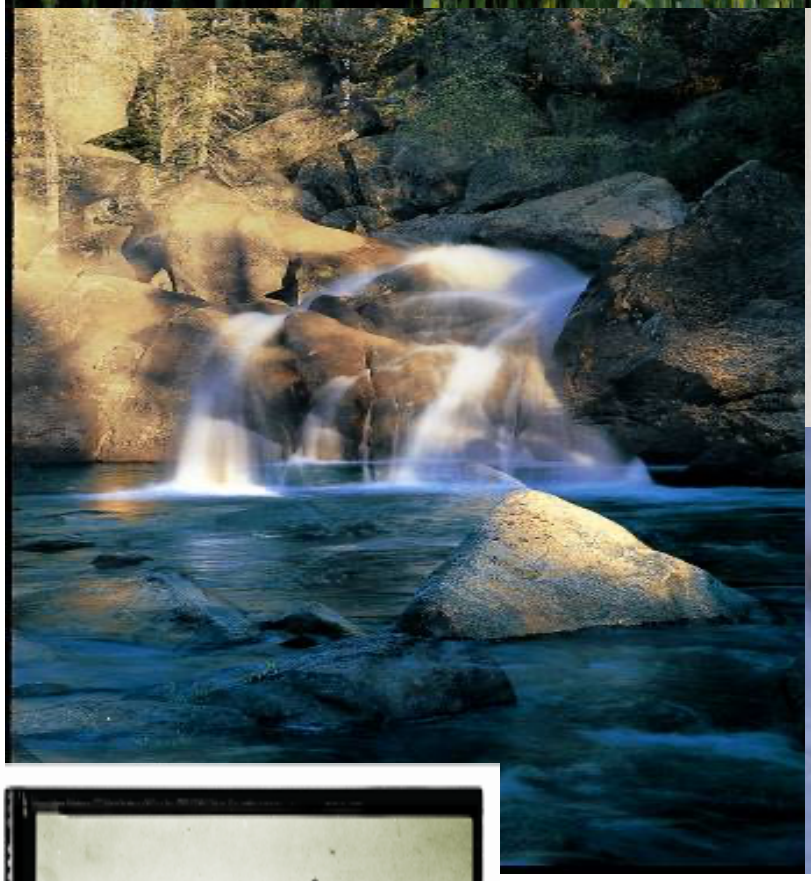
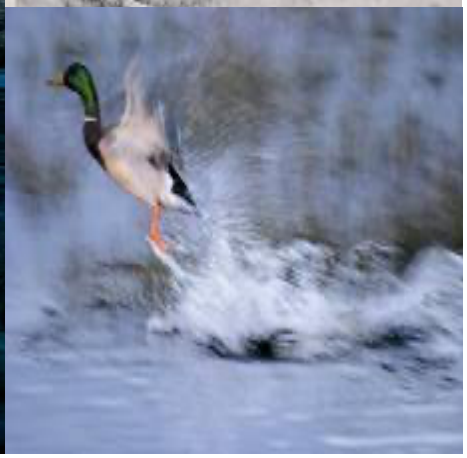
Historical and Natural Resource Assessment for Big Grizzly Creek





PREPARED FOR THE

GRIZZLY RANCH CONSERVANCY

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October 2006

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Acknowledgements

Gathering and compiling existing data for the Grizzly Creek Watershed was an exhausting process, which required extensive research, personal contacts and elbow grease. I would like to acknowledge and thank several key individuals who made significant contributions to the production of this report as follows: rs Cindy Noble and Don Rigney (Project Team Members); Micki Kelly (Kelly Biological); Andy Norris and Mike Mohler (Lowe Enterprises); Julie Cunningham and Laurie Powers (California Department of Fish and Game); Doug Riechbieter (California Department of Water Resources); local residents Amelio and Betty Folchi, Jack Bridge, Richard Hardy, and John Williamson; Bob Shultz (US Forest Service); Jim Wilcox (Feather River Coordinated Resource Management); Holly George and Dan Martynn (UC Cooperative Extension); and Bob Stein (Walton Ice Pond).

