	_	s	_	s	_
Interior Least Tern	Sterna antillarum athalassos	E mg	E	s	_	_	_
Black Tern	Chlidonias niger surinamensis	_	_	_	s	_	s
Flammulated Owl	Otus flammeolus	_	_	s	_	_	_
Burrowing Owl	Athene cunicularia hypugaea	_	_	_	s	_	s
Loggerhead Shrike	Lanius ludovicianus	_	_	_	s	s	_
Baird's Sparrow	Ammodramus bairdii	_	T	s	s	_	s
Mexican Spotted Owl	Strix occidentalis lucida	T hmg	_	s	_	s	_
Boreal Owl	Aegolius funereus	_	T	s	_	_	_
Mammals							
Gunnison's Prairie Dog	Cynomys gunnisoni	_	_	_	_	s	_
Heather Vole	Phenacomys intermedius intermedius	_	_	_	_	s	_
Red Fox	Vulpes vulpes	_	_	_	_	s	_
Ringtail	Bassariscus astutus	_	_	s	_	s	_
American Marten	Martes americana origenes	_	T	s	_	_	_
Butterflies							
Socorro Mountainsnail	Oreohelix neomexicana	_	_	_	_	s n	_
False Ameletus Mayfly	Ameletus falsus	_	_	s	_	_	s
Pearly Checkerspot butterfly	Charidryas acastus acatus	_	_	_	_	_	s

(Biota Information System NM, 2003)

Abbreviations:

FWS: Fish and Wildlife Service. ESA: Endangered Species Act. NM: New Mexico.
WCA: Wildlife Conservation Act. FS: Forest Service. R3: Region 3 of the USFS.
BLM: Bureau Land Management. Sen: Sensitive. SOC: Species of concern.
n. Endemic to NM. c. Candidate. AD: Proposed delisting.
DM: Delisting; still monitoring. T: Threatened. E: Endangered.

6.3 Native Species Apparently no Longer Occurring in Los Pinos and San Antonio Watersheds

The following table 6.13 shows native species from New Mexico no longer occurring in Los Pinos and San Antonio watersheds. These species have been extirpated from New Mexico or there is no record about the specimen in the area.

Table 6.13 Native Species No Longer Occurring

Common Name	Scientific Name	Status
Gunnison Sage-Grouse	Centrocercus minimus	Extirpated from NM
Gray Wolf	Canis lupus	Extirpated from NM
Grizzly Bear	Ursus arctos	Extirpated from NM
Black-footed Ferret	Mustela nigripes	Extirpated from NM
Mink	Mustela vison energumenos	Extirpated from NM
Southwestern River Otter	Lutra canadensis sonorae	Extirpated from NM
Lynx	Lynx lynx	No specimens or verified records
Wolverine	Gulo gulo	No specimens or verified records

7.0 WETLANDS INVENTORY

Wetlands in the San Antonio River and Los Pinos River are an important source of life for many species and provide water for human activities such as agriculture and cattle rising. This area is characterized by different types of wetlands. According to the United States Environmental Protection Agency (EPA) classification the most typical wetlands in Los Pinos and San Antonio River area are the following: Freshwater marshes, wet meadows, wet prairies and depression wetlands.

"**Freshwater Marshes** are characterized by periodic or permanent shallow water, little or no peat deposition, and mineral soils. They typically derive most of their water from surface waters, including floodwater and runoff, but do receive ground water inputs.

Wet Meadows commonly occur in poorly drained areas such as shallow lake basins, low-lying depressions, and the land between shallow marshes and upland areas. Precipitation serves as their primary water supply, so they are often dry in the summer.

Wet Prairies are similar to wet meadows but remain saturated longer. Wet prairies may receive water from intermittent streams as well as ground water and precipitation.

Depression Wetlands which are a mixed between Playas and Vernal pools. They are small basins that collect rainfall and runoff from the surrounding land. They have either bedrock or a hard clay layer in the soil that helps keep water in the pool. They are covered by shallow water for variable periods during on yearly precipitation" (EPA, 2001). This kind of wetlands is typical in Laguna Larga and Lucero Lake at San Antonio Watershed.

Riparian Wetlands is another type and we can find it in the Conejos Watershed. These wetlands occur in areas where the floodplains adjacent to rivers or streams sometime flooded by rivers or streams (Mitsch and Gosselink, 1993).

Riverine Wetlands are located along the river and they include other types of wetlands such as freshwater marshes, wet meadows, wet prairies and riparian wetlands. This type of wetland is very common along the two rivers San Antonio and Los Pinos.

Stewart Meadows is a special area in San Antonio River watershed where the combination of wet meadows, riparian wetlands and freshwater marshes occur. The ecosystem in Stewart Meadows attracts a lot of wildlife, especially waterfowl which use wetlands as resting places during their migrations and as breeding grounds (Liptak, 1991). Also, this wetland is the perfect habitat for beavers which contribute to protect and maintain harmony in the whole area. Water resources in the Stewart Meadows, Laguna Larga and Lucero Lake are scarce and it can be a problem for the survival of many species.

8.0 LAND USE

Land use is the management of a specific area in the manner of what types of activities are allowed, such as agriculture, recreation, grazing, construction, industry and forestry. The knowledge about land use is crucial to develop future effective regional plans and to manage wildlife resources. Federal, State and Local agencies need information about land use and land cover to estimate water resource for the future and to analyze the possible action to restore wetlands and to improve a specific area (Anderson, Hardy, Roach and Witmer, 1976). Land use affects biological diversity in different ways, such as abundance, variety, and genetic structure of native animals and plants. A change in the land cover can provide a different habitat, which can increase or decrease the variety of species. In addition, native species can lose available areas due to an incorrect change in land cover (USGS, 2006).

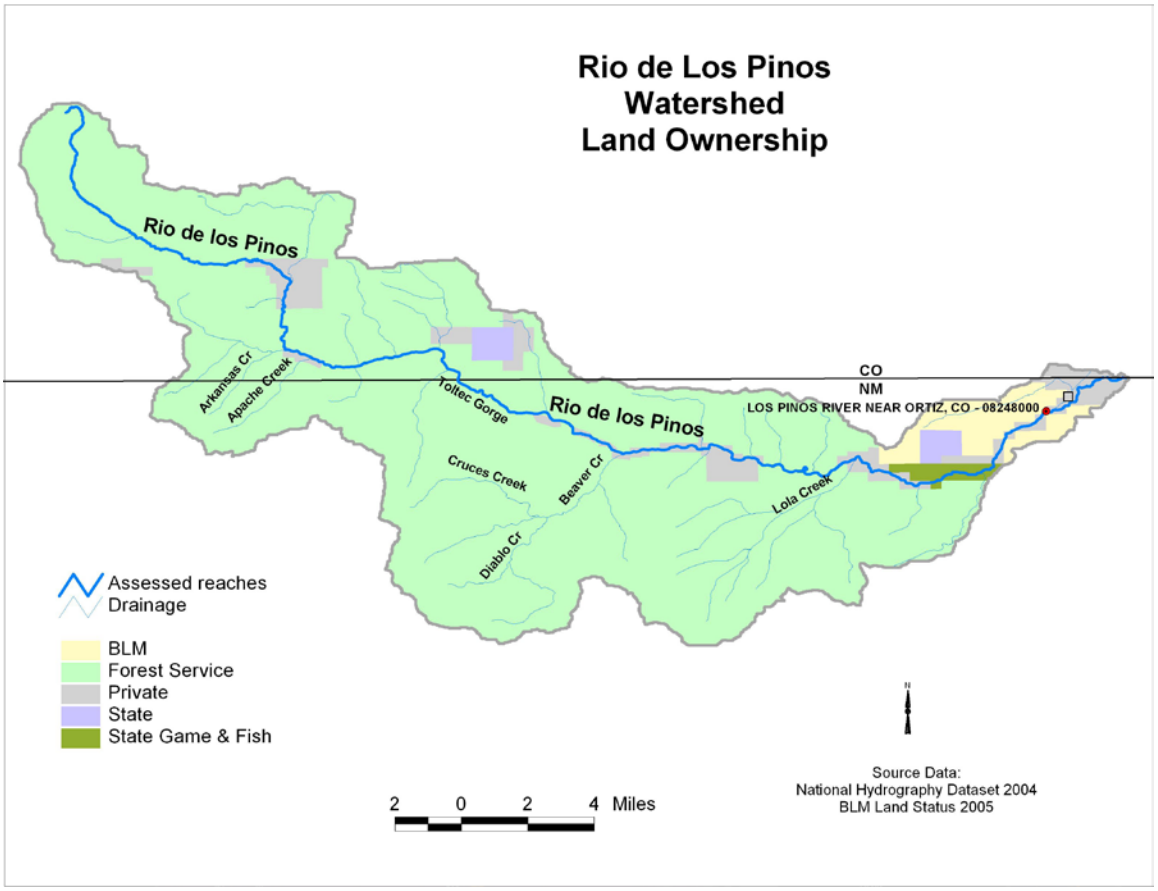
The lost of wetlands has been a consequence of inappropriate changes in land use. Alteration in the number of forests across a landscape may show additions as croplands or rangelands (USGS, 2006). Also, a bad management of forests can cause fires and the destruction of wetlands. San Antonio and Los Pinos watersheds are victims of these changes, where the forests and the wetlands areas need restoration. The property of these watersheds is divided by BLM, US Forest, NM State and private property. In this section we are going to analysis the percentage of land owned by each agency and by private landowners in Los Pinos watershed and the upper San Antonio watersheds. In addition, we will examine the land cover according to the National Land Cover Data (NLCD), which is a specific indicator of the use of land.

8.1 Land Ownership

Land ownership is important information to manage wetlands and to plan future restoration projects. When the land is owned by individual landowners the cooperation between landowners and agencies is basic to protect and to develop new wetlands areas. If a specific watershed is owned by state or federal agencies, it is easier to coordinate action plans due to the interagency collaboration. The participation of all owners and the willing to improve wetlands is essential to achieve an efficient management of a watershed.

Land Ownership maps (Figure 9.1 and 9.2) show us how Los Pinos watershed and the Upper San Antonio watershed are divided by different owners. Tables 9.1 and 9.2 show both watersheds in mi^2 owned by each agency and private landowners, the percentage of these areas are illustrated in Figure 9.3 and 9.4. Forest Service is the most important manager in the two watersheds. As we can see, Forest Service owns the 84% in the upper San Antonio watershed and the 88% in Los Pinos watershed. Private property, NM State property and State Game & Fish have a low percentage in the two watersheds. Private property is 7% of the Upper San Antonio watershed and 6% of the Los Pinos watershed. The amount of private property is low, but the location of these percentages in wetlands areas is a risk factor in the change of land use. The uncontrolled grazing and the excess use of pesticide in agriculture can damage wetlands and in consequence destroy the habitat of waterfowl and other species. The collaboration between private landowners and agencies is fundamental to protect wetlands and to guarantee the habitat in the San Antonio and Los Pinos watersheds.

Figure 8.1 Rio de Los Pinos Watershed Land Ownership



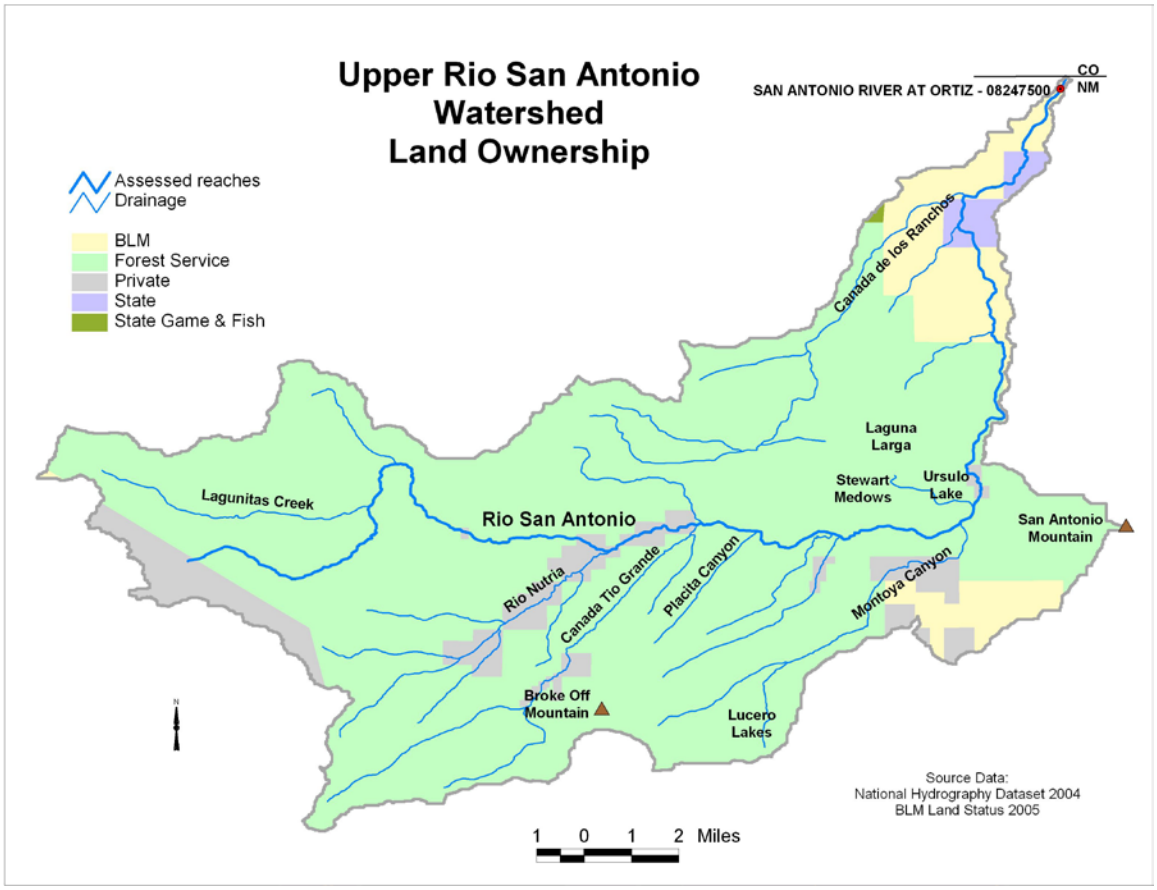
(Skinner,2006)

Table 8.1 Landowner Areas Los Pinos Watershed

Landowner	Area mi²
BLM	5.69
Forest Service	137.68
Private	9.62
NM State	1.86
State Game & Fish	1.22

(Skinner,2006)

Figure 8.2 Upper Rio San Antonio Watershed Land Ownership



(Skinner,2006)

Table 8.2 Landowner Areas San Antonio Watershed

Landowner	Area mi²
BLM	9.49
Forest Service	95.71
Private	8.17
NM State	1.42
State Game & Fish	0.07

(Skinner,2006)