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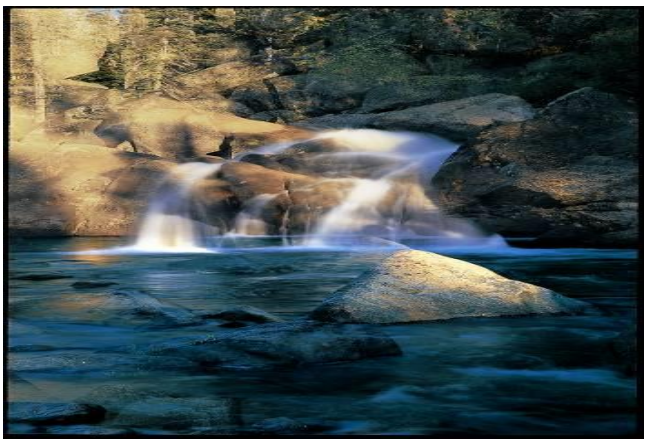
1.0 Introduction

This report presents a compilation of existing data that was prepared for the Grizzly Ranch Conservancy to better understand the history and natural resources of the Big Grizzly Creek watershed, Plumas County, California. The information focuses on land around the Grizzly Ranch Community and was obtained from a variety of sources including technical papers and reports, correspondence, museum journals, a broad internet literature search, and personal interviews with long time residents (Appendix E). This document provides background information on the historical, physical, and biological settings of the regional area; characterizes the existing condition of both aquatic and terrestrial resources along Big Grizzly Creek; and presents results from physical and chemical testing of water samples from Big Grizzly Creek. The resulting "snap-shot" of existing condition will be useful in better understanding the natural resources at the watershed scale, and more specifically the habitat values that currently exist to support a productive cold-water fishery in Big Grizzly Creek. This information will facilitate planning improvements along the creek that will maximize recreational values for property owners at Grizzly Ranch while protecting aquatic and riparian resources. Educational literature and detail for interpretive trail markers will also be generated from this existing conditions analysis.

Grizzly Ranch Conservancy seeks to enhance recreational access, aesthetics and environmental values along Big Grizzly Creek for property owners in the Grizzly Ranch Community. Preliminary plans include construction of a ½-mile nature trail that parallels the east side of the creek from the northern to the southern property boundary. Installation of interpretive signs, stone benches, picnic areas, limited clearing of thick brush along the creek to improve access, a family recreation area (Camp Grizzly), and construction of a creekside boardwalk are envisioned as potential improvements. A spatially referenced aerial map of the project was prepared to identify possible locations for these improvements with a description of site improvements that may be required. The map and narrative were attached to the Conservancy's Fish and Game 1603 Stream Alteration Agreement application which was prepared as part of this study to obtain permits required to remove and maintain a small amount of riparian vegetation to improve creek access.



Big Grizzly Creek

2.0 Project Background

The Grizzly Ranch Community is a private housing and golf course development that is comprised of approximately 1,042 acres of land. The project is located in California's northern Sierra Nevada in Plumas County, about 1.5 miles north of Highway 70 and 5 miles east of Portola on Grizzly Road (Figure 1). Project construction began in 2003 and full build-out is anticipated in 2008. The project includes 380 single-family home sites, infrastructure buildings and an 18-hole championship golf course designed by Bob Cupp. Striking mountain vistas, sub-alpine mountain meadows, and stands of healthy mixed conifer forest surround the development and provide unique opportunities for outdoor recreation and appreciation of natural resources in the area.

Big Grizzly Creek is a major tributary of the Middle Fork Feather River (Middle Fork), which is a designated National Wild and Scenic River. The creek outflows from Lake Davis through the Grizzly Valley Dam and travels south approximately 7 miles to the confluence with the Middle Fork. From an elevation of 5,670 feet at the dam, the creek drops through steep-walled canyons, flows through the eastern edge of Smith Peak State Game Refuge, Grizzly Ranch, Walton's Ice Pond, crosses under Highway 70 about 2 miles east of Portola, and joins the Middle Fork on the western side of Sierra Valley at an elevation of 4,870 feet. The creek traverses the western edge of the Grizzly Ranch property for ½ mile approximately 3 miles upstream from the mouth of the Middle Fork.

To preserve creek access, the Grizzly Ranch Community designated Big Grizzly Creek and its floodplain area as common space, which provides limitless opportunities for fishing, wading, bird watching, hiking, observing fall colors and simply the enjoyment of the unique natural setting. Grizzly Ranch intends to plan and implement a series of low-impact improvements designed to increase use of the creek by property owners while protecting natural resource values.