Figure 8.3 Los Pinos Watershed Above Ortiz Land Ownership

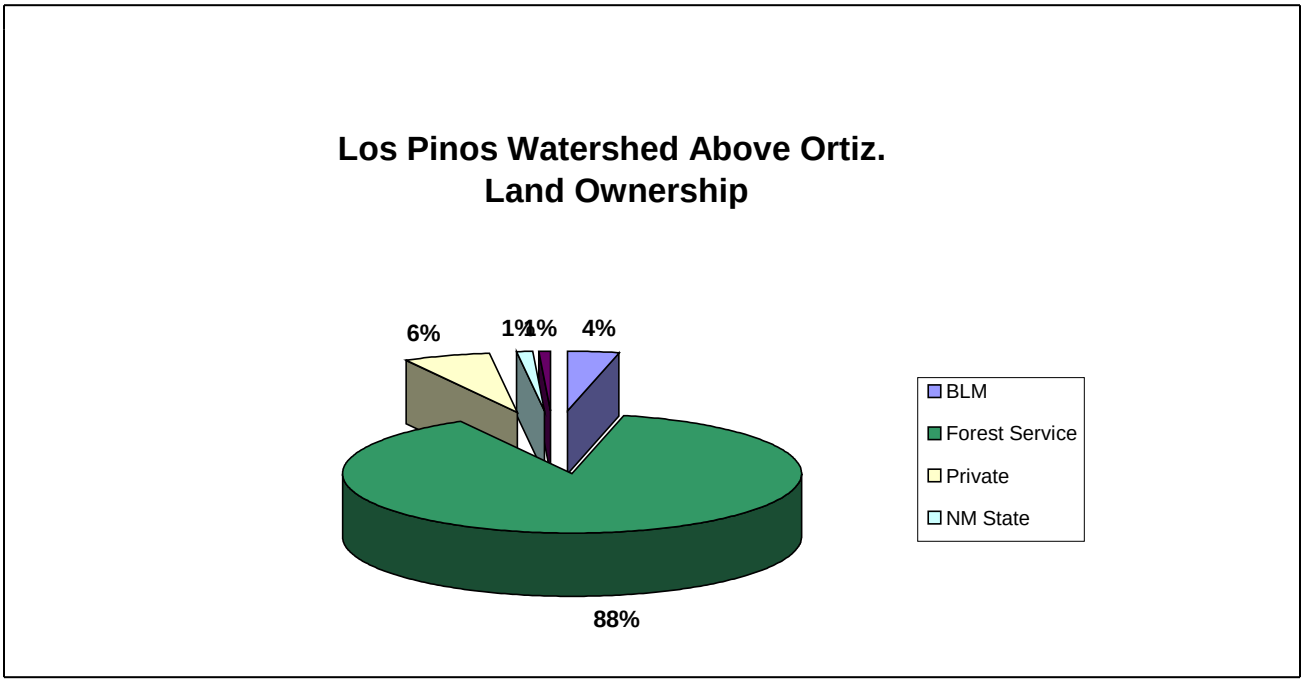
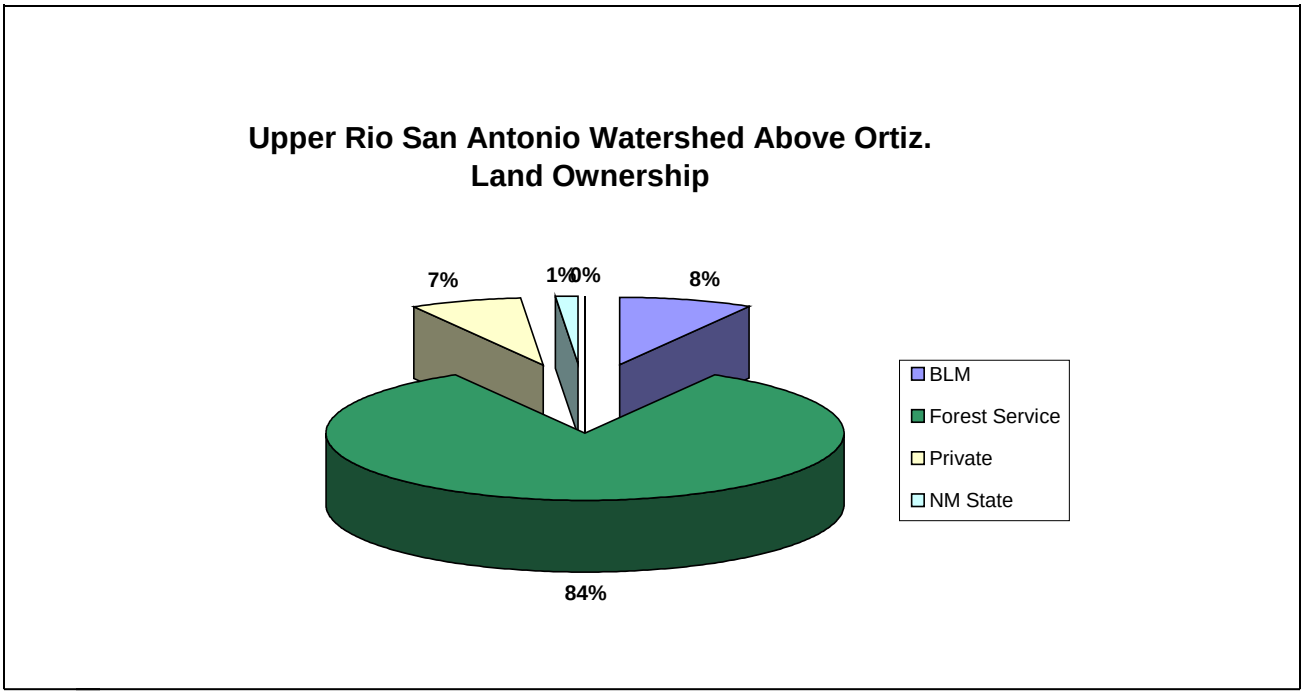


Figure 8.4 Upper Rio San Antonio Watershed Above Ortiz. Land Ownership



9.0 LAND COVER

The knowledge of land cover from one specific area is an important tool, which provides us with data about the major classes of land use, such as agriculture, forest and urban use (Department of the Interior U.S. Geological Survey, 1990). Land cover shows change in use over time. A change in land cover implies also a change in the management of land, which affects the habitat of plants and animals (U.S. Geological Survey, 2006). Figure 5 and Figure 6 show the different land cover classes in Los Pinos watershed and the Upper San Antonio watershed. According to the National Land Cover Data (NLCD), we analyzed the different class of land cover. The NLCD is structured in groups and in each group, there are different classes, each class has a number which represents the digital value of the class in the data set. In this study, we used the latest version 2000 NLCD; the updated version will be available at the end of 2006. Tables 3, 4, 5 and 6 show the groups and the classes in each group. Counts represent the number of pixels of each class, which are obtained from the Digital Model of each watershed. The percentage and the area in m^2 indicate the amount of each class in the different watersheds.

Following, we analysis the NLCD groups in our area of study and define the different classes in Los Pinos and the Upper San Antonio watersheds.

Water group: "All areas of open water or permanent ice/snow cover."

> (11) Open Water, "it is all areas of open water; typically, 25 percent or greater cover of water (per pixel)."

Develop group: "Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g. asphalt, concrete, buildings, etc)."

> (21) Low Intensity Residential, "it includes areas with a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas."

Barren group: "Areas characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no "green" vegetation present regardless of its inherent ability to support life. Vegetation, if present, is more widely spaced and scrubby than tat in the "green" vegetated categories; lichen cover may be extensive."

> (31) Bare Rock/Sand/Clay, "Perennially barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, beaches, and other accumulations of earthen material."

> (33) Transitional, "Areas of sparse vegetative cover (less than 25 percent of cover) that are dynamically changing from one land cover to another, often because of land use activities. Examples include forest clear-cuts, a transition phase between forest and agricultural land, the temporary clearing of vegetation, and changes due to natural causes (e.g. fire, flood, etc.)."

Forested Upland group: "Areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover."

(41) Deciduous Forest. " Areas dominated by trees where 75 percent of more of the tree species shed foliage simultaneously in response to seasonal change."

(42) Evergreen Forest. "Areas dominated by trees where 75 percent or more of the tree species maintain their leaves all year. Canopy is never without green foliage."

(43) Mixed Forest. "Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present."

Shrubland group: "Areas characterized by natural or semi-natural woody vegetation with aerial stems, generally less than 6 meters tall, with individuals or clumps not touching to interlocking. Both evergreen and deciduous species of true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions are included."

(51) Shrubland. "Areas dominated by shrub canopy accounts for 25-100 percent of the cover. Shrub cover is generally greater than 25 percent when tree cover is less than 25 percent. Shrub cover may be less than 25 percent. Shrub cover may be less than 25 percent in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25 percent and shrubs cover exceed the cover of the other life forms."

Herbaceous Upland group: "Upland areas characterized by natural or semi-natural herbaceous vegetation; herbaceous vegetation accounts for 75-100 percent of the cover."

(71) Grasslands/Herbaceous. "Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing."

Planted/Cultivated group: "Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in developed settings for specific purposes. Herbaceous vegetation accounts for 75-100 percent of the cover."

(82) Row Crops. Areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.

Wetlands group: "Areas where the soil or substrate is periodically saturated with or covered with water as defined by Cowardin et al."
Emergent Herbaceous Wetlands (92). "Areas where perennial herbaceous vegetation accounts for 75-100 percent or the cover and the soil or substrate is periodically saturated with or covered with water."

The prevalent land cover class in Los Pinos Watershed is Evergreen Forest with a 36.30% of the total area (see table 10.1). Evergreen Forest is also the prevalent class in the New Mexico and Colorado (see tables 10.2 and 10.3). In addition, the most abundant land cover class in the Upper San Antonio Watershed is Grasslands/Herbaceous with 46.88% of the total area (see table 10.4). According to these data, the Upper San Antonio Watershed has a more intense grazing activity than Los Pinos Watershed. Wetlands, which are soil areas periodically saturated with or covered with water, are very limited only 0.01% in the whole Upper San Antonio Watershed and 0.07% in the Los Pinos Watershed. Agriculture production is also reduced in the area, 0.01% in the San Antonio watershed and 0.07% in Los Pinos watershed. We can see different types of classes in both watersheds, but the prevalent are Evergreen Forest and Grasslands/Herbaceous.

Figure 9.1 Rio de Los Pinos Watershed Land Cover

(Skinner,2006)

Table 9.1 Los Pinos Watershed above Ortiz Land Cover. New Mexico and Colorado area

Group (NLCD)	Value	Class (NLCD)	Count	%	Area mi²
Water	11	Open Water	435	0.09	0.14
Developed	21	Low Intensity Residential	3	0.00	0.00
Barren	31	Bare Rock/Sand/Clay	855	0.17	0.27
	33	Transitional	17	0.00	0.01
Forested Upland	41	Deciduous Forest	18288	3.66	5.71
	42	Evergreen Forest	181514	36.30	56.65
	43	Mixed Forest	13007	2.60	4.06
Shrubland	51	Shrubland	118903	23.78	37.11
Herbaceous Upland	71	Grasslands/Herbaceous	160781	32.15	50.18
Herbaceous Planted/Cultivated	81	Pasture/Hay	4866	0.97	1.52
	82	Row Crops	1084	0.22	0.34
Wetlands	92	Emergent Herbaceous Wetlands	326	0.07	0.10
Total			**500079**	**100**	**156.07**

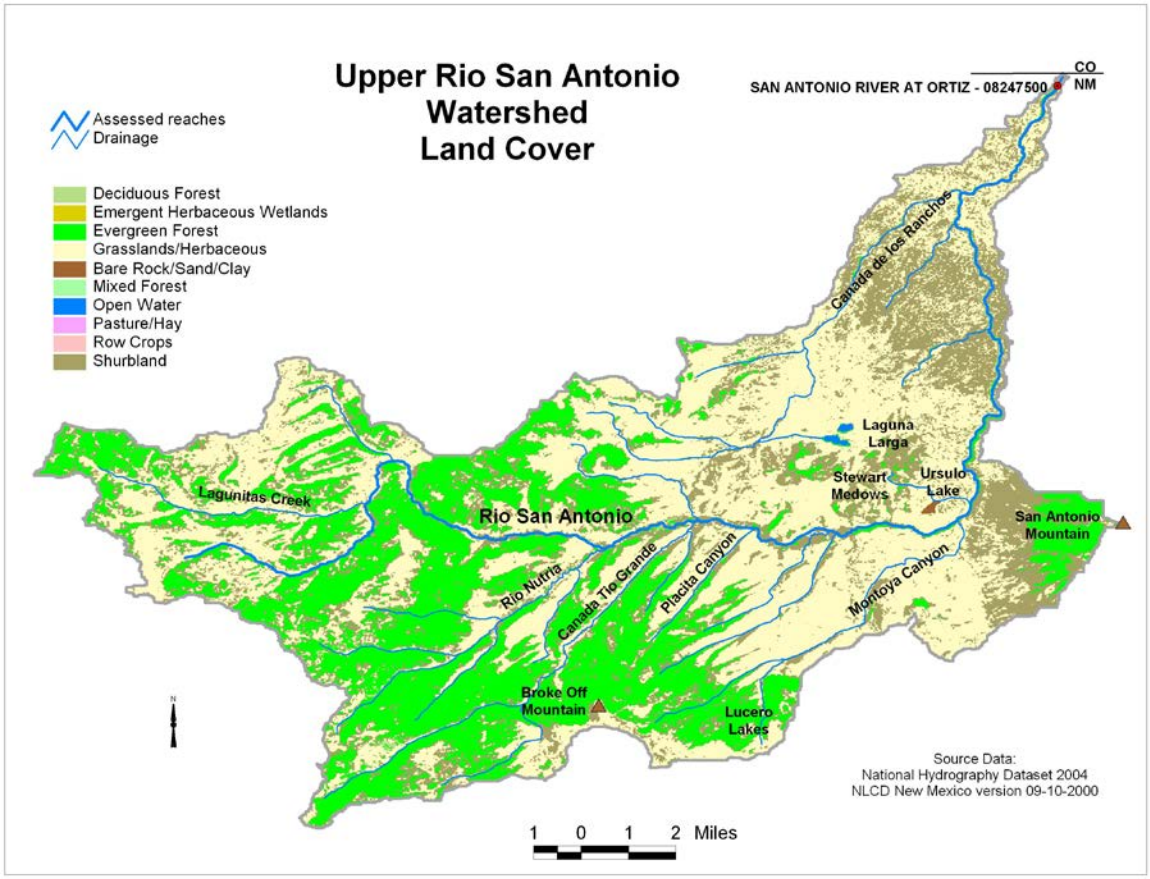
Table 9.2 Los Pinos Watershed above Ortiz Land Cover. New Mexico Area

Group (NLCD)	Value	Class (NLCD)	Count	%	Area mi²
Water	11	Open Water	26	0.01	0.01
Developed	21	Low Intensity Residential	1	0.00	0.00
Barren	31	Bare Rock/Sand/Clay	61	0.02	0.02
	33	Transitional	3	0.00	0.00
Forested Upland	41	Deciduous Forest	11111	3.58	3.72
	42	Evergreen Forest	113934	36.68	38.17
	43	Mixed Forest	10231	3.29	3.43
Shrubland	51	Shrubland	71042	22.87	23.80
Herbaceous Upland	71	Grasslands/Herbaceous	100777	32.44	33.76
Herbaceous Planted/Cultivated	81	Pasture/Hay	2574	0.83	0.86
	82	Row Crops	680	0.22	0.23
Wetlands	92	Emergent Herbaceous Wetlands	178	0.06	0.06
Total			**310618**	**100**	**104.07**

Table 9.3 Los Pinos Watershed above Ortiz Land Cover. Colorado area.

Group (NLCD)	Value	Class (NLCD)	Count	%	Area mi²
Water	11	Open Water	409	0.22	0.11
Developed	21	Low Intensity Residential	2	0.00	0.00
Barren	31	Bare Rock/Sand/Clay	794	0.42	0.22
	33	Transitional	14	0.01	0.00
Forested Upland	41	Deciduous Forest	7177	3.79	1.97
	42	Evergreen Forest	67580	35.67	18.55
	43	Mixed Forest	2776	1.47	0.76
Shrubland	51	Shrubland	47861	25.26	13.14
Herbaceous Upland	71	Grasslands/Herbaceous	60004	31.67	16.47
Herbaceous Planted/Cultivated	81	Pasture/Hay	2292	1.21	0.63
	82	Row Crops	404	0.21	0.11
Wetlands	92	Emergent Herbaceous Wetlands	148	0.08	0.04
Total			**189461**	**100**	**52.00**

Figure 9.2 Upper Rio San Antonio Watershed Land Cover



(Skinner,2006)

Table 9.4 San Antonio above Ortiz-Land Cover

Group (NLCD)	Value	Class (NLCD)	Count	%	Area mi²
Water	11	Open Water	262	0.08	0.09
Barren	31	Bare Rock/Sand/Clay	141	0.04	0.05
Forest	41	Deciduous Forest	1685	0.50	0.57
	42	Evergreen Forest	97406	28.63	32.88
	43	Mixed Forest	9	0.00	0.00
Rangeland	51	Shrubland	81172	23.85	27.40
	71	Grasslands/Herbaceous	159537	46.88	53.85
Agriculture	81	Pasture/Hay	5	0.00	0.00
	82	Row Crops	20	0.01	0.01
Wetlands	92	Emergent Herbaceous Wetlands	40	0.01	0.01
Total			**340277**	**100**	**114.86**

(Skinner,2006)

10.0 WETLAND VALUE

Value of wetlands can be interpreted in different ways according to the field of study. For ecologists, value means "that which is desirable or worthy of esteem for its own sake; thing or quality having intrinsic worth" (Webster's New World Dictionary 1988) (Freeman, 2003). On the other hand, economists use this term to determinate "how much a product or service is worth to someone relative to other things (often measured in money). It can be either an evaluation of what it could or should be worth or an explanation of its actual market value" (Wikipedia, 2006) (Freeman, 2003).

"The Economic Value of the World's Wetlands states the world's wetlands provide $70 billion worth of goods and services each year. The most valued functions of wetlands are recreation, flood control, living close to a wetland, fishing, and water filtration." (Soil and Water Conservation, 2004). Wetland functions are essentially internal function, but the value of each function can be internal or external to the wetland. "Functions that provide internal values are the functions that maintain or sustain the wetland and are essential to the continued existence of the wetland" (Novitzki, Smith, Fretwell, 2006). The external value of a function is determined by the community of the watershed. Sometimes the value of one specific function is more important to one person than to another. As an example, the value of waterfowl is important for ecologists and hunters but it doesn't have the same value to agricultures.

When we talk about wetlands value, expenditures on recreational activities, such as fishing and hunting, are good sources of information to determinate the value of wetlands (Bergstrom and Stoll, 1993). Recreation activities are a very important source of income in US. A study made by the Ramsar Convention on Wetlands states that "more than 45 million people take part in recreational fishing in the USA, spending a total of US $24 billion each year on their hobby"(Ramsar, 2006).

Determining the value of a natural area is always a challenge for an economist because most of these areas do not have value in a market and normally there is no price for them. When there are partially priced supply matches with demand, this is the case of hunting license fees (Hammack and Mallard, 1974). We will analyze in the next section different methods to value wetlands, although we find lack of value. In addition, we will determinate the land use and the value of the San Antonio River and Los Pinos River in the Conejos watershed Northern New Mexico. We will analyze recreation activities, grazing permits and agriculture lease by State and Federal agencies in New Mexico.