On a grander scale of environmental protection, Grizzly Ranch has designated 55 acres of wetland across the project to be protected by conservation easements, which are held by the Grizzly Ranch Conservancy. Most of these designated wetlands areas are tributaries to Big Grizzly Creek. The Grizzly Ranch Conservancy was developed to manage and maintain these conservation areas and designated buffer areas within Grizzly Ranch. The Conservancy provides community services within the development, and supports environmental conservation, habitat restoration and wildlife management plans benefiting the lands described in the Conservation Easement. Funding of the Conservancy occurs through a fee imposed on the sale of lots. This fee will generate funds to use to support the long-term maintenance of the Conservation Easements and the mitigation areas, some of which will involve land and resources on Big Grizzly Creek.

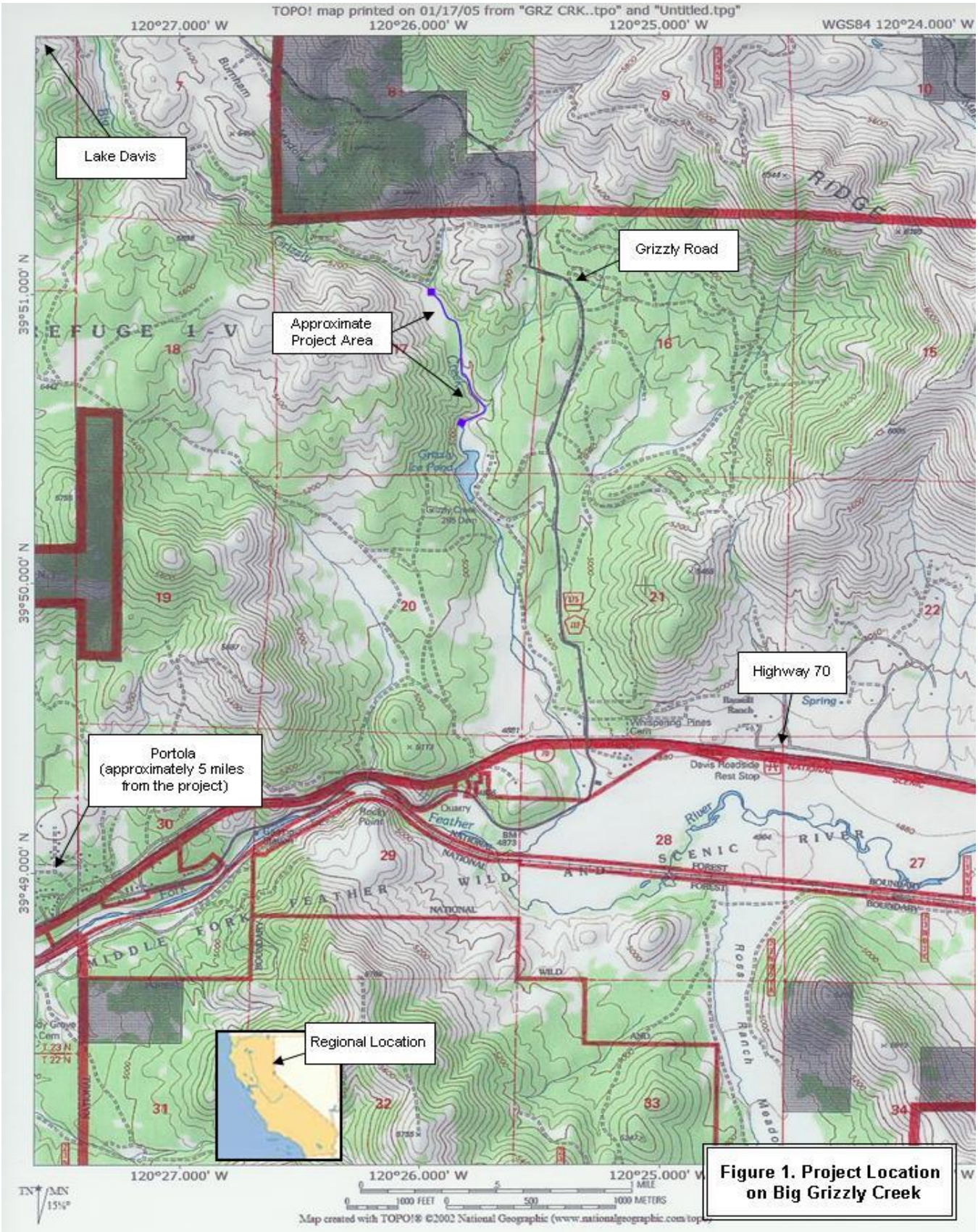


Figure 1. Project Location on Big Grizzly Creek

3.0 Historical Setting

Information obtained for this section was derived from an extensive literature search, review of existing regulatory documents, technical reports prepared for the Grizzly Ranch development, and personal interviews with long-time residents who fished and camped in the area over the last fifty years.

3.1 Native Americans

The northeastern Maidu are the most distinct aboriginal people in the vicinity of Grizzly Ranch and within Plumas National Forest. They are a hunting-fishing-gathering tribe who have great respect for the Mother Earth and depend upon the natural environment for food and shelter. From creation myths to material culture the Maidu express this closeness with nature in all walks of life. Though the Maidu populations occupied the land for hundreds of years, evidence suggests that they rarely traveled or migrated to other regions and therefore, association between divisions of the tribe were rare. Contact was reported periodically during the hunting and fishing seasons, and in early fall when acorns were gathered. Within a tribe, maximum travel distances are estimated at 20 miles.

The Maidu inhabited the vicinity for at least 2,500 years, following prehistoric tribes that settled in the watershed over 10,000 years ago. Prehistoric lithic scatters are present today in many locations in Plumas National Forest, including the perimeter of Lake Davis, along rivers and creeks, near springs, and in large meadows located on both public and private lands. Remnants of rich prehistoric and historic habitation along Big Grizzly Creek through Grizzly Valley were inundated by the construction of the Lake Davis reservoir in 1967 so are no longer accessible. The first European visitors found an undeveloped region with a vast network of Indian trails in mountains and valleys that had been used for hundreds of years. The Maidu accepted, rather passively, this invasion of their territory with its attendant losses of game and destruction of fisheries by mining refuge. The tremendous and sudden influx of white population into Maidu territory though, took its toll over the years with disease and warfare. Prior to 1850, there were about 4,000 Maidu in Plumas County; by 1880 there were about 500; and the best guess in 1962 was about 350. More recently, the California Native Heritage Commission reported that 604 Native Americans live in Plumas County, primarily comprised of Maidu tribes.

The northeastern Maidu inhabited a distinct topographic area, which includes the upper reaches of the North and Middle Fork Feather River drainages. They settled in a series of large, flat-floored valleys, which are largely old glacial lakebeds. A large number of Maidu lived north and west of Grizzly Valley and they permanently occupied the entire Honey Lake valley. Although the Lake Davis area and Sierra Valley were not permanently occupied because of heavy winter snows, they were regarded as Maidu territory and used as summer hunting grounds. The Washoe Indians from Nevada occasionally sent hunting parties into this area during the summer, which caused trouble and often warfare with the Maidu. The Maidu frequently burned large areas of native vegetation to produce more fertile soils to produce crops, grasses and herbs used for food and basket weaving. Burning also made traveling and hunting easier and helped avoid potential ambushes.

The northeastern Maidu generally lived along the edges of meadows in the pine timbered highlands to avoid the snowy uplands and the wet and marshy meadow bottomlands. These "edge" sites provided a good source of water and game during the summer months, and sites for collecting acorns and other food materials. To grind plant material or acorns, the Maidu women used either the smooth, flat surface of some large boulder or rock ledge, or a flat stone slab in the floor of their dwelling. In the course of time, from constant pounding, a hole or cavity would be worn in the surface of the stone. When the cavity became too deep, the stone was discarded or a new site was located. Many of these mortar sites can be found along the Middle Fork Feather River near the confluence with Big Grizzly Creek and north around Grizzly Valley prior to inundation.

Basket weaving was by far the most important art of the Maidu while serving a functional purpose. The materials varied, but most commonly were various species of willow or redbud. In the higher Sierra, the roots of the yellow pine were used to a large extent in making burden baskets along with the roots of common bracken ferns and maidenhair fern. Both coiled basketry, which are water tight, and twined basketry were in use among the Maidu for different purposes. Collection of plant materials for baskets occurred in the spring, when new shoots had grown to a certain height and size.

Though the numbers are relatively small, the Maidu remain a viable and dynamic culture with many elders and youth interested in maintaining their cultural identity. They continue to be proficient weavers and basket makers, retain their close relationship with nature, and carry on with traditions and values passed down from past generations. Some areas north and northwest of Grizzly Ranch on Plumas and Lassen National Forests are still used by the Maidu for hunting, fishing and gathering plant food and basketry material. The Susanville Rancheria, a Maidu settlement, is located in Susanville, California, which is approximately 55 miles north of the Grizzly Ranch property. Several Maidu settlements are also located near Greenville, California in and around Indian and Genessee Valleys within Plumas County.