10.1 Methods to Value Wetlands

The Davis Method

This method is based on the direct use of consumer's surplus. The author of this method Robert K. Davis studied the recreation benefits in Maine woods. He used interview, questionnaire techniques, and data about the willingness to pay from 100 individuals. "The willingness to pay was developed through a bidding game in which respondents could react positively, negatively or indifferently to increased costs of visiting the area. Bids were systematically raised (or lowered) until the user switched his reaction from inclusion to exclusion (or vice versa)" (Hammack and Mallard, 1974).

During this method the author assumed that the area is annually used only once for each individual. This means that the first visit is the marginal visit and the willingness to pay is the marginal valuation. The data were used as follow:

Willingness to pay → regressed on income
Years of experience → measure of taste
Visit length → measure of the quality of the recreational experience

Travel Cost and Transfer Cost Methods

This method is based on transportation and other cost of travel. It was suggested by Harold Hotelling and developed by Marion Clawson and Jack L. Knetsch. The average travel costs and participation in a specific geographic area are used to design the demand curve and to determinate the consumer's surplus. One of the requirements of this of this method is the selection of similar zonal population characteristics. When the sample has the same distribution of income and taste, we will be able to get accurate results about the cost of travel and preference from a specific sample (Hammack and Mallard, 1974).

Contingent Behavior and Recreation Demand Methodology

This method represents the number of trips taken to a site which will be used to derive the consumer surplus and trip estimates. "The observed and contingent responses from the travel cost instrument can be combined to form a single model for site demand under the conditions of policy-induced changes at the site. The demand for visits to the site under current and hypothetical conditions can be represented by a general travel cost model:

$v_{ij} = f(p_i, y_i, d_i, q_j)$

where v_{ij} is the number of trips taken by group i under the current or hypothetical conditions j at the site. p_i is the cost of travel to the site, y_i is income, d_i is a vector of socio-demographic characteristics for the individual; q_j is a vector of site characteristics that varies by policy. This basic recreation demand model can then be used to develop an empirical model of recreation demand" (Starbuck, 2004).

The Pearse Method

This method stratifies users of a recreational area. The criteria to this stratification are based on one or more factors other than recreational cost. Pearse based his research on income in a big-game hunting area in Canada. "The person with the largest costs within a stratum is considered a marginal user who has received no net benefits from his recreational trip. All others within the same stratum are assumed to have obtained net benefits equal to the difference between their costs and those of the specified marginal user. The total net benefits determined depend to a large extent on the number of strata defined by the experimenter; net benefits will be zero if a stratum is defined for each recreationist and will reach a maximum if all recreationists are considered as a single category. Furthermore, if the diligent researcher stratifies both on the basis of differences in incomes and tastes, the possibility of downward bias of course increases as the number of strata increases" (Hammack and Mallard, 1974).

Input-Output Method

"An Input-Output model is a method of organizing the basic accounting relations that describe the production sector of the economy. The input sectors are connected via linkages to the output sectors from which economic output is produced.

An Input-Output model is constructed from observed data for a particular economic area. The economic activity data are the flows of products from each of the sectors (as a producer) to each of the sectors (as purchaser). These interindustry flows are measured for a specific time period and in monetary terms. The exchanges of goods between sectors are sales and purchases of physical goods" (Starbuck, 2004).

Valuing a Recreational Component

The previous methods use measurement of net benefits for the recreational experience and also attribute those benefits to the value of the area. However, when waterfowl or other game or fish are valuated, we will find two additional complexities. The first is that there is more than one component to determinate the value of a recreation area. The bagged waterfowl is one of those elements, as well as other such as exercise and exposure to natural surroundings. The total net benefits for waterfowl in an area will be obtained through the value properly attributed to the birds. The second difficulty is to determine marginal net benefits from waterfowl and not total net benefits (Hammack and Mallard, 1974).

It is necessary to determinate a marginal value of bagged waterfowl to hunters. It is important to determinate a purchase price for waterfowl in a market. Following, we can see different technique to quantify the marginal net value of waterfowl.

- Jon H. Goldstein's technique uses a regression model, where "the depend variable was the rental payment of a hunter of a hunter for seasonal hunting rights on privately owned property, and the independent variables were travel distance from home to hunting site, income, and ducks shot per season on the land. The first derivative of rental value with respect to the number of ducks shot was the estimated marginal net value of a duck. Data for the regression were obtained from responses to a questionnaire mailed to Minnesota waterfowl hunters. The model proves inappropriate for less than 10 percent of the sample indicated they rented

waterfowl hunting lands. Extrapolation from a very select group the entire Minnesota waterfowl hunter population indeed does seem inappropriate" (Hammack and Mallard, 1974).

- Travel-transfer cost method used to increase values for waterfowl. "If two hunting sites differ in the availability of waterfowl for a season, but are virtually identical in all other respects, and if it is possible to adjust for such hunter characteristics affecting use as incomes, tastes, and availability of substitute recreational pursuits, and if an adequate formulation of the cost method is obtained, a measurement of the value of the additional waterfowl available at the better hunting site is feasible" (Hammack and Mallard, 1974).

10.2 Economic Value

We will analyze the wetland value in the Conejos Watershed placed in New Mexico. We base our study on the benefit of recreational activities and the amount of money obtained by grazing permits and agriculture leases release by state and federal agencies located in New Mexico. This study uses the Travel cost and Transfer Cost Method to estimate expenditures on fish gear, gasoline, lodging, license, food, etc. using the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

U.S. Forest Grazing Permits 2006

Area	Cows/Calf	Ewel/Lamb	Season permit	Amount of $ 2006
Apache livestock	743	1385	6/16 to 09/30	$3,570.05
Sublette	161	----	5/25 to 10/10	$823.68
Lagunitas	925	----	6/16 to 10/05	$4,538.04
San Antone	890	----	5/17 to 10/16	$5,070.00
Tio Grande	1021	----	5/15 to 10/14	$6,976.32
San Antonio Mountain	----	1502	6/04 to 07/03	$267.84
Total	3740	2887		$21,245.93

(U.S. Forest, Tres Piedras Ranger District, 2006)

The Season permits show the period of time when livestock is allowed to graze in each area of the Conejos watershed. We can see how in areas of high elevation, such as Apache livestock, the season starts later and finish earlier than in areas of low elevation. The reason for these different terms is due to winter temperatures, which go up later in high elevation than in low elevation. Due to this situation, grass normally grows later in areas of high elevation than in areas of low elevation, restricting the period of permits. As example, we can see how in Tio Grande (low elevation) the season starts on May and finish on October while in Apache Livestock (high elevation) the season starts on June and finish on September. The total amount of dollar for grazing permit in 2006 was $21,245.93. The U.S. Forest does not charge for permit trailing. In this specific area the U.S. Forest doesn't have any agriculture lease.

BLM Grazing Permits 2006

BLM Active Grazing Permits 2006

Area	Cattle	Sheep	Season permit	AUMS	Fee Amount
Los Cerritos	46	----	8/1 to 10/1	94	$146.64
Narrow Gauge Comm.	100	----	5/15 to 6/30	136	$212.16
East Rio San Antonio	53	----	5/11 to 9/16	225	$351.00
Los Pinos	54	----	11/1/05 to 1/30/06	162	$289.98
San Antone Mountain		1000	11/9/05 to 1/30/06	502	$783.12
Total	253	1000		1119	$1,782.9

(Bureau Land Management Taos, 2006)

BLM Trailing Grazing Permits 2006

Area	Cattle	Sheep	Date permit	AUMS	Fee Amount
Salazar Place	53	----	05/10	2	$3.12
Salazar Place	53	----	09/17	2	$3.12
Salazar Place	----	500	05/09	3	$4.68
San Antone Mountain	----	500	06/15	3	$4.68
Salazar Place	----	500	11/01	3	$4.68
Salazar Place	----	500	01/30	3	$4.68
Salazar Place	90	----	05/01	3	$4.68
Salazar Place	170	----	12/16	6	$9.36
Salazar Place	44	----	10/15	1	$1.56
Salazar Place	140	----	10/29	5	$7.80
San Antone Mountain	74	----	10/09	2	$3.12
Total	624	2000		33	$51.49

(Bureau Land Management Taos, 2006)

Total permits BLM 2006

Active Grazing Permits	$1,782.9
Trailing Grazing Permits	$51.49
Total	$1,834.39

AUM is the amount of forage a 1,000 pound cow W/Calf will eat in a month which is – 2.6% of their body weight or 26 lbs/day or 780 lbs. per month. The cost of each AUM is $1.56.

The fee amount is the numbers of AUMS by $1.56 (the cost of one AUM). The approximately economic value of grazing permit by the BLM is $1,834.39.

The formula used to calculate AUM is:

$$\text{AUM'S Permitted} = \frac{\text{Days x No. of Animals}}{30.41666} \times \%PL$$

$$\text{No. Of Animals} = \frac{\text{AUM'S Permitted}}{\text{Days}} \times 30.41666/\%PL$$

12 Months/365 Days in a Year=30.4166 Days in a Month

Percent Public Land (%PL) = Forage production, not acres

New Mexico State Grazing

Total Acres	Expiration Date	Annual Rent
640.00	09/30/2010	$424.70
1,081.49	09/30/2007	$662.97
640.00	09/30/2008	$544.00
1,281.80	09/30/2009	$744.28
4,170.00	09/30/2009	$2,603.19
Total 7,813.29		$4,979.14

(NM State Land, 2006)

The New Mexico State Land is able to establish grazing and agriculture leases for long term of time. The rent is annual and is set up according to the number of acres.

The total approximate value of grazing permits and agriculture leases release by state and federal agencies located in New Mexico is $28,059.46

Recreational

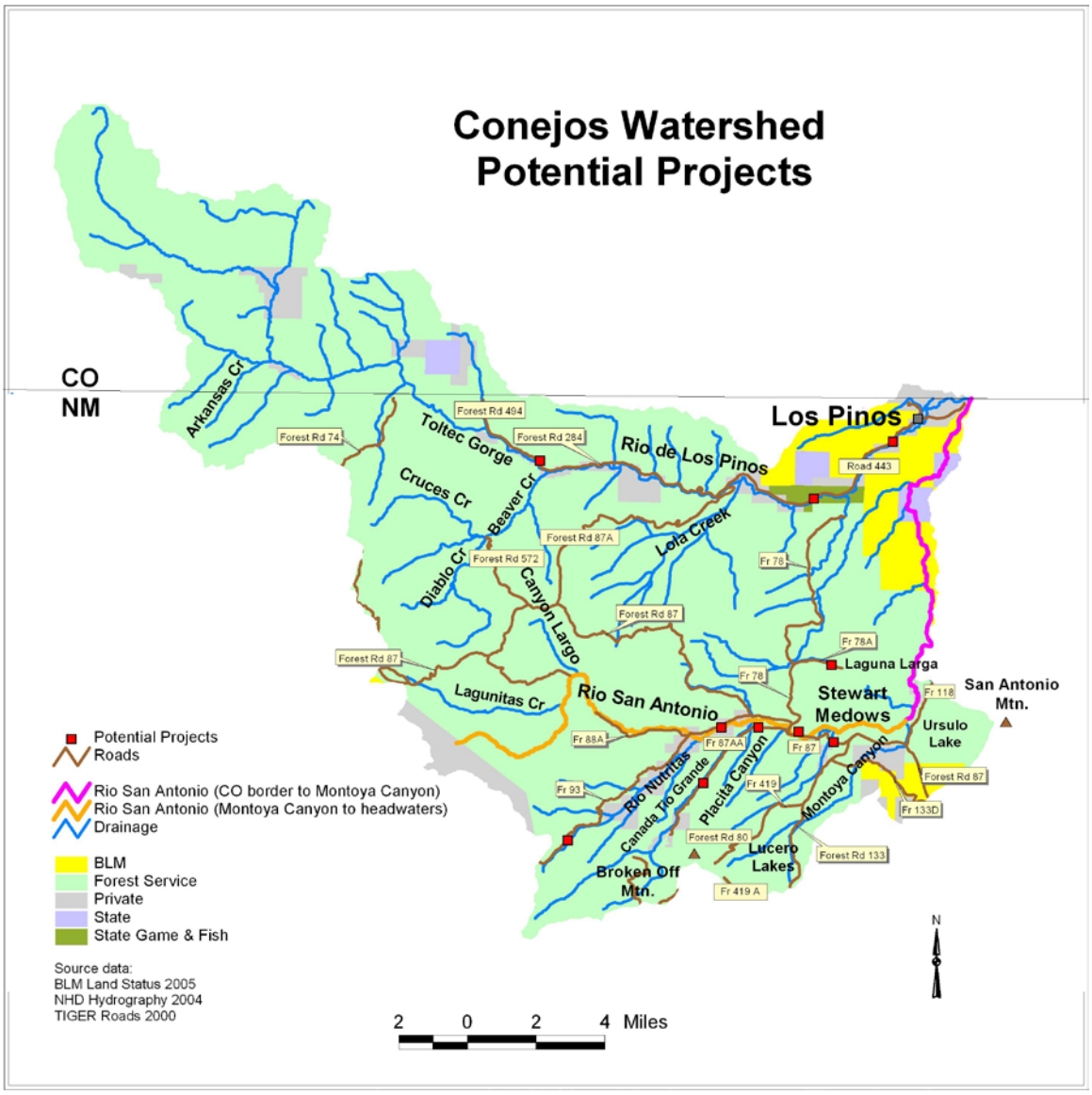
Wetlands are special places, where outdoor activities such as, hunting, fishing and bird watching contribute to increase the national economy. Wetlands are a very important source of income in the US economy. In 2000, the recreational fishing industry provided $40 billion (nbc4, 2006). Recreational activities are a good estimator to analyze the value of wetlands. In our analysis we use the number of anglers and hunters in the area and the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. This survey gives us the multiplier in expenditures by each person for hunting and fishing.

In 2003-04 the number of anglers was 1125 at the Rio de los Pinos, 136 anglers at Lagunitas Lakes, and 112 anglers at Laguna Larga. The other streams did not receive enough use to show up in our statewide survey. Game and Fish would estimate total use of the basin at 1500 anglers in the 2003-04 license year. This number was lower than average due to drought conditions (generally about 2000-2200 anglers use this area in a year). We estimate use using angler days (1 angler fishing for 1 day= 1 angler day). For the 2003-04 license year Game and Fish's survey recorded 5060 angler days for the basin (I would estimate a total of about 6000 angler days for this period). 100% of the use recorded in our survey was due to New Mexico residents during the 2003-04 license year. (Generally, use is 90% NM residents).

The revenue of a fishery was calculated by multiplying use (angler days) by the estimated expenditure by anglers per angler day obtained from the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Department of Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*). This number incorporates estimated expenditures on fish gear, gasoline, lodging, license, food, etc. The estimated revenue from the basin for the 2003-04 license year was $420,000 (or $70 per angler day). Just figuring fishing licenses the total revenue was $26,000 for the 2003-04 license year (Game and Fish, 2006).

11.0 THREATS AND IMPAIRMENTS, RATIONAL FOR RESTORATION. POTENTIAL PROJECTS IN SAN ANTONIO AND LOS PINOS WATERSHED.

Figure 11.1 Conejos Watershed Potential Projects.



(Skinner, 2007)

Wetlands are threatened by human activities and by natural events such as fire. Restoration and protection are essential to guarantee wetlands in San Antonio and Los Pinos Watersheds for a future. The analysis of each basin can give us the necessary information to restore, to protect and to develop new wetlands areas (O'Connell, 2003).

11.1 Fire and Wetlands

One of the most significant problems confronted by the San Antonio and Los Pinos basins is the fire hazard. Along these two watersheds there is a forest, which contributes to avoiding erosion and is also the habitat of hundreds of animals. The principal function of woods in the protection of rivers is to stop a big part of the rainfall-runoff. Runoff is caused by precipitation, irrigation water and snow melts, and it is evident with simple visual inspection in uncontrolled surface streams. Runoff contributes to maintaining rivers and lakes with water, but it changes the countryside by the action of erosion. The principal characteristics affecting runoff are land use, vegetation, soil type, drainage area, slope, elevation, topography and basin shape. Forests in watershed absorb an important quantity of rainfall. This situation contributes to recharging ground water resources and to avoid excessive erosion in the landscape (USGS, 2006).

A fire in the watershed's forest will affect the health of the river. Erosion caused by a fire leads to very aggress run off. Hydrological alteration is probably the first effect of fire with the lost of habitat of many species, such as macroinvertebrates, fishes and benthic. Also, the special conditions that guarantee life in wetlands would disappear. The greatest impact of fire is most likely a habitat modification in most of the species in the watershed. The good management of forest is essential to avoiding fires and thus to prevent its impact in wetlands (Gresswell, 1999).