The Grizzly Ranch project was surveyed for archaeological and historical resources as part of the regulatory review process. The survey revealed no archaeological sites along Big Grizzly Creek but did reveal a historic site which consists of an old railroad grade on the east side of the creek. An abundance of pre-historic archeological sites are located 3 miles south of the project near the Middle Fork Feather River.

3.2 European Settlers

Records indicate that very few white trappers, traders and explorers passed through Plumas County in the early 1800's. In 1820, a Spanish expedition headed by Captain Louis A. Arguello traveled east from Oroville toward Plumas County and named the river they followed Rio de las Plumas, or Feather River, but the expedition never proceeded as far as Sierra Valley. The trappers of the Hudson Bay Company and the American Fur Company crossed the Sierra Nevada first in 1825, and frequently thereafter, but further to the south and along the Pit River to the north. It wasn't until gold was discovered in California in 1849 that eager bands of adventurers arrived in the Plumas County area and opened up the unexplored mountains and picturesque valleys to the world. The rumor of a "gold lake" had spread throughout mining communities in spring of 1850, resulting in an immediate stampeded of prospectors to the northern Feather River country.

The California gold rush was responsible for the arrival of large numbers of Euroamericans in the Feather River area by the mid-1800s. Mining claims sprang up throughout the area, especially along the Feather River Canyon west of Quincy where hydraulic mining was used to rip through drainages and mountain terrain in search of gold and other metals. With the spring of 1851, came a new throng of miners, who crowded the streams of Plumas County, spreading out and making new discoveries in all directions. Claims were made; flumes and wing-dams were built; substantial cabins were erected and in every way the people indicated their intentions of staying at least as long as the "diggings" held out. But the winter of 1852-53 was unusually long and harsh. Early winter snows blocked the miners from supply routes through the mountains and many died from starvation or desperate attempts to leave the area. But in 1853, miners streamed back into Plumas County over the Beckwourth Pass from the east with their families, to settle upon the rich lands of Sierra Valley and lay the foundation for the communities that exist today.

James Pierson Beckwourth: Beckwourth was an African American trapper, explorer, mountain man, and alleged Crow chieftain. He was an interesting character who embellished stories and boasted endlessly about his good deeds, making it difficult to separate fact from fiction. He was born in Fredericksburg, Virginia in 1798 as a slave, and was later freed by his father. Young Beckwourth joined a fur trapping expedition with General Ashley in 1824 and traveled extensively on the western plains and in the mountains. For several years, he lived among the Crow Indians where he developed skills as a guide, scout and interpreter prior to his arrival in California in 1844.

Beckwourth was operating a trading post in Sonora in 1849 when gold rush fever struck California. He entered Sierra Valley in 1850 with a wave of newcomers to prospect for gold and to explore what he thought might be a low elevation pass over the Sierra Nevada. He intended to find a route that would offer the best wagon road to connect the main California Trail (from Truckee Meadows) to Bidwell's Bar (submerged under Lake Oroville). After months of exploring, he discovered Beckwourth Pass in spring 1851 and led the first group of emigrants through the pass in summer 1851 and spring 1852.

Beckwourth Cabin

The trail was difficult and rough, so Beckwourth lobbied investors and government officials for funds to improve the passage. Although improvements were made in 1855 to bypass some of the worst sections, use of the trail began to decline, as the route was still difficult over Grizzly Ridge and it was reported that stock frequently died from eating poisonous weeds along the trail. With the presence of new and better routes, the Beckwourth Trail was more of a stage and freight road than an emigrant trail by 1860.

Today, much of the trail is overlain or paralleled by graded or paved highway, however many traces of the original trail remain including along Grizzly Road through the Grizzly Ranch property. Trail markers are located along the path where wagon wheel marks or the old trail itself can be identified. The closest trail marker to Grizzly Ranch is located about 1.5 miles north just south of Grizzly Road. The Beckwourth trail was designated as a National Historic Trail in 1992.

In 1852, Beckwourth laid claim to land in Sierra Valley, built a hotel and cabin on his "War Horse Ranch," and established a profitable trade with emigrants who came over the new route. His original house was built on a hill just west of the town of Beckwourth and was reported to be the first structure in that area. Early references to his house indicated that he lived in a frame house that burned down in the early twentieth century. Many people today, though, believe that a log cabin moved from Beckwourth to Portola was Jim Beckwourth's original home. So the controversy wages on.

In 1854, Beckwourth related the story of his life to Thomas D. Bonner and at the same time allegedly changed the spelling of his name from "Beckwith" to Beckwourth." In the 1860's, he returned to the Crow Nation in Montana where he died and was buried in an unmarked grave in 1866.

Beckwith Tavern: Blackie Tucker built the Beckwith Tavern, a local landmark located on Highway 70, in 1932. Blackie was a retired railroad conductor who was described as "being full of jokes, quirks and witticisms- most of which are not geared for publication." He amassed a small fortune as a bootlegger, and decided to become a saloonkeeper, so he built the tavern. He had a Chinese chef who prepared great food at a reasonable price, so the tavern was a very successful. The tavern is currently closed but it is being restored and will once again provide meals to travelers along the Highway 70 corridor.

3.3 Land Use and Recreation

Prior to the Euroamerican settlement, Native American tribes used the land in the vicinity of Grizzly Ranch for hunting, fishing and food gathering. They routinely burned brush on hillsides and the timbered understory within Plumas County to open up new areas for crops, for protection, and to cultivate plant materials for basket weaving. The primary land uses by white settlers include timber harvesting, cattle grazing, mining, recreation, rail transportation, and ice production along Big Grizzly Creek. The interior of Grizzly Ranch was criss-crossed with old ranch roads, skid trails from logging, ranch fencing, railroad grades and trestle crossings that emphasize the extensive use of the land in this area. Grizzly Bears were reported as common, especially in and around productive meadow areas near Grizzly Valley (Lake Davis).

Around the turn of the century, the Grizzly Ranch property was severely impacted by the collective land uses mentioned above, which caused soil disturbance and removal of vegetation over large areas, especially along intermittent channels. As land disturbance activities continued, many channels were incised and degraded, and became subject to erosion. Since reestablishing native vegetation is a relatively slow process in this area due to clay soils, cycling moisture availability, and past overgrazing, recovery can take many years. The fact that land use has dramatically changed since the 1970's and that disturbance outside of construction zones is minimized, soils and native vegetation have rebounded and are showing signs of healing. The intermittent channels now in conservation easements at Grizzly Ranch are also showing signs of recovery.

Historically, summer recreation in the area included hiking, fishing, boating, horseback riding, camping, gold panning, bird watching, and swimming, with cross country skiing and snow shoeing in the winter months. More recently, golf and snowmobiling were added as popular recreation activities. Overall, recreation use in Plumas County has greatly increased, with water-related uses a major attraction.

Total recreation use on Big Grizzly Creek was estimated at 1,400 recreation hours (400 hours) for the period April 24 to July 5, 2004. Overall, anglers and other recreationists have traditionally used about 4.25 miles of the 6.5-mile reach of Big Grizzly Creek below the dam. The remaining two miles of the creek were generally inaccessible and/or clearly posted against trespass. Surveys conducted by the Department of Water Resources (DWR) indicated that overall, fishing was the major activity, followed by just relaxing, walking for pleasure, swimming and wading, and bicycle riding. In general, the data indicates a continual decline in total recreation use on Big Grizzly Creek since a peak in 1994, due in part to the 1997 pike eradication project which is discussed in Section 6.0 and increased efforts by local landowners to restrict public access across privately held land.

According to reports from long time residents, fishing limits were 10 trout or 10lbs + 1 fish along Big Grizzly Creek prior to the construction of Lake Davis in 1967. The area was patrolled by local game wardens who were on call day and night to enforce the limits. The fishery included rainbow, brown and brook trout, and catfish, and fishing was described as excellent all along Big Grizzly Creek.

3.4 Railroad Legacy

Plumas County has a rich legacy of railroad use since the latter part of the 19th century. Much has been written by historians about the development and utilization of the early railroads. However, from these accounts it is difficult now to trace the route of a given railroad line. In some cases the places referred to no longer exist and few people living today know or remember the exact location of where these railroads passed. Mother Nature has a way of gradually covering up man's work after it has been abandoned for a number of years. Such is the case with the railroad in Plumas County.