The forest area in San Antonio and Los Pinos watersheds is in poor conditions due to dense woods, which helps a fire to spread and makes human extinguish it difficult. The best solution to prevent a fire is a good management of the forest, cutting unhealthy trees and leaving space for new healthy trees. Enough distance between trees makes easier to extinguish fire, and as a consequence, prevents the erosion, so it helps to conserve the wetlands. The USFS is interested in developing a project to protect the forest in these two watersheds and to avoid the destruction of new wetlands areas.

11.2 Beaver and Human. The Role of the Beaver

Riparian environment is the North American Beaver's habitat. It was in early 1800s when beavers were in endangered situation due to excessive trapping activity. In 1820s and 1830s the North of New Mexico was stripped of their beavers. Luckily, in 1897 New Mexico's Legislature prohibited the capturing of beavers as same as other states in the country (SWQB, 2000). This rodent whose weight could be over 55 lb (25 kg) has played a very important role in the management and conservation of watersheds in The United States. Because they are a main dement in the fertility of the West valleys.

The role of beavers is very important due to its behavior. They build dams which are their lodges. Dams mean new wetlands environment for the benefits of humans, wildlife, waterfowl, aquatic insects, birds and fish. These dams are an essential factor to slow the velocity of water which avoid erosion, maintain water along the river, raising the water table and cleaning water by stopping sediment and excess nutrients. Beavers contribute to keeping meander and deep areas in rivers where fish find the perfect habitat to reproduce. Behind the beaver dam water spreads across an extensive area which makes possible the recharge of the aquifer, the storage of water in the flood plains and to reduce the negative effect of flooding. Beavers also build burrows in the banks of rivers, which contribute to spread water underground, therefore contributing to enrich the riparian area. When beavers leave their dams and move to another place their pool will be taken over by plants such as shrubs and the area will become a meadow (NatureWorks, 2006). This environment provides shadow that will protect tree seedlings. When

trees mature we will have woodland to enrich the ecosystem (Westbrook, Cooper and Baker, 2006).

Private owners and beavers have been in conflict for decades. The fact is beavers cut trees to make their dam and in same cases these trees belong to private owners. In defense of beavers, we can remember that tree cutting stimulates growth in most of the cases. A second reason for the mentioned hostility lies in the fact that beavers store water in their lodge. Although today, it is demonstrated how this activity contribute to avoid erosion and to have water the whole year. When there are no beavers in the river the periods of drought affect the ecosystem more dramatically, due to the absence of the beaver reservoir. Beavers make the stream flow more continuous and smooth, so that even irrigation and domestic animals can benefit from them (NatureWorks, 2006).

The number of beavers in San Antonio and Los Pinos Rivers has been reduced due to agriculture activities and to the loss of food, which includes vegetarian food such as aspen, willow, cottonwood, leaves, apples, crops, and similar fare. Aspen is also essential to building beaver dams. The reintroduction of beavers in these two basins would have very positive impact. The reduction of slope and spreading water underground are very important benefits from beavers.

11.2.1 Beaver Project

A very interesting project in Los Pinos and San Antonio Rivers would be to attract and maintain beaver population along the two rivers. The first step in increasing the number of beaver is to plant more aspen and willow, which also helps to avoid erosion and to control flood plain. The biggest problem in this project is the conflict between beaver and human interests. The solution to this problem is to prevent road flooding and to guarantee water to wildlife, irrigation and human consumption (beaversww, 2006).

Preventing road flooding is essential to avoiding erosion on the road and possible conflicts with beavers. Following, we show a solution to prevent this problem which would be used for future projects in the San Antonio and Los Pinos basins. Constructing a device (pre-dam) to diver beaver's attention from the culvert is very efficient to prevent road flooding. Normally, beavers like culverts beneath roads; they see those holes as perfect dams. When culverts are plugged roads have the risk to get flooded. A semi-circular fence of sturdy, large diameter wire mesh around road culverts may be sufficient to avoid road flooding when the road beds are high enough and the water level upstream does not matter (beaversww, 2006).

Another important aspect is guaranteeing water to wildlife, irrigation and consumption avoiding conflicts between human being and beavers. A way to obtain that goal is adding drain pipes through the fencing controlling the water level. Large diameter pipes made by plastic pipes, PVC drain pipes, or rectangular wooden pipes with wire mesh bottoms (New Hampshire pipes) are set in pre-dams or directly in beaver dams to control flooding. Pipe can be protected from beavers' bite with triangular or round cages of large diameter mesh fencing. The beavers will build their dams and water will flow without restraint. The cost of maintaining this device is cheap and does not need too much time. These systems are currently used in New England where population saves money and essential wetlands (beavers, 2006).

Beaver deceiver is a solution to protect beavers and maintain the natural flow of a river. This device was invented by Skip Lisle of Vermont, who beaver-proofed 130,000 acres of Penobscot Indian lands in Maine. "A typical Beaver Deceiver is a trapezoidal fence that is narrow at the culvert and widens upstream. Figure ( ) the one shown is 15 ft. x 15 ft. x 15 ft., but sizes

and shapes vary, according to the site. It is made with cedar posts and heavy gauge wire fencing with 6 inch squares (this often comes in 5 ft. x 10 ft. sheets or rolls). These devices can be works of art that take Skip anywhere from a few hours to two days to install". This deceiver causes water to flow from the inside of the trapezoid's sides out and beavers cannot dam the fence on the sides (beavers, 2006).

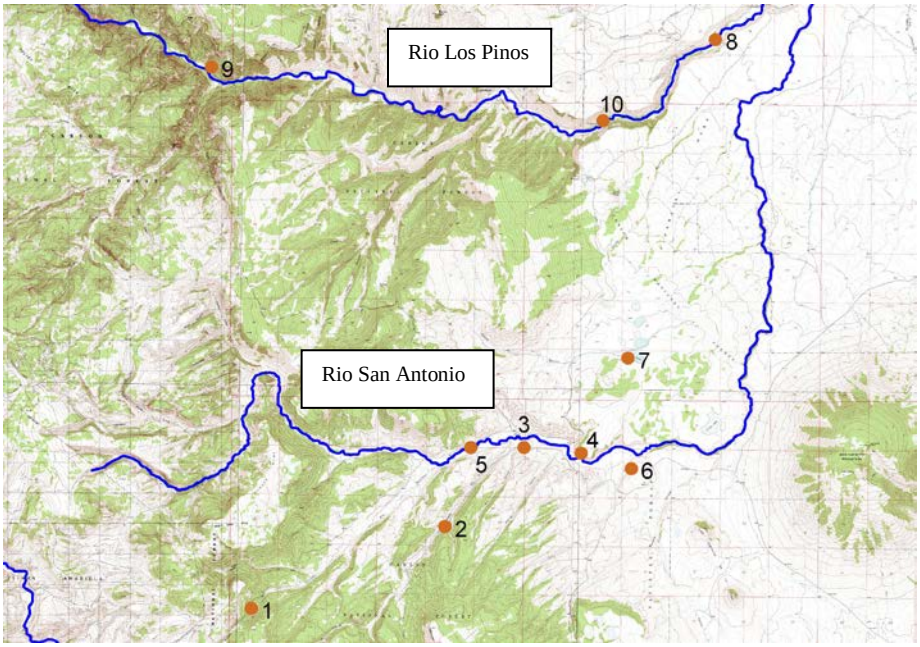
Another problem is to avoid low elevation road flooding. Normally roads leave about 10" between one of the roadside posts and the culvert to permit wildlife to pass through. This size helps to avoid traffic accidents, although it could be too small for beavers. It is recommended to add a floor to deter burrowing in muddy streams with active beavers. Beaver baffler is a solution to avoid low elevation road flooding. Sometimes it is impossible to have a wetland without road flooding and beaver baffler can solve this problem. A baffler is "a 5-foot-long concentric cylinders of 4 to 5" welded wire with the inner tube of a size to fit inside the road culvert. Connect each 5-foot-long section end to end to make the desirable length (10 to 20-feet-long) to fit your situation. Covering the inside cylinder with 1 by 2" mesh welded wire (garden variety) fencing prevents beaver from stuffing it with debris". Moreover, fencing off the outlet to the culvert is important to avoid beaver to incoming from downstream (beavers, 2006).

The San Antonio and Los Pinos Watersheds need restoration projects to manage water flow. These systems are the solution to prevent road flooding and guarantee river flow. Achieving these results, we will need the collaboration of other agencies and landowners. The U.S. Fish and Wildlife Service Partners for Wildlife program may supply funding and /or materials for a beaver water level control device if an organized entity applies. In addition, it is needed the collaboration of federal and state agencies to obtain any required permit, as well as, permission from landowners before installing a device. Moreover, the collaboration of expert such as Skip Hilliker, a beaver consultant for the Fund for Animals in Connecticut, can be an important help to solve beaver/human conflicts.

Beavers: Wetland and Wildlife. 2002. BWW INC.

11.2 San Antonio and Los Pinos Basins. Special Problems and Potential Projects

Figure 11.2 Potential Projects Location



11.3 San Antonio Basin. Special Problems

The San Antonio watershed flows through private property, BLM land, and adjacent USFS and NM State land. Wetlands in this river are in fair condition due to water quality, stream conditions and external modification. Moreover, San Antonio river has been affected by land management issues and today there are some areas along the river where wetlands are damaged (Jacobi, G., Jacobi, M., Barbaour, M., Leppo, E., and SWQB. 2006). The Rio San Antonio is listed for not meeting High Quality Cold Water Fishery standards. In November 2004, the TMDL for the San Antonio River was made under this criterion. In addition, the survey conducted by the Environment Department about invertebrate conditions shows fair conditions with a score of 42.211. The standard score for the New Mexico M-SCI is between 37.20 and 56.70. The next two subsections refer to assessments units and specific areas which need restoration in the San Antonio NM Portion.

11.3.1 Assessments Units in the San Antonio River NM portion

According to the State of New Mexico Water Quality Control Commission, 2004-2006 State of New Mexico Integrated Clean Water Act §303(d)/§305(b) report, we explain and analyze each assessment unit in the San Antonio River NM portion. In addition we show the probable causes of impairment.

- **The Rio San Antonio (CO border to Montoya Canyon)** has the assessment Unit ID: NM-2120.A_902 and the WQS reference is 20.6.4.123. The monitoring of this section is scheduled for 2008. According to its IR Category 2: "some of the designated or existing uses are based on numeric and narrative parameters which were tested, and there is no reliable monitored data available to determine if the remaining uses are attained or threatened." In the following, we can see the designated uses categorized in this section according to the attainment status:
  - Domestic water supply, fish culture and high quality coldwater fishery are fully supported.
  - Irrigation, livestock watering, secondary contact and wildlife habitat are not assessed.
- **The Rio San Antonio (Montoya Canyon to headwaters)** has the assessment Unit ID: NM-2120.A_901 and the WQS reference is 20.6.4.123. The monitoring is scheduled for 2008. TMDL was done by 2004 for water temperature. Its IR Category was 5A and after the TMDL its category changed to 4A which mean: "impaired for one or more designated uses, but does not require development of a TMDL because TMDL has been completed. Assessment Units are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard". One impairment for that portion of the river and the cause is water temperature. In the following, the designated uses are categorized according to the attainment status:
  - Domestic water supply, fish culture, irrigation and wildlife habitat are fully supported.
  - High quality cold water fishery (HQCWF) is not supported.
  - Livestock watering and secondary contact are not assessed.

- **Laguna Larga (Rio San Antonio Watershed)** has the assessment Unit ID: NM-9000.B_057, the WQS reference is unclassified. The monitoring is scheduled for 2008. Its IR Category is 3 which means: "no reliable monitored data and/or information to determine if any designated or existing use is attained. Assessment Units are listed in this category where data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology". According with this category:

- Livestock watering and wildlife habitat are not assessed.

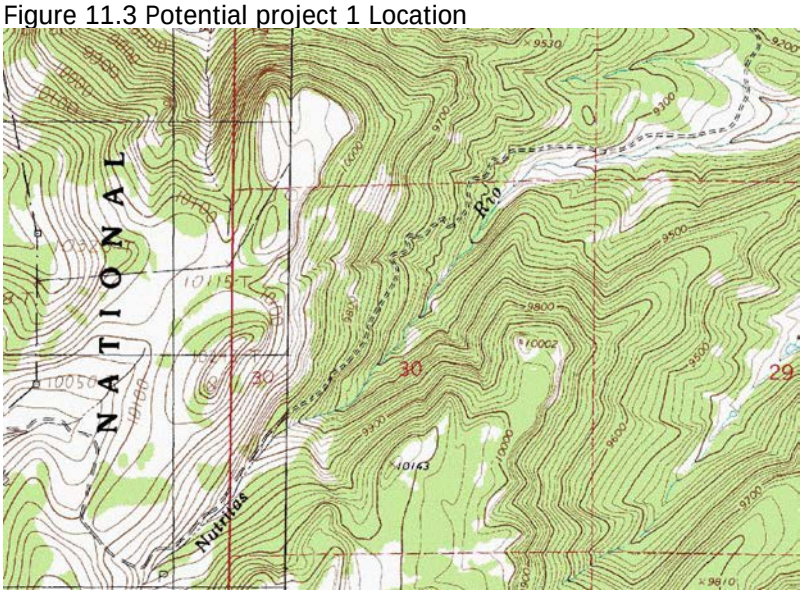
11.3.2 Potential Projects in the Rio San Antonio NM portion.

- **Rio San Antonio (Montoya Canyon to headwaters):**

The Rio San Antonio (Montoya Canyon to headwaters) needs restoration due to high temperature. In 2002, recorded temperatures from July 2 (18:44) through August 31, 2002 exceeded the HQCWF criterion 255 of 1,446 (18%) with a maximum temperature of 27.1 ºC. In 2003, recorded temperatures from July 2 (18:00) through August exceeded the (HQCWF). A project should be developed in this area to decrease stream temperature and improve wildlife habitat. The project should be focused on stabilizing stream banks, increasing canopy (shade), and increasing the depth to width ratio to effectively decrease stream temperature along the river (see figure 11.1).

- **Potential Project 1 Rio Nutritas:**

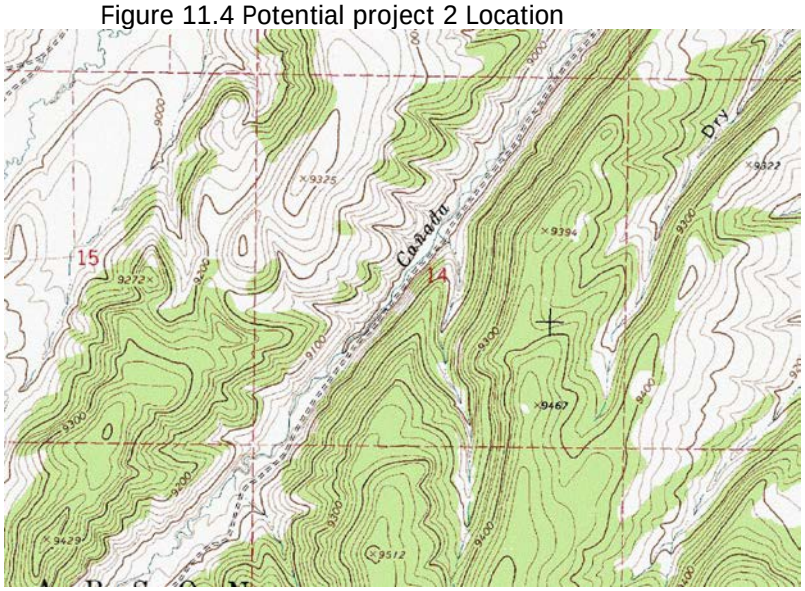
Figure 11.3 Potential project 1 Location



The Nutritas River is a tributary of San Antonio River where most of the wetlands are private property and only the headwater and a small portion is National Forest Land. The situation along this river is not in good condition because there are not enough willows to avoid erosion and to guarantee a healthy habitat for fishes such as deep and narrow streams where willows provide shadow to maintain cold water. Along the river we find the road 93 which is in bad condition, contributing to the erosion and degradation of this stream. Roads in bad condition can produce a lot of sediment, which in many cases are the major source of water pollution and turbidity (Zeedyk, 2006). The Nutrias River is crossed by a small National Forest Road where there is no bridge and this road's traffic harms the wetlands and riparian area. It is necessary to fence wetlands, plant willows and build a bridge to protect this stream.