Plumas County emerged into the 20th century as an important mining, lumbering, and agricultural area. Since these industries required adequate and dependable transportation for their products, various proposals for building a railroad began to emerge. The goal was to construct a rail line that would connect the Pacific coast cities with cities of the east. In 1885, the California Land and Timber Company was instrumental in organizing the first pioneer railroad, the Sierra Valley and Mohawk Railroad (SVRR), which could deliver its lumber and agricultural products to Reno, Nevada. Work began from Plumas Junction early in 1886, and on to Beckwourth Pass. Financial problems stalled the project and it wasn't until 1903 that the line was completed to Clio in Mohawk Valley. A locomotive named Plumas was purchased in the late 1800's to pull the first rail cars down the new track.

In 1900, continuing financial problems brought operations of the SVRR to a screeching halt. At this time, the Nevada-California-Oregon Railroad (NCORR) purchased the railroad from Southern Pacific. Operations continued but so did feuds with a smaller railroad company, Boca and Loyalton Railroad that serviced Sierra Valley. A few years later, the Western Pacific Railroad began construction of its route through Beckwourth Pass and to the west. Both railroads survived over a number of years until in 1918, the SVRR was abandoned and parts of the line were sold to the Western Pacific.

Today, most of the pioneer railroads have disappeared under new roadways, highways or are concealed from site by dirt and growth of vegetation. Rotting ties, grading, cuts and occasional bits of iron provide evidence of where these rail lines used to run. The closest crossing of the railroad to Grizzly Ranch was at the old highway at the south end of Grizzly Road, near the Middle Fork Feather River. This area was formally known as Kerby. An old railroad grade from the Boca and Loyalton Railroad is visible to the east of a pasture gate and it runs to the south between a cluster of cottonwood trees. The rail line continues along the Feather River toward Portola where it crosses the river at or near the present Western Pacific Bridge. Its route into Portola then followed quite closely what is now the Western Pacific right-of-way.

Narrow gauge railroad lines were constructed in the early 20th century throughout the county to provide temporary transportation for timber harvested in areas that were being logged. The Grizzly Road corridor is riddled with old railroad grades and other artifacts that bear witness to the fact that this area was heavily logged until the 1960's. A narrow gauge railroad grade is still evident along Big Grizzly Creek within the land ownership of Grizzly Ranch. Long time residents reported that most of the rail line was constructed within the creek itself or along its banks and therefore, it is difficult to see its exact path. Some old railroad ties can be found and an old metal switch box near the creek, but not much else remains.

3.5 Ice House Operation

The harvesting, storage and sale of natural ice began in Boston in 1806. As the tools and processing were perfected by the 1850's, ice was being shipped all over the world. Realizing that ice production was a profitable business venture, many San Francisco merchants formed a company to bring ice to California from Alaska, then eventually from the Sierra Nevada. With the development of the first refrigerated railroad cars, this allowed fruit, vegetables and meat to be transported great distances and provided great profit for businessmen and employment to laborers and trainmen.

In 1912, Charles Gulling established the Grizzly Creek Ice Company. A dam was built across Big Grizzly Creek backing up the water for about ½ mile, which created an area of about 14 acres. This provided an ample field for ice harvest. Later a large building was constructed to store the ice crop. The walls were 3 feet thick and insulated with sawdust. A combination cookhouse and dining room, as well as a barracks and several 4-man cabins were also built. Today, piles of old tin cans, which are artifacts of the era, can be found behind the old cookhouse on Grizzly Ranch property.

Natural ice was harvested from the frozen pond by scoring the surface with an ice hook, cutting the ice with a horse-drawn ice plow, and then completing the cuts with a saw. The ice had to be at least 10 inches thick before cutting began. The long blocks of ice were then floated to the flume, and then to a chute into the ice storage house. In cold winters, 2-3 harvests were possible, and in very warm winters, ice was not harvested at all. Over 100 men would be employed to cut and store the ice. The ice was loaded in refrigerated rail cars and transported out of state. The same operation was also employed along the Middle Fork Feather River on the east end of Portola, in a small lake that was created behind the visitor's center.

The ice harvesting was discontinued in 1941. During World War II, the buildings at the Big Grizzly Creek ice camp were used to house and feed some of the young men who were taking flying instruction at Nervino Airport in Beckwourth. In 1943, the property was purchased by the Walton family and was converted to a children's camp, which is still in operation today. The dam and some of the original buildings can be found just south of the Grizzly Ranch property.