- **Potential Project 2 Tio Grande:**

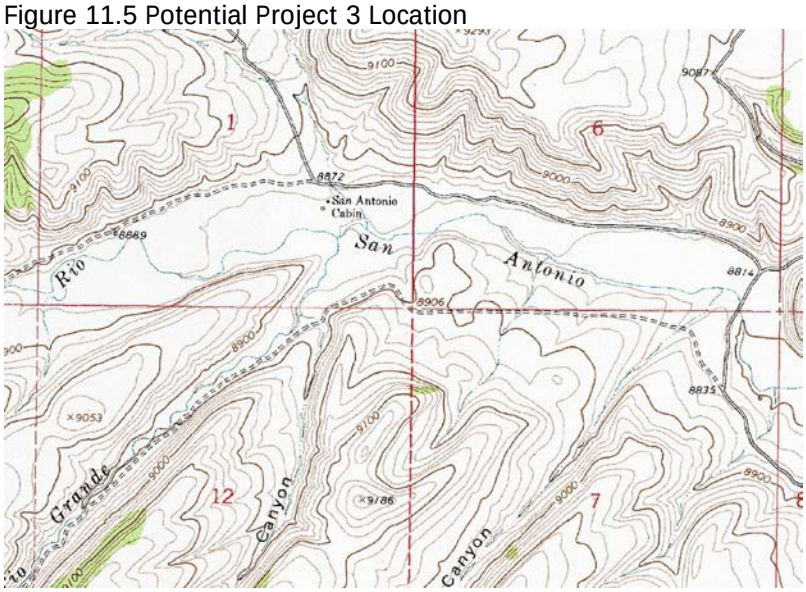
Figure 11.4 Potential project 2 Location



Tio Grande River is another tributary of Rio San Antonio. Most of the wetlands and riparian land is owned by the National Forest; only a small portion in the Corral area is private property. The area between private property and the mouth of Tio Grande is National Forest property and it is in poor condition. There is not enough riparian vegetation, and this causes the disappearance of beavers that need willows and other riparian vegetation to construct their dams. Grass in this specific area is very short, less than 4'' which is the minimum limit permitted by the US Forest for grazing activities. This situation is a consequence of excessive grazing without appropriate control. The National Forest is considering restoring the area by using rotation periods and fencing the wetlands.

- **Potential Project 3 San Antonio River between the Steward Meadows and the mouth of Tio Grande:**

Figure 11.5 Potential Project 3 Location



The portion of San Antonio River between the Stewart Meadows and the mouth of Tio Grande is National Forest property. Last June 2006 the NMED examined this area and the situation is fair. One mile after Steward Meadows in west direction there is a small bridge. It has two small tunnels where water tries to flow but under the bridge there are a number of pieces of wood that have the effect of a small dam. Here, water can not flow easily due to this dam. These pieces of wood should be removed to avoid flooding. On the other hand, stagnant water seeps through the land and develops an area full of willows and wildlife; this is the same effect cause by beavers. Two hundred meters upstream from the bridge, the slope of the San Antonio River become steeper so that the stream river is newly classified as a B type, while before this point was considered C, according to the Rosgen stream classification (Rosgen and Silvey, 1998). Here, water flows faster because of the effect of the slope. There are willows in the bank but in the floodplain the vegetation is typical from high desert elevation such as Seich grass. In this area water does not have time to filter due to fast flow. In fact, Seich grass needs small amounts of water, its roots die when there is an abundance of water. This plant is evidence of drought and shows us where a restoration project to help water filtration should take place.

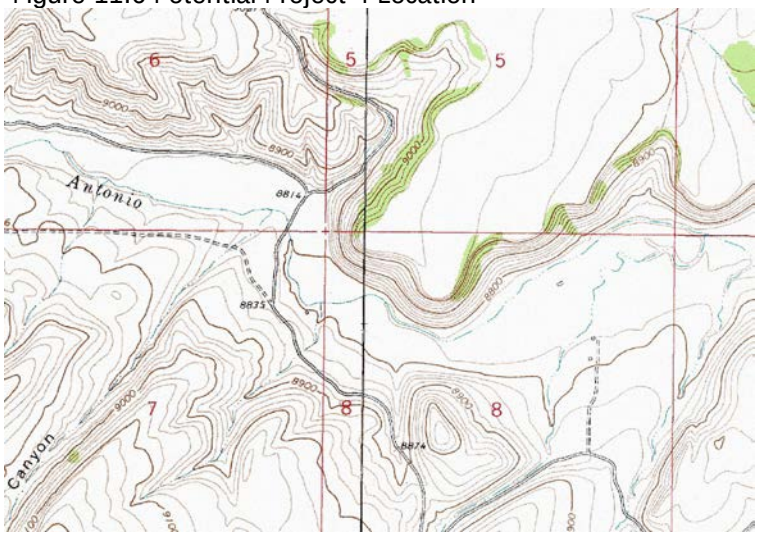
The SWQB is working in The Stewart Meadows Wetland Waterfowl Habitat Partnership Project in cooperation with the Carson National Forest. The main purpose of this project is to protect waterfowl habitat improving and creating between 25-50 acres of wetland. This new habitat is providing more space for waterfowl and avoiding the possibility of diseases which are in connection to high concentrations of birds (Arvidson, 2004). Moreover, the population of beaver is increasing due to the restoration of this area. For more information on this project contact Maryann McGraw: voice: (505) 827-0581

email: maryann.mcgraw@state.nm.us

The San Antonio watershed is very dry and the grass length is very short. It could be the consequence of two factors: scarce precipitation in the area and grazing by domestic cattle and wildlife animals such as elks. We found evidence inside Stewart Meadows and in the riparian area of the presence of elks and cattle. This evidence included excrements and some willows bitten by herbivorous. In conclusion, Rio San Antonio can be categorized as poor to fair based on habitat for a cold water fishery and in M-SCI. This river has several sections of wide shallow area that contributes to higher temperatures. The stream pool to depth ratio along the river is extremely low (Frey, Storch and Martinez 2006). The restoration and improvement of this river will be possible through the collaboration of different institutions, which makes it achievable to protect wetlands and guarantee more habitats to migratory waterfowl and other animals.

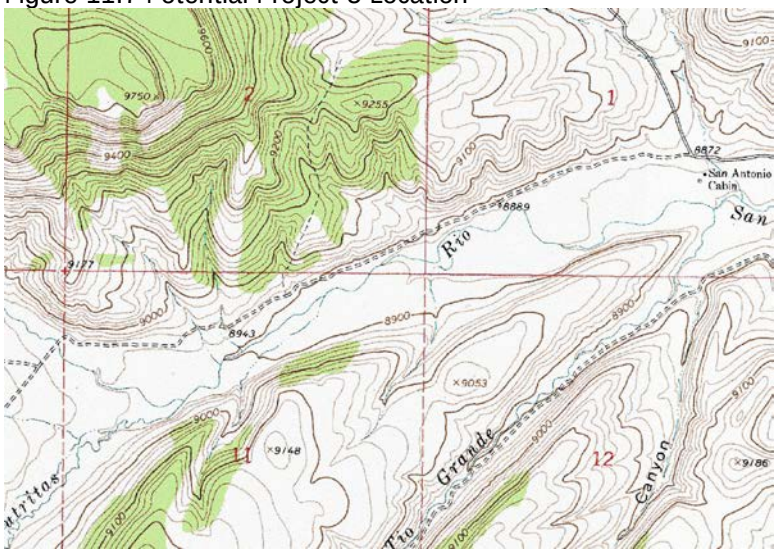
- **Potential Project 4 Road Fr 87AA:**

Figure 11.6 Potential Project 4 Location



- **Potential Project 5 San Antonio River between Nutritas River mouth and Tio Grande mouth:**

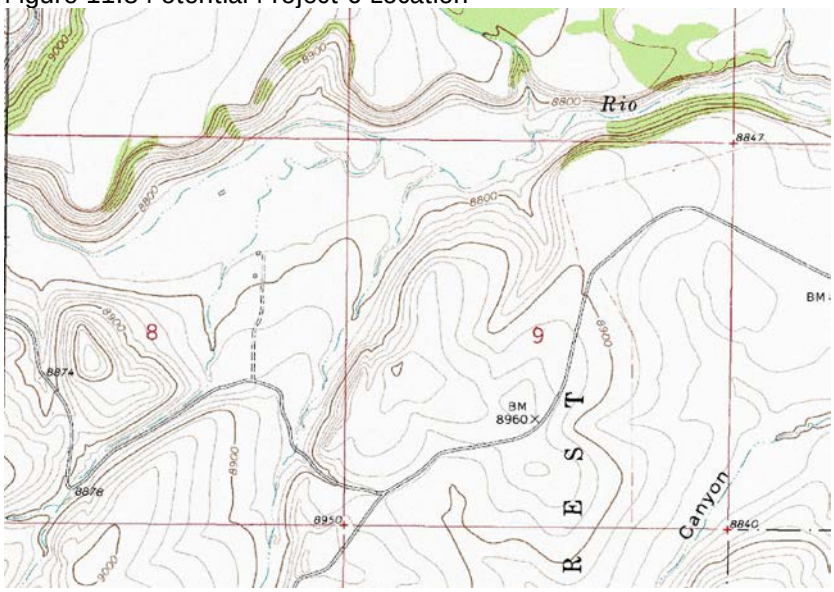
Figure 11.7 Potential Project 5 Location



The area in San Antonio River between the Nutrias River mouth and the Tio Grande mouth is private property. The whole area is dedicated to agriculture and grazing. The conditions between these two tributaries are poor due to a very low population of willow and riparian vegetation. The possibility of a future restoration project in this area will improve the natural conditions. Fencing the area and planting willows will help to develop a healthy river. In addition, road 87 along San Antonio River and road 87A are not in good condition, and this is producing erosion and increasing sedimentation. The roads' elevations are not enough to keep the streambed at the normal elevation and stabilize the channel slope.

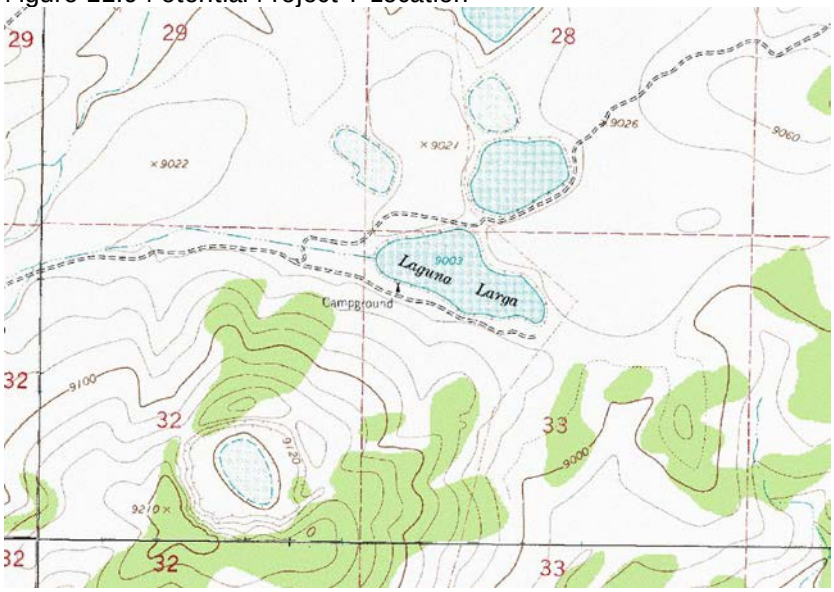
- **Potential Project 6 Road 87A:**

Figure 11.8 Potential Project 6 Location



- **Potential Project 7 Laguna Larga:**

Figure 11.9 Potential Project 7 Location



11.4 Los Pinos River Basin. Special Problems

Los Pinos River flows through private property, BLM land, adjacent US Forest and NM State Land. Water quality in this area is acceptable. The survey conducted by the Environment Department about invertebrate conditions MSC-I shows good conditions with a score of 64.9331. The standard score for the New Mexico M-SCI is between 56.70 and 78.35. The condition of Los Pinos is bad for cold water fishery as proved by the fish surveys. It is necessary to improve the ecosystem conditions in this river. The TMDL for the Rio de los Pinos was made in November 2004, and the cause of impairment was for temperature because does not meet High Quality Cold Water Fishery standards.

11.4.1 Assessments Units in Los Pinos River NM portion

According to the State of New Mexico Water Quality Control Commission, Report of 2004-2006 State of New Mexico Integrated Clean Water Act §303(d)/§305(b) (see section 9). Following, we explain and analyze each assessment unit in the Los Pinos River NM portion. We show the probable causes of impairment and the possible solution to each problem.

- **The Rio the Los Pinos (New Mexico reaches)** has the assessment Unit ID: NM-2120.A_900 and the WQS reference is 20.6.4.123.The monitoring is scheduled for 2008. TMDL was done by 2004 for water temperature. Its IR Category was 5A and after the TMDL its category changed to 4A: "Impaired for one or more designated uses but does not require development of a TMDL because TMDL has been completed. Assessment Units are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard." One impaired for that portion of the river and the cause is water temperature. The probable cause of impairment is water temperature and the probable source of impairment is rangeland grazing. Following, the designated uses which are categorized according to the attainment:
    - Domestic water supply, fish culture, irrigation, livestock watering and wildlife habitat are fully supported.

- High Quality Coldwater Fishery is not supported.
- Secondary contact is not assessed.

11.4.2 Potential Projects in the Rio Los Pinos NM portion.

Lower section:

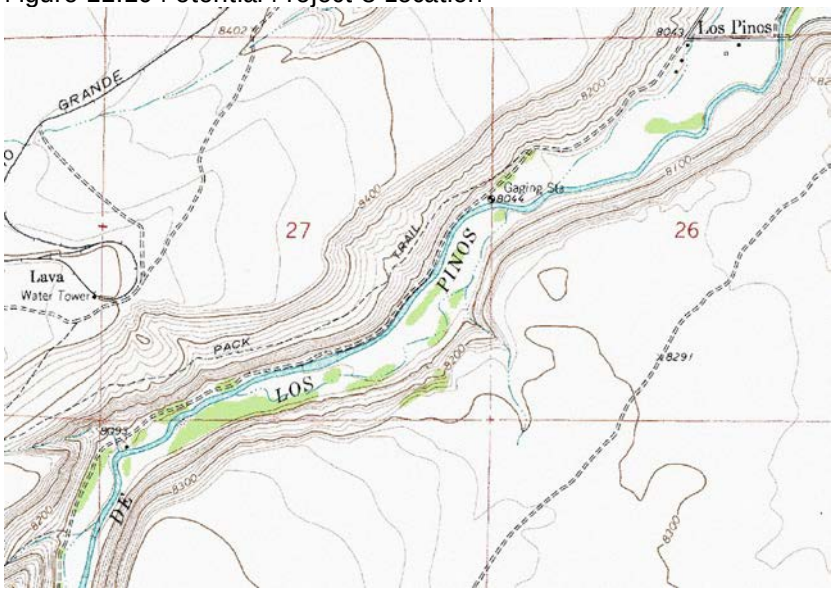
The lower section has high temperatures caused by the wide shallow areas, and it is high in silt. The stream pool to depth ratio is extremely low. The USFS property ranges from poor to good conditions in habitat. The lower portion of the USFS property is very similar to situation described above. The upper portion of the USFS is in better health with a narrower stream, more pools and lower temperatures. The higher fish densities reflect the better habitat. The USFS and Game and Fish are completing a stream habitat survey. The survey will show all the limiting factors on the river. There are plans for restoration and improvement of the habitat on the Los Pinos River (Frey, Storch and Martinez 2006).

The grazing activity in the Los Pinos basin is less aggressive than in San Antonio due to natural conditions. The canyon in the private area makes it impossible to approach the stream for cows and other grazing animals. Along this area the riparian vegetation is in healthy condition while in other parts of the river the impact of grazing damages wetlands.

The New Mexico Environment Department's Surface Water Quality Bureau is working in a project in the Los Pinos Watershed, located near the town of San Miguel, NM. The name of this project is Conejos Watershed: Rio de los Pinos River Restoration Pilot Project. Following the 2004-2006 State of New Mexico Integrated Clean Water Act project's objectives are decreasing stream temperature and improving wildlife and fish habitat. The way to achieve these goals is stabilizing stream banks, increasing canopy (shade), and increasing the depth to width ratio to effectively decrease stream temperature along the river. Sampling from 2002, 2003 and 2004 thermograph readings indicated that temperatures in the Rio de los Pinos exceeded the High Quality Cold Water Fishery (HQCWF) criterion with temperatures between 23 and 27.7 ºC in different locations. This project is taking place along private property, the collaboration of landowners is essential to obtain results. The Rio de los Pinos have suffered severe soil erosion, loss of riparian vegetation, and channel widening. The measures taken by the NMED include constructing rock barbs and installing large rocks in the stream which improve fishery habitat, re-vegetating the stream banks with willows and other native species, and installing some riparian fencing and stream bank log structure. This work will be the solution to stream bank erosion problems. Moreover, the public outreach and participation of the community is an important tool to achieve this project. This project is an example of restoration which should take place in more areas along Rio de los Pinos and Rio San Antonio to improve stream and habitat conditions.

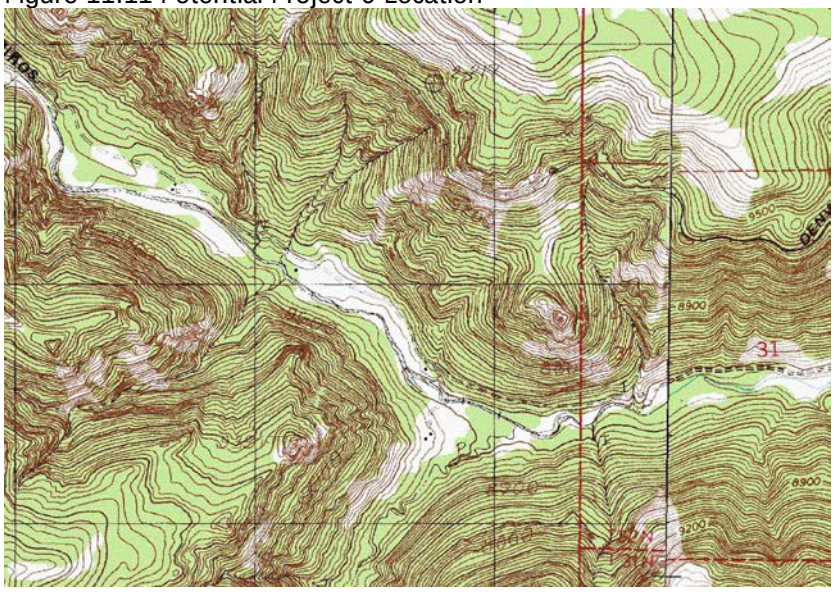
- **Potential Project 8 Road 443:**

Figure 11.10 Potential Project 8 Location



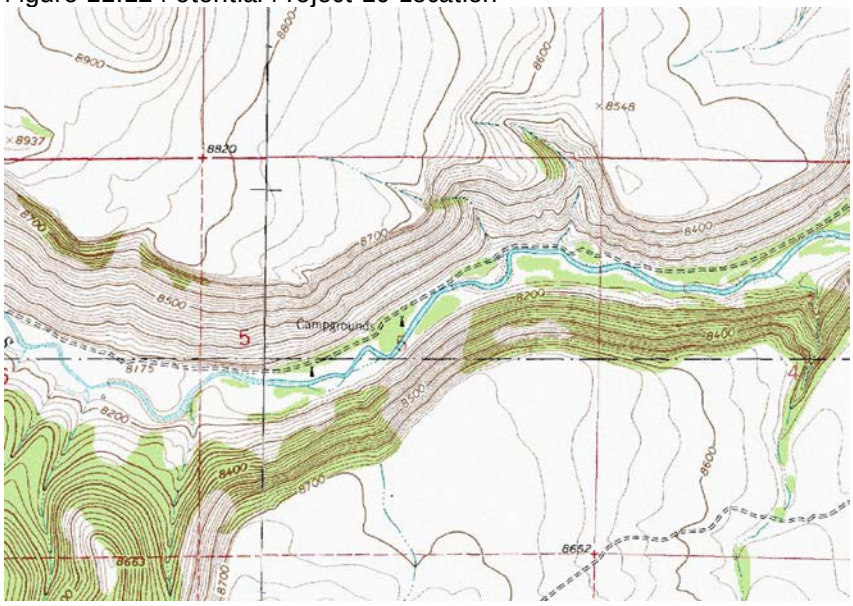
- **Potential Project 9 Road 284:**

Figure 11.11 Potential Project 9 Location



- **Potential Project 10 Water Temperature and Road 443:**

Figure 11.12 Potential Project 10 Location



11.5 Roads Improvement

Roads in San Antonio and Los Pinos rivers should be repaired. Following the guidelines designed by Bill Zeedyk for streamside road locations, Stream Crossings and for roads crossing wetlands these roads should:

Stream Crossings:

"1. Always cross streams at right angles to direction of flow; cross at a straight reach or meander crossover. Never cross in a bend or meander apex.

2. Align the road to cross the stream at the right spot and angle. Do not build the road first and then channelize the stream to align it with the crossing.

3. Place culverts, fords or bridges at the proper elevation to keep the stream bed at the normal elevation and stabilize the channel slope. A culvert installed bellow grade will cause the channel to down cut, initiate head cutting and lower the water table. A culvert placed above grade will pond water and capture sediments.

4. A bridge, ford, culvert or culvert array of the right size should be used to maintain natural bankfull channel width.

5. A low water crossing, improved ford or multistage culvert array should be used to maintain the stream's access to its floodplain at bankfull flood stage" (Zeedyk, 2006).

Streamside Road Locations:

"1. Avoid encroaching on the active channel or its floodplain. Encroachment will narrow the channel, increase stream velocities, initiate bed scour and cause the opposite bank to erode.

2. Maintain a vegetated buffer zone between the road and the stream bank. Spill road runoff onto the buffer zone to filter sediments and reduce turbidity. Do not spill runoff directly into the stream. Buffer effectiveness increases exponentially with width.

3. Use berms to keep runoff on the roadway between buffered sites.

4. In the absence of a buffer zone, spill road runoff into a rock-lined ditch to avoid gaining additional sediment.

5. Keep the road high on the terrace and out of the floodplain to avoid capturing stream flow on the roadway during flood events" (Zeedyk, 2006).

Roads Crossing Wetlands and Former Wetlands:

"1. When crossing former wetland or wet meadow that has been dehydrated by road-related drainage structures and erosional processes, attempt to reestablish moist soil conditions in the wetland through the careful design and construction of replacement structures.

2. If the road or ditch system is incised beneath the meadow surface, attempt to relocate the road to a higher location. Install dams or berms across the abandoned location and backfill ditches to restore dispersed flow, raise the water table and increase storage capacity. Do not inundate the site but saturate in keeping with seasonal runoff cycles and natural water depths.

3. If relocation/restoration is not feasible consider backfilling incised road segments, plugging ditches and removing berms as above.

4. Examine stream and ditch crossing to determine if improper culvert installations have de-watered the site. If so, consider raising culverts or culvert inlets to the elevation needed to restore wetland function.

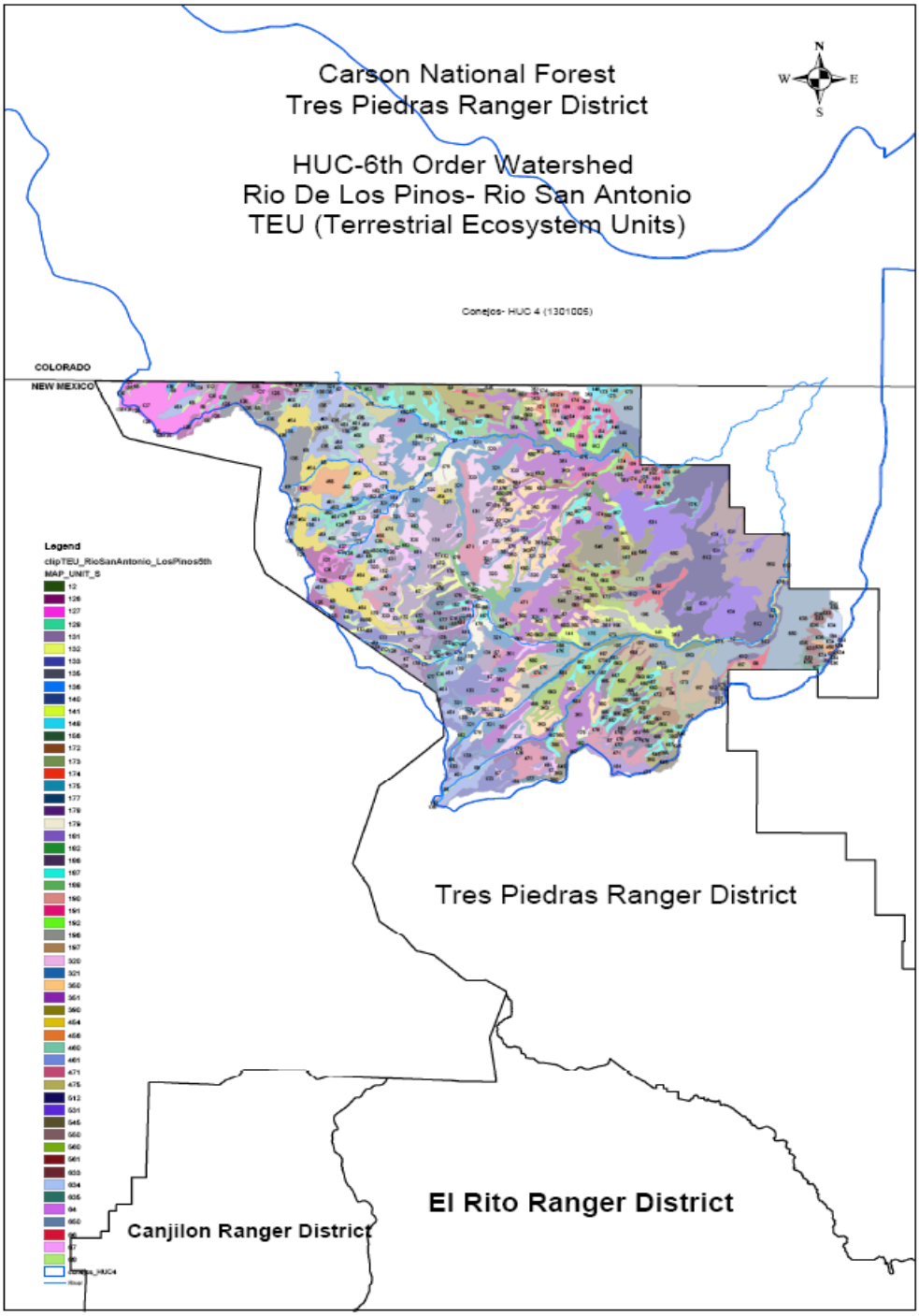
5. If has been customary in the past to dig culvert footings too deeply into the meadow bottom. This practice is used to insure rapid drainage and minimize the amount of fill materials needed to cover the pipe. Improper culvert installation can be corrected by removing the pipe, backfilling the hole and replacing the pipe at the proper elevation to rehydrate the soil. A multiple-culvert array spread across the breadth of the meadow may be useful in some situations to restore sheet flow to the entire meadow surface. As an alternative, it may be feasible to simply raise the culvert inlet (invert) elevation without replacing the pipe by building a small dam at the inlet. Such a dam should be porous.

6. Depending on the size of the watershed and other features, a well defined stream channel may or may not be characteristic of the wetland under consideration. This may require further investigation. If a natural channel is indicated, the culvert should be sized and installed at the proper elevation to accommodate bankfull discharge and establish floodplain function. If it is determined that a defined stream channel is not characteristic of the site, then the culvert should be installed level with the meadow surface to restore sheet flow. Better still, a porous road fill (French drain) may be the proper treatment if the wetland is fed by a spring or spring seep; dispersed rather than concentrated flow" (Zeedyk, 2006).

It is important to remember that wetlands are protected by the Clean Water Act. When wetlands, stream channel or stream crossing are modified or installed permits may be required. In addition, to improve roads several aspects should be studied. Tools and equipment cost of operation, availability, difficulty of the job, type of material, weather, operator and any special equipment.

Annexes

Appendix 1



(Courtesy: Jotero, Paul, 2006)

Terrestrial Ecosystem

1- (12) The wetlands areas in both rivers are composed by **Pachic Haploborolls (deep loam), Cumulic Haplaquolls (frigid deep loam), Pachic Argiborolls (deep loam) and river wash** with the flowing characteristics:

a) Setting: "This unit consists of multitaxa Terrestrial Ecosystem components Pachic Haploborolls and Cumulic Haplaquolls occurs on valley plains. Mean annual precipitation ranges from 50 to 60 centimeters, mean annual air temperature ranges from 5 to 6 degrees Celsius. Approximately 55 percent of the mean annual precipitation occurs during the period of 01 October to 31 March and winters are cold. Continuous snow cover normally occurs on this unit from 01 November to 15 April. This unit has a mean annual snowfall of 120 centimeters and a mean annual snow accumulation of 35 centimeters. The freeze free period is 100 days. Elevations range from 2300 to 2500 meters. Delineations are irregular in shape and vary in size from 21 to 210 hectares. Perennial streams are present within the unit. The unit is characterized by a dendritic drainage pattern.

b) Landform: "Valley plains; simple linear slopes, average slope length of 20 meters, average gradient of 2 percent; transported parent material derived from various sources".

c) Major uses: Wildlife habitat, recreation, grazing.

d) Masses of land wasting by fluvial transport.

e) The revegetation is high in the Pachic Haploborolls soil (floodplain) and very low in the Cumulic Haplaquolls because of too wet.

f) The wildlife in this soil is elk, deer, black bear and turkey.

g) It is easy to find gully in these soils

h) The productivity: Grazing:

- Pachic Haploborolls (deep loam)

Herbaceous/woody 2750b/ac/yr
Forage 2550b/ac/yr
Forage (maximum) 2750/ac/yr

-Cumulic Haplaquolls (frigid deep loam)

Herbaceous/woody 3500b/ac/yr
Forage 2800b/ac/yr
Forage (maximum) 3500/ac/yr

2- (126) **Typic Cryoboralfs (fine-loamy, mixed), Typic Cryoboralfs (loamy-skeletal, mixed), Dystric Cryochrepts (loamy-skeletal, mixed)** have the flowing characteristics:

a) Setting: "This unit consists of a single Terrestrial Ecosystem component. It occurs on nearly level to strongly sloping plains. Mean annual precipitation ranges from 75 to85 centimeters; mean annual air temperature ranges from 0 to 2 degrees Celsius. Approximately 50 percent of the mean annual precipitation occurs during the period of 01 October to 31 March and winters are cold. Continuous snow cover normally occurs on this unit from 01 October to 15 May. This freeze free period is

50 days. Elevations range from 3050 to 3300 meters. Delineations are irregular in shape and vary in size from 100 to 2765 hectares. Ephemeral streams are present within the unit. This unit is characterized by a dendritic.

b) Landform: “Elevated plains; linear slopes, average slope length of 20 meters, average gradient of 8 percent; residual parent material derived from various sources”.
The Dystric Cryochrepts differ in the following landform features: Average gradient of 6 percent; residual parent material derived from rhyolite.
c) Major uses: Timber production, wildlife, range.
d) Masses of land wasting are slight.
e) The erosion is severe
f) The revegetation is high.
g) The reforestation is low because of too cold
h) The wildlife habitat in this soil is elk, hairy woodpecker and red squirrel.
i) Plant Invasive: There are not a lot. The only one is Carex.
j) The productivity: Grazing:
Herbaceous/woody 100b/ac/yr
Forage 25b/ac/yr
Forage (maximum) 2800b/ac/yr
Timber (pine) 75b/ac/yr → Harvest: Moderate

3- (127) In high elevation it is possible to find **Typic Cryoboralfs (fine-loamy, mixed), Typic Cryoboralfs (loamy-skeletal, mixed) and Dystric Cryochrepts** where we can find the flowing characteristics:

a) “This unit consists of multitaxa Terrestrial Ecosystem components. Typic Cryoboralfs (fine-loamy, mixed) and Typic Cryoboralfs (loamy-skeletal, mixed) occur in an intricate pattern and are not separable. It occurs on moderately steep and steep hills and scarps. Mean annual precipitation ranges from 75 to 85 centimeters; mean annual air temperature ranges from 0 to 2 degrees Celsius. Approximately 50 percent of the mean annual precipitation occurs during the period of 01 October to 31 March and winters are cold. Continuous snow cover normally occurs on this unit from 01 October to 15 May. This unit has a mean annual snowfall of 190 centimeters and a mean annual snow accumulation of 150 centimeters. The freeze free period is 50 days. Elevations range from 3100 to 3500 meters. Delineations are irregular in shape and vary in size from 10 to 1045 hectares. Ephemeral streams are present within the unit. This unit is characterized by a dendritic drainage pattern.”

b) Landform: “Hills and scarps; concave and convex slopes, average slope length of 20 meters, average gradient of 26 percent; residual parent material derived from rhyolite, conglomerate”.

c) Major uses: Wildlife, timber.
d) No masses of land wasting.
e) The erosion is severe
f) The revegetation is moderate.
g) The reforestation is low because of too cold.
h) The Wildlife Habitat in this soil is elk, deer, red squirrel, hairy woodpecker and bear.
i) No plant invasive
j) The productivity: Grazing: (same conditions Typic Cryoboralfs (fine-loamy, mixed) and Typic Cryoboralfs (loamy-skeletal, mixed).
Herbaceous/woody 100b/ac/yr
Forage 25b/ac/yr
Forage (maximum) 2600b/ac/yr

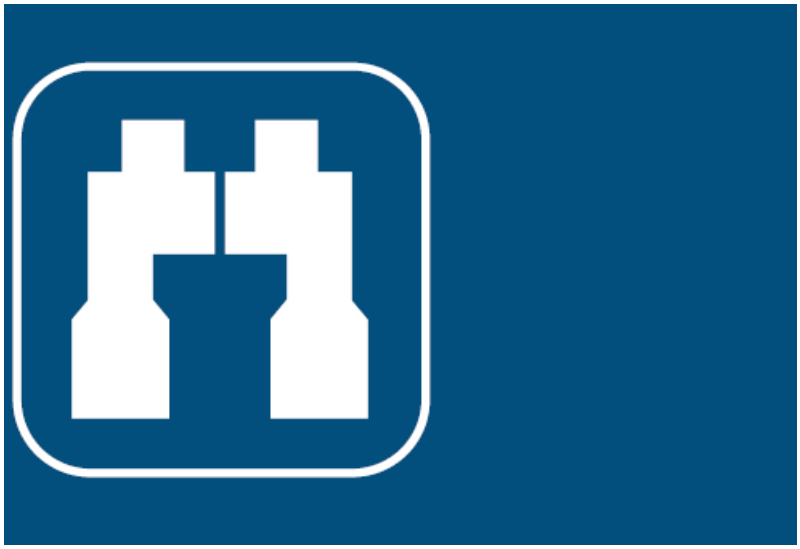
4-
5- (131) Typic Cryoboralfs (fine-loamy, mixed), Typic Cryoboralfs

Appendix 2

U.S. Fish & Wildlife Service

Alamosa and Monte Vista

National Wildlife Refuges Wildlife List



Elk, deer, coyotes, porcupines, and beaver are some of the other wildlife you may see while visiting the refuges. Resident deer and elk are found on the refuges year round, while migrating herds are seen in the fall and winter moving from higher elevations to the valley floor.

Seasonal Abundance

- a abundant - numerous and easily found in appropriate habitat
- c common - should be found in appropriate habitat with little search effort
- u uncommon - might see in appropriate habitat
- o occasional - seen only a few times during the season
- r rare - observed once or twice every 2 - 5 years
- Ac accidental - observed only a few times in the history of the Refuge

Sandhill crane
USFWS

Common Bird Name	Sp	S	F	W
__ Bufflehead	u		o	r
__ Common Goldeneye	o		o	r
__ Hooded Merganser	Ac			
__ Common Merganser	c		c	o
__ Red-breasted Merganser	Ac			
__ • Ruddy Duck	c	c	c	
Osprey, Kites, Hawks, and Eagles				
__ Osprey	o	r	r	
__ Bald Eagle	u		u	c
__ • Northern Harrier	c	c	c	c
__ Sharp-shinned Hawk	o		o	o
__ Cooper's Hawk	o		o	o
__ Northern Goshawk	Ac			
__ • Swainson's Hawk	c	c	c	o
__ • Red-tailed Hawk	c	c	c	c
__ Ferruginous Hawk	r	r	r	r
__ Rough-legged Hawk	o		c	c
__ Golden Eagle	u	u	u	u
Falcons and Caracaras				
__ • American Kestrel	c	c	c	o
__ Merlin	r	r	o	o
__ Peregrine Falcon	o	o	o	r
__ Prairie Falcon	u	u	u	u
Gallinaceous Birds				
__ • Ring-necked Pheasant	c	c	c	c
Rails				
__ • Virginia Rail	u	u	u	r
__ • Sora	u	u	u	
__ Purple Gallinule	Ac			
__ Common Moorhen	Ac			
__ • American Coot	a	a	a	
Cranes				
__ Sandhill Crane	a	o	a	r
__ Whooping Crane	u		u	
Plovers				
__ Black-bellied Plover	r		r	
__ Semipalmated Plover	o			
__ • Killdeer	a	a	a	o
__ Mountain Plover	r	r		
Stilts and Avocets				
__ • Black-necked Stilt	u	u	o	
__ • American Avocet	a	a	c	

Common Bird Name	Sp	S	F	W
Hummingbirds				
__ Black-chinned Hummingbird	o	r	o	
__ Broad-tailed Hummingbird	u	u	u	
__ Rufous Hummingbird		u	u	
Kingfishers				
__•Belted Kingfisher	u	u	u	r
Woodpeckers				
__ Lewis' Woodpecker	r			
__ Red-headed Woodpecker	Ac			
__ Williamson's Sapsucker			r	
__ Red-naped Sapsucker	u	o	o	
__ Downy Woodpecker	u	u	u	u
__ Hairy Woodpecker	u		u	
__•Northern Flicker	c	c	c	u
Tyrant Flycatchers				
__ Olive-sided Flycatcher			r	
__•Western Wood-Pewee	u	u		
__•Willow Flycatcher	o	o	r	
__•Say's Phoebe	u	u		
__ Vermilion Flycatcher	Ac			
__ Cassin's Kingbird	r	r		
__•Western Kingbird	u	u	u	
__ Eastern Kingbird		o	r	
Shrikes				
__•Loggerhead Shrike	u	u	o	r
__ Northern Shrike			o	o
Vireos				
__ Warbling Vireo	o	o		
Crows, Jays, and Magpies				
__•Black-billed Magpie	a	a	a	a
__ American Crow	u	o	u	u
__ Common Raven	c	c	c	c
Larks				
__•Horned Lark	c	c	c	c
Swallows				
__ Purple Martin	Ac			
__•Tree Swallow	c	c	u	
__ Violet-green Swallow	u	o	u	
__•Northern Rough-winged Swallow	u	u	u	
__ Bank Swallow	u	u	u	
__•Cliff Swallow	a	c	u	
__•Barn Swallow	a	a	c	

Common Bird Name	Sp	S	F	W
Titmice and Chickadees				
__ Black-capped Chickadee	u	u	u	u
__ Mountain Chickadee	o	r	o	o
Nuthatches				
__ White-breasted Nuthatch	o	r	o	
Wrens				
__ Rock Wren	r		o	
__• House Wren	u	u	u	
__• Marsh Wren	a	a	c	o
Kinglets				
__ Ruby-crowned Kinglet	o		o	
Thrushes				
__ Western Bluebird	o			
__ Mountain Bluebird	c	r	u	
__ Swainson's Thrush	r			
__• American Robin	c	c	c	o
Mimic Thrushes				
__ Northern Mockingbird	u	u	u	
__• Sage Thrasher	c	c	u	r
Starlings				
__• European Starling	a	a	a	a
Wagtails and Pipits				
__ American (Water) Pipit	o		o	
Wood Warblers				
__ Orange-crowned Warbler	o			
__• Yellow Warbler	c	c	u	
__ Yellow-rumped Warbler	c	u	c	
__ Townsend's Warbler			r	
__ Black-and-white Warbler	Ac			
__ Prothonotary Warbler	Ac			
__ Northern Waterthrush	o			
__ MacGillivray's Warbler	o	r	o	
__• Common Yellowthroat	c	c	u	
__ Hooded Warbler	Ac			
__ Wilson's Warbler	u		u	
Tanagers				
__ Western Tanager		o	o	

Common Bird Name	Sp	S	F	W
Sparrows and Towhees				
__ Green-tailed Towhee	u		u	
__ Spotted Towhee	r		r	
__ Cassin's Sparrow	r			
__ American Tree Sparrow	o		c	c
__ Chipping Sparrow	u	u	u	
__• Brewer's Sparrow	c	c	u	
__• Vesper Sparrow	c	c	u	r
__ Lark Sparrow	o	o	o	
__ Black-throated Sparrow	r	r		
__ Sage Sparrow	r	r		
__ Lark Bunting		o		
__• Savannah Sparrow	c	c	c	
__ Grasshopper Sparrow		r		
__• Song Sparrow	c	c	c	c
__ Swamp Sparrow	Ac			
__• White-crowned Sparrow	c	c	c	o
__ Dark-eyed Junco	o		c	c
__ Lapland Longspur	Ac			
Cardinals, Grosbeaks, and Allies				
__ Black-headed Grosbeak	o	o		
__ Blue Grosbeak	o	o		
__ Indigo Bunting	Ac			
Blackbirds and Orioles				
__ Bobolink	r		r	
__• Red-winged Blackbird	a	a	a	a
__• Western Meadowlark	a	a	c	u
__• Yellow-headed Blackbird	a	a	c	r
__• Brewer's Blackbird	c	c	c	o
__ Great-tailed Grackle	o	o		o
__• Brown-headed Cowbird	c	c	c	
__ Bullock's Oriole	u	u	u	
Finches				
__ Gray-crowned Rosy-Finch				r
__ Cassin's Finch	o	o	o	o
__• House Finch	c	c	c	c
__ Pine Siskin	o	o	o	o
__ Lesser Goldfinch	o	o		
__• American Goldfinch	u	u	u	
Old World Sparrows				
__• House Sparrow	a	a	c	c

Mammals

__ Cinereus or Masked Shrew *(Sorex cinereus)*
__ Dusky or Montane Shrew *(Sorex monticolus)*
__ Common Water Shrew *(Sorex palustris)*
__ Western Small-footed Myotis *(Myotis ciliolabrum)*
__ Long-eared Myotis *(Myotis evotis)*
__ Little Brown Myotis *(Myotis lucifugus)*
__ Yuma Myotis *(Myotis yumanensis)*
__ Hoary Bat *(Lasiurus cinereus)*
__ Silver-haired Bat *(Lasionycteris noctivagans)*
__ Big Brown Bat *(Eptescius fuscus)*
__ Townsend's Big-eared Bat *(Plecotus townsendii)*
__ Brazilian Free-tailed Bat *(Tadarida brasiliensis)*
__ Desert Cottontail *(Sylvilagus audubonii)*
__ Mountain Cottontail *(Sylvilagus nuttallii)*
__ White-tailed Jackrabbit *(Lepus townsendii)*
__ Least Chipmunk *(Tamias minimus)*
__ Yellow-bellied Marmot *(Marmota flaviventris)*
__ Thirteen-lined Ground Squirrel
(Spermophilus tridecemlineatus)
__ Gunnison's Prairie-dog *(Cynomys gunnisoni)*
__ Botta's Pocket Gopher *(Thomomys bottae)*
__ Northern Pocket Gopher *(Thomomys talpoides)*
__ Plains Pocket Mouse *(Perognathus flavescens)*
__ Silky Pocket Mouse *(Perognathus flavus)*
__ Ord's Kangaroo Rat *(Dipodomys ordii)*
__ American Beaver *(Castor canadensis)*
__ Western Harvest Mouse *(Reithrodontomys megalotis)*
__ Deer Mouse *(Peromyscus maniculatus)*
__ Northern Grasshopper Mouse *(Onychomys leucogaster)*
__ House Mouse *(Mus musculus)*
__ Long-tailed Vole *(Microtus longicaudus)*
__ Montane Vole *(Microtus montanus)*
__ Meadow Vole *(Microtus pennsylvanicus)*
__ Western Jumping Mouse *(Zapus princeps)*
__ Common Porcupine *(Erethizon dorsatum)*
__ Coyote *(Canis latrans)*
__ Red Fox *(Vulpes vulpes)*
__ Common Gray Fox *(Urocyon cinereoargenteus)*
__ Black Bear *(Ursus americanus)*
__ Common Raccoon *(Procyon lotor)*
__ Ermine *(Mustela erminea)*
__ Long-tailed Weasel *(Mustela frenata)*
__ American Mink *(Mustela vison)*
__ American Badger *(Taxidea taxus)*
__ Western Spotted Skunk *(Spilogale gracilis)*
__ Striped Skunk *(Mephitis mephitis)*
__ Mountain Lion *(Puma concolor)*

Mammals *(continued)*

__ Bobcat *(Lynx rufus)*
__ Wapiti or Elk *(Cervus elaphus)*
__ Mule or Black-tailed Deer *(Odocoileus hemionus)*
__ White-tailed Deer *(Odocoileus virginianus)*
__ Pronghorn *(Antilocapra americana)*

Amphibians

__ Tiger Salamander *(Ambystoma tigrinum)*
__ Plains Spadefoot *(Scaphiopus bombifrons)*
__ Western Frog *(Bufo boreas)*
__ Great Plains Toad *(Bufo cognatus)*
__ Woodhouse's Toad *(Bufo woodhousii)*
__ Striped Chorus Frog *(Pseudacris triseriata)*
__ Bullfrog *(Rana catesbeiana)*
__ Northern Leopard Frog *(Rana pipiens)*

Reptiles

__ Snapping Turtle *(Chelydra serpentia)*
__ Short-horned Lizard *(Phrynosoma douglassii)*
__ Eastern Fence Lizard *(Sceloporous undulatus)*
__ Many-lined Skink *(Eumeces multivigratus)*
__ Milk Snake *(Lampropeltis triangulum)*
__ Bullsnake *(Pituophis melnoleucus)*
__ Western Terrestrial Garter Snake *(Thamnophis elegans)*
__ Western Rattlesnake *(Crotalus viridis)*

Date _____

Total _____

Observers _____

Weather _____

Time _____

Accessibility Information

Equal opportunity to participate in and benefit from programs and activities of the U.S. Fish and Wildlife Service is available to all individuals regardless of physical or mental ability. Dial 7-1-1 for a free connection to the State transfer relay service for TTY and voice calls to and from the speech and hearing impaired. For more information or to address accessibility needs, please contact the Refuge staff at 719 / 589 4021 or the U.S. Department of the Interior, Office of Equal Opportunity, 1849 C Street, NW, Washington, D.C. 20240

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For State transfer relay service
TTY / Voice: 711

U.S. Fish and Wildlife Service
http://www.fws.gov

For Refuge Information
1 800 / 344 WILD

September 2003

Appendix 3

	Rio de Los Pinos 0.5 mi CO border at DG&F area	
	9/27/2000	kicknet
	FinalID	**Individuals**
Mayfly	Acentrella insignificans	2
Mayfly	Baetis tricaudatus	7
Mayfly	Rhithrogena	3
Mayfly	Paraleptophlebia	12
Mayfly	Ephemerella inermis	7
Mayfly	Tricorythodes	3
Stonefly	Chloroperlidae	2
Backswimmer	Ambrysus mormon	24
Caddisfly	Hydropsyche occidentalis	93
Caddisfly	Leucotrichia	8
Caddisfly	Brachycentrus (Sphinctogaster) occidentalis	6
Caddisfly	Helicopsyche (Feropsyche) borealis	22
Caddisfly	Ceraclea	1
Caddisfly	Nectopsyche	1
Moth	Petrophilia	1
Beetle	Cleptelmis	5
Beetle	Optioservus	6
Midge (Diptera)	Diamesa	3
Midge (Diptera)	Cricotopus	3
Midge (Diptera)	Cricotopus (Nostococladius) nostocicola	6
Midge (Diptera)	Eukiefferiella	1
Midge (Diptera)	Orthocladius	3
Diptera	Simulium	4
Diptera	Protoplasa fitchii	1
Diptera	Tipula	4
Diptera	Hexatoma	12
Diptera	Limnophila	2
Diptera	Atherix pachypus	8
Snail	Physella	6
Midge (Diptera)	Stempellinella	1

	Rio de Los Pinos at FS Boundary	
	9/27/2000	kicknet
	FinalID	Individuals
Mayfly	Baetis tricaudatus	6
Mayfly	Rhithrogena	9
Mayfly	Paraleptophlebia	20
Mayfly	Ephemerella inermis	9
Stonefly	Pteronarcella badia	1
Stonefly	Perlodinae	2
Stonefly	Megarcys signata	1
Stonefly	Claassenia sabulosa	2
Stonefly	Chloroperlidae	5
Backswimmer	Ambrysus mormon	28
Caddisfly	Arctopsyche grandis	1
Caddisfly	Hydropsyche	1
Caddisfly	Hydropsyche occidentalis	143
Caddisfly	Rhyacophila hyalinata	2
Caddisfly	Rhyacophila verrula	1
Caddisfly	Protoptila	12
Caddisfly	Leucotrichia	3
Caddisfly	Brachycentrus (Sphinctogaster) occidentalis	5
Caddisfly	Neothremma	2
Caddisfly	Helicopsyche (Feropsyche) borealis	3
Beetle	Optioservus	28
Beetle	Zaitzevia parvula	2
Biting midge	Ceratopogonidae	1
Midge (Diptera)	Cricotopus (Nostococladius) nostocicola	3
Midge (Diptera)	Eukiefferiella	4
Midge (Diptera)	Orthocladius	3
Midge (Diptera)	Microtendipes	1
Diptera	Maruina	1
Diptera	Hexatoma	5
Diptera	Atherix pachypus	12
Worm	Lumbriculidae	2
Snail	Ferrissia	3
Snail	Physella	1

	Stream	Rio de los Pinos near Oritz
	Site	**27RPinos007.3**
	Rep	**Nutrient Criteria Dev (2004)**
	Date	**10-07-2004**
	Percent Subsampled	**25.00**
	Device	**Hess**
	Habitat	
	EcoAnalysts Sample ID	**19**
Ephemeroptera	Acentrella insignificans	0
Mayfly	Acentrella sp.	0
Mayfly	Acentrella turbida	0
Mayfly	Ameletus sp.	0
Mayfly	Baetidae	0
Mayfly	Baetis magnus	0
Mayfly	Baetis notos	7
Mayfly	Baetis sp.	0
Mayfly	Baetis tricaudatus	3
Mayfly	Caenidae	0
Mayfly	Caenis latipennis	0
Mayfly	Caenis sp.	0
Mayfly	Callibaetis sp.	0
Mayfly	Camelobaetidius sp.	0
Mayfly	Cinygmula sp.	0
Mayfly	Diphetor hageni	1
Mayfly	Drunella doddsi	0
Mayfly	Drunella grandis	0
Mayfly	Epeorus sp.	32
Mayfly	Ephemerella inermis/infrequens	0
Mayfly	Ephemerella sp.	1
Mayfly	Ephemerellidae	0
Mayfly	Fallceon quilleri	0
Mayfly	Heptagenia sp.	0
Mayfly	Heptageniidae	0
Mayfly	Homoleptohyphes sp.	0
Mayfly	Isonychia sp.	0
Mayfly	Leptohyphes sp.	0
Mayfly	Leptohyphidae	0
Mayfly	Leptophlebiidae	0
Mayfly	Neochoroterpes oklahoma	0
Mayfly	Neochoroterpes sp.	0
Mayfly	Paraleptophlebia sp.	67
Mayfly	Rhithrogena sp.	0
Mayfly	Thraulodes gonzalesi	0
Mayfly	Traverella sp.	0
Mayfly	Tricorythodes sp.	0
Odonata	Aeshna sp.	0
Dragonfly/Damselfly	Aeshnidae	0
Dragonfly/Damselfly	Anax sp.	0

Dragonfly/Damselfly	Argia sp.	0
Dragonfly/Damselfly	Coenagrion/Enallagma sp.	0
Dragonfly/Damselfly	Coenagrionidae	0
Dragonfly/Damselfly	Erpetogomphus sp.	0
Dragonfly/Damselfly	Gomphidae	0
Dragonfly/Damselfly	Hesperagrion heterodoxum	0
Dragonfly/Damselfly	Hetaerina sp.	0
Dragonfly/Damselfly	Libellulidae	0
Dragonfly/Damselfly	Ophiogomphus sp.	0
Dragonfly/Damselfly	Oplonaeschna armata	0
Dragonfly/Damselfly	Progomphus sp.	0
Dragonfly/Damselfly	Pseudoleon superbus	0
Plecoptera	Amphinemura sp.	0
Stonefly	Capniidae	0
Stonefly	Chloroperlidae	5
Stonefly	Claassenia sabulosa	0
Stonefly	Hesperoperla pacifica	0
Stonefly	Isogenoides sp.	1
Stonefly	Isoperla sp.	0
Stonefly	Leuctridae	0
Stonefly	Megarcys sp.	0
Stonefly	Perlodidae	0
Stonefly	Pteronarcella sp.	0
Stonefly	Skwala sp.	0
Stonefly	Sweltsa sp.	0
Stonefly	Taeniopterygidae	0
Stonefly	Zapada cinctipes	0
Stonefly	Zapada oregonensis gr.	0
Hemiptera	Ambrysus sp.	6
True bug	Belostomatidae	0
True bug	Corixidae	0
True bug	Notonecta sp.	0
True bug	Sigara sp.	0
True bug	Trichocorixa sp.	0
Coleoptera	Agabus sp.	0
Beetle	Berosus sp.	0
Beetle	Cleptelmis addenda	0
Beetle	Dubiraphia sp.	0
Beetle	Dytiscidae	0
Beetle	Elmidae	0
Beetle	Enochrus sp.	0
Beetle	Gyretes sp.	0
Beetle	Helichus sp.	0
Beetle	Heterelmis sp.	0
Beetle	Heterlimnius sp.	0
Beetle	Hexacylloepus sp.	0
Beetle	Hydrophilidae	0
Beetle	Hygrotus sp.	0
Beetle	Laccophilus sp.	0
Beetle	Microcylloepus sp.	0

Beetle	Narpus sp.	0
Beetle	Optioservus sp.	0
Beetle	Postelichus sp.	0
Beetle	Psephenus sp.	0
Beetle	Stenelmis sp.	0
Beetle	Tropisternus sp.	0
Beetle	Zaitzevia sp.	0
Megaloptera	Corydalus sp.	0
Diptera-Chironomidae	Ablabesmyia sp.	0
Midge	Apedilum sp.	0
Midge	Brillia sp.	0
Midge	Cardiocladius sp.	0
Midge	Chironomini	0
Midge	Chironomus sp.	0
Midge	Cladotanytarsus sp.	0
Midge	Corynoneura sp.	0
Midge	Cricotopus (Nostoc.) nostocicola	0
Midge	Cricotopus bicinctus gr.	0
Midge	Cricotopus sp.	0
Midge	Cricotopus trifascia gr.	0
Midge	Cryptochironomus sp.	0
Midge	Diamesa sp.	0
Midge	Dicrotendipes sp.	0
Midge	Djalmabatista sp.	0
Midge	Endotribelos sp.	0
Midge	Eukiefferiella brehmi gr.	0
Midge	Eukiefferiella claripennis gr.	0
Midge	Eukiefferiella coerulescens gr.	0
Midge	Eukiefferiella devonica gr.	2
Midge	Eukiefferiella gracei gr.	1
Midge	Eukiefferiella pseudomontana gr.	1
Midge	Gillotia sp.	0
Midge	Glyptotendipes sp.	0
Midge	Goeldichironomus sp.	0
Midge	Heleniella sp.	0
Midge	Krenopelopia sp.	0
Midge	Larsia sp.	0
Midge	Lauterborniella agrayloides	0
Midge	Limnophyes sp.	0
Midge	Lopescladius sp.	0
Midge	Metriocnemus sp.	0
Midge	Micropsectra sp.	0
Midge	Micropsectra/Tanytarsus sp.	0
Midge	Microtendipes pedellus gr.	0
Midge	Microtendipes rydalensis gr.	0
Midge	Nilotanypus sp.	0
Midge	Nilothauma sp.	0
Midge	Orthocladiinae	0
Midge	Orthocladius (Euortho.) rivicola gr.	0
Midge	Orthocladius (Euortho.) rivulorum	2

Midge	Orthocladius (Euorthocladius) sp.	0
Midge	Orthocladius (Symp.) lignicola	0
Midge	Orthocladius Complex	0
Midge	Orthocladius sp.	1
Midge	Pagastia sp.	0
Midge	Parachironomus sp.	0
Midge	Paracricotopus sp.	0
Midge	Parakiefferiella sp.	0
Midge	Parametriocnemus sp.	0
Midge	Paraphaenocladius sp.	0
Midge	Paratendipes sp.	0
Midge	Pentaneura sp.	0
Midge	Pentaneurini	0
Midge	Phaenopsectra sp.	0
Midge	Polypedilum sp.	0
Midge	Potthastia longimana gr.	0
Midge	Procladius sp.	0
Midge	Psectrocladius sp.	0
Midge	Pseudochironomus sp.	0
Midge	Rheocricotopus sp.	0
Midge	Rheotanytarsus sp.	0
Midge	Robackia demeijerei	0
Midge	Saetheria tylus	0
Midge	Stempellina sp.	0
Midge	Stempellinella sp.	0
Midge	Stictochironomus sp.	0
Midge	Stilocladius sp.	0
Midge	Sublettea sp.	0
Midge	Synorthocladius sp.	0
Midge	Tanypus sp.	0
Midge	Tanytarsus sp.	0
Midge	Thienemanniella sp.	0
Midge	Thienemannimyia gr. sp.	0
Midge	Tokunagaia sp.	0
Midge	Tvetenia bavarica gr.	2
Midge	Tvetenia discoloripes gr.	2
Midge	Tvetenia sp.	0
Midge	Xestochironomus sp.	0
Diptera	Antocha sp.	0
Fly	Athericidae	0
Fly	Bezzia/Palpomyia sp.	0
Fly	Ceratopogonidae	0
Fly	Ceratopogoninae	0
Fly	Chelifera/Metachela sp.	0
Fly	Cryptolabis sp.	60
Fly	Dasyhelea sp.	0
Fly	Dicranota sp.	0
Fly	Dixa sp.	0
Fly	Dixella sp.	0
Fly	Dolichopodidae	0

Fly	Empididae	0
Fly	Ephydridae	0
Fly	Hemerodromia sp.	0
Fly	Hexatoma sp.	0
Fly	Limonia sp.	0
Fly	Maruina sp.	0
Fly	Muscidae	0
Fly	Nemotelus sp.	0
Fly	Neoplasta sp.	0
Fly	Pericoma/Telmatoscopus sp.	0
Fly	Simulium sp.	54
Fly	Stratiomyidae	0
Fly	Tabanidae	0
Fly	Tipula sp.	0
Fly	Tipulidae	0
Trichoptera	Arctopsyche grandis	0
Caddisfly	Atopsyche sp.	0
Caddisfly	Brachycentrus americanus	0
Caddisfly	Brachycentrus occidentalis	0
Caddisfly	Cheumatopsyche sp.	33
Caddisfly	Chimarra sp.	0
Caddisfly	Culoptila sp.	3
Caddisfly	Dolophilodes sp.	0
Caddisfly	Glossosoma sp.	0
Caddisfly	Glossosomatidae	0
Caddisfly	Helicopsyche sp.	1
Caddisfly	Hydropsyche sp.	84
Caddisfly	Hydroptila sp.	0
Caddisfly	Hydroptilidae	0
Caddisfly	Ithytrichia sp.	0
Caddisfly	Lepidostoma sp.	0
Caddisfly	Leucotrichia sp.	3
Caddisfly	Limnephilidae	0
Caddisfly	Limnephilus sp.	0
Caddisfly	Micrasema sp.	0
Caddisfly	Nectopsyche sp.	0
Caddisfly	Neotrichia sp.	0
Caddisfly	Ochrotrichia sp.	0
Caddisfly	Oecetis avara	0
Caddisfly	Oecetis disjuncta	0
Caddisfly	Oecetis sp.	0
Caddisfly	Oligophlebodes sp.	0
Caddisfly	Oxyethira sp.	0
Caddisfly	Phylloicus sp.	0
Caddisfly	Polycentropodidae	0
Caddisfly	Polycentropus sp.	0
Caddisfly	Protoptila sp.	2
Caddisfly	Psychomyia sp.	0
Caddisfly	Rhyacophila brunnea gr.	0
Caddisfly	Rhyacophila coloradensis gr.	0

Caddisfly	Rhyacophila pellisa/valuma	0
Caddisfly	Rhyacophila sp.	0
Caddisfly	Trichoptera	0
Lepidoptera	Petrophila sp.	2
Gastropoda	Ancylidae	0
Snail	Ferrissia sp.	4
Snail	Gyraulus sp.	0
Snail	Physa (Physella) sp.	1
Snail	Planorbella sp.	0
Bivalvia	Corbicula sp.	0
clam	Sphaeriidae	0
Annelida	Branchiobdellida	0
worm	Erpobdellidae	0
worm	Oligochaeta	8
Acari	Acari	0
mite	Atractides sp.	1
mite	Corticacarus	0
mite	Estelloxus sp.	0
mite	Hydrovolzia sp.	0
mite	Hygrobates sp.	0
mite	Lebertia sp.	0
mite	Limnesia sp.	0
mite	Oribatei	0
mite	Protzia sp.	0
mite	Sperchon sp.	0
mite	Testudacarus sp.	0
mite	Torrenticola sp.	0
Crustacea	Amphipoda	0
Branchiopod	Artemia sp.	0
crayfish	Cambaridae	0
amphipoda	Gammarus sp.	0
	Hyalella sp.	0
	Ostracoda	0
crayfish	Procambarus sp.	0
Other Organisms	Hydra sp.	0
	Nematoda	0
	Nematomorpha	0
	Polycelis sp.	0
	Prostoma sp.	0
	Turbellaria	0
		390

Rio San Antonio at FR 87

kicknet **9/27/2000**

	FinalID	Individuals
Mayfly	Paraleptophlebia	1
Mayfly	Tricorythodes	206
Dragonfly	Ophiogomphus	1
caddisfly	Hydropsyche occidentalis	5
caddisfly	Ochrotrichia	5
caddisfly	Helicopsyche (Feropsyche) borealis	1
caddisfly	Ceraclea	1
caddisfly	Nectopsyche	1
	Dubiraphia	1
biting midge	Ceratopogonidae	2
midge	Procladius	1
midge	Thienemannimyia	1
midge	Cricotopus	9
midge	Cryptochironomus	3
midge	Dicrotendipes	21
midge	Microtendipes	10
midge	Phaenopsectra	4
midge	Polypedilum	14
fly	Simulium	1
fly	Pericoma	1
fly	Tipula	3
fly	Hexatoma	1
fly	Limnophila	1
fly	Dicranota	5
worm	Tubificidae	11
worm	Lumbriculidae	1
worm	Turbellaria	1
snail/clam	Pisidium	4
snail/clam	Ferrissia	2
snail	Physella	1

Appendix 4

RECORD OF DECISION FOR THE 2004-2006 STATE OF NEW MEXICO §303(d)/§305(b) SAN ANTONIO AND LOS PINOS RIVERS ASSESSED SURFACE WATERS:

HUC 13010005 Conejos

Rio San Antonio (Montoya Canyon to headwaters)
WQS: 20.6.4.123 AU: NM-21210.A_901

Previously listed for stream bottom deposits, reduction of riparian vegetation and streambank destabilization. No associated physical/chemical data are available.

1998 ACTION: The reach was retained on the 303(d) with stream bottom deposits as the cause of non-support.

2000 ACTION: None

2002 ACTION: This reach was sampled during the 2000 Upper Rio Grande 1 intensive water quality study. Benthic macroinvertebrate and pebble count data were collected at for comparison to reference condition at Rio Los Pinos. The biological condition was 73% of reference condition at this site with 31% fines. There were 17% fines at the reference station which corresponds to an 82% increase in fines at the sample condition. Combined geomorphologic and benthic macroinvertebrate data from this water body **indicate Full Support Impacts Observed for stream bottom deposits.**

The dissolved oxygen standard (≥6.0 mg/L) was exceeded on 18 October at Station 4 (5.15 mg/L). The proportion of exceedances was such that this reach is listed **as Full Support Impacts Observed for dissolved oxygen.**

2004 ACTION: Previously listed as Rio San Antonio (CO border to headwaters), this AU was split to acknowledge the different character above at Montoya Canyon. Thermograph data from station 4 (Forest Road 87) indicate non-support for temperature for this AU, as instantaneous temperature readings exceeded 23°C (maximum = 26.97°C). Therefore, temperature will be added as a cause of non support.

Rio San Antonio (CO border to Montoya Canyon)
WQS: 20.6.4.123 AU: NM-2120.A_902

2004 ACTION: This reach was sampled during the 2000 Upper Rio Grande 1 intensive water quality study. Previously listed as Rio San Antonio (CO border to headwaters), this AU was split to acknowledge the changing character between at Montoya Canyon. The station near the CO border at Ortiz was dry during the summer sampling run.

HUC 13010005 Conejos

Rio de los Pinos (New Mexico reaches)
WQS: 20.6.4.123 AU: NM-2120.A_900

Previously listed for metals (Al), total phosphorus, temperature and stream bottom deposits. Data on this reach are limited to single grab sample data collected at two times during 1990. The first sampling was during April and the second during August. For temperature, the ratios at four of five sampling stations (URG120.031010, URG120.031020, URG120.031030 and URG120.031040) were 1/2 with all exceedances during the summer sampling. Station URG120.031050 had no exceedances. Temperature will be classified as Full Support, Impacts Observed at the exceeding stations and full support at. URG120.031050. For total phosphorus, the results were similar but

with the exceedances occurring during the spring sampling. Stations URG120.031010, URF120.031030 and URG120.031050 all had 1/2 ratios with stations URG120.031020 and URG120.031040 having 0/2 exceedances. For aluminum, only one station had an exceedance. At station URG120.031010, 1/1 samples collected exceeded the screening criteria. There were no exceedances of the acute criteria.

1998 ACTION: This reach will be listed as Full Support, Impacts Observed on the 1998 305(b) list with aluminum, total phosphorus, and temperature as the causes. The reach continues to be listed as Partially Supporting on the 1998 303(d) list with stream bottom deposits as the cause.

2000 ACTION:

Metals (Al): Data reviewed from 8/09/90 shows that the aluminum listing on the Riot de los Pinos is erroneous. The SLD Analytical Report from the 1990 results shows digested aluminum at <0.3 mg/L. The STORET retrieval shows a dissolved aluminum number of 300 ug/L. This is obviously a data entry error and the listing for aluminum will be deleted.

2002 ACTION: This reach was sampled during the 2000 Upper Rio Grande 1 intensive water quality study. Benthic macroinvertebrate and pebble count data were collected at Rio de lost Pinos at the NMDGF area for comparison to reference condition at Rio Los Pinos at the FS boundary. The biological condition was 86% of reference condition at this site with 25% fines. Combined geomorphologic and benthic macroinvertebrate data from this station combined with the fact that a second Rio Los Pinos station is a reference station indicate Full Support for stream bottom deposits. 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). A total of eight samples were collected at each station. However, the proportion of exceedances was such that this reach will be listed as Full Support Impacts Observed for dissolved oxygen.

2004 ACTION: In 2002, two thermographs were deployed on Rio de los Pinos at USGS gage and Rio de los Pinos at the USFS bridge. At the USGS gage, recorded temperatures from July 2 through August 31, 2002 exceeded the HQCWF criterion 508 of 1,446 times (35%) with a maximum temperature of 29.8°C. At the USFS bridge in 2002, recorded temperatures from July 2 through August 31, 2003 exceeded the HQCWF criterion 344 of 1,446 times (24%) with a maximum temperature of 27.7°C. In 2003, two thermographs were re-deployed at these two stations. At the USGS gage, recorded temperatures from July through August 31, 2002 exceeded the HQCWF criterion 246 of 1,446 times (17%) with a maximum temperature of 25.3°C. At the USFS bridge in 2003, recorded temperatures from July 2 through August 31, 2003 exceeded the HQCWF criterion 387 of 1,446 times (27%) with a maximum temperature of 27.1°C. Therefore, temperature will be added as a cause of non support.

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