3.6 Lake Davis

Lake Davis was formed in 1967 by the construction of the Grizzly Valley Dam, on Big Grizzly Creek. The California Department of Water Resources (DWR) constructed the Grizzly Valley Dam as part of the State Water Project. The dam is about six miles north of Portola, California and creates a reservoir of about 4,026 surface acres and 84,371 acre-feet storage when full to its spillway elevation of 5,775 feet above sea level. The average depth of the reservoir is 21 feet, and the deepest point of the lake is 108 feet just upstream from the dam. The drainage area covers about 44 square miles. Originally planned to supplement irrigation in Sierra Valley, it was completed mainly to provide reservoir recreation, improve the fishery downstream in Big Grizzly Creek, and provide supplemental domestic water to the City of Portola.

Prior to construction of the reservoir, Big Grizzly Creek meandered across Grizzly Valley, which is now inundated by the lake. After leaving the valley, the creek dropped into a steep canyon at the south end and then into the stream channel that is present today. A rough dirt road followed the creek across the valley. Long time residents report that the creek was relatively stable through Grizzly Valley and below, with cobble, gravel and sand armoring the streambed. The riparian area supported willows and alders, which were dense in some areas, and the creek provided excellent habitat for rainbow and brook trout, frogs and insects. The water clarity was generally very clear and residents report that the creek never went dry, although flow was very low in the summer. Grizzly Valley was extensively grazed over a long period of time, which created barren areas along flatter reaches of the creek that were subject to some erosion. The valley is also rich with prehistoric lithic scatters and villages and other significant artifacts, which are largely submerged under the lake.

Today, Lake Davis supports a well-known trophy trout fishery. It provides both excellent summer and winter fishing. Ice fishing is a popular pastime, and often yields the biggest fish of the year. Fish species include rainbow trout, brook trout, brown trout, brown bullheads, northern pike, golden shiners, pumpkinseed sunfish, and large mouth bass. The lake also provides habitat for a diverse array of aquatic and terrestrial plants, waterfowl and wildlife species. It supports recreational opportunities on land such as camping and hiking. Recreation use of Lake Davis and its three campgrounds, which are managed by the Plumas National Forest, is estimated to average over 400,000 recreational visitor-days per year.

Below the reservoir, Big Grizzly Creek flows approximately 6.5 miles and drops 800 feet in elevation into the Middle Fork Feather River, which is hydrologically connected to the Bay Delta and the Pacific Ocean. The connectivity of Lake Davis with the Bay Delta poses concerns that are discussed in Section 6.0 regarding the presence of northern pike, an exotic species, which were discovered in Lake Davis in1994.

4.0 Physical Setting

4.1 Location and Topography

The Grizzly Ranch project generally lies in a gently sloping basin, which drains to the west and southwest into Big Grizzly Creek. The elevation ranges from slightly less than 5,000 feet in the southwest part of the property to over 6,000 feet in the northeast corner. The property is bounded on the west by the northwest trending Grizzly Ridge and on the east by the ridge that extends south from Crocker Mountain. Grizzly Valley (now Lake Davis) lies northwest of the site, and Sierra Valley lies to the southeast.

The north, east and southeast edges of the basin consist of moderate to steep sloping hill and ravine topography, with slopes ranging from 15 to 30 percent toward the central portion of the site, then to the southwest. The northwest portion of the site, divided by Grizzly Road, is moderately sloping with slopes ranging from 10-15 percent. The central and southwest areas are gently to moderately sloping hill and ravine topography with slopes ranging from 5 to 10 percent. Numerous small drainages are situated from northeast to southwest, and historically the major portion of the runoff was collected in a large drainage basin in the central portion of the project. Consistent with the geology found east of the Sierra crest, the project area consists of numerous small fault blocks that create the ridges and valleys of the area.

Aerial View of Grizzly Ranch

Moderately Sloped Topography

For the most part, Big Grizzly Creek flows through a steep canyon from the dam at Lake Davis to the Grizzly Ranch property and beyond. Though the topography along the creek is generally steep even as it crosses Grizzly Ranch, several relatively flat floodplain areas are located in the north end of the property, which could provide suitable locations for creek access and other recreational development.

4.2 Climate

No historical precipitation data is available for the Grizzly Ranch. The closest precipitation measurements are taken at the Department of Water Resources (DWR) Beckwourth office, 5 miles east, where average annual precipitation of approximately 16-inches is reported. Given the higher elevation and westerly location of Grizzly Ranch from Beckwourth, precipitation is probably greater. Climatic records from Lake Davis estimate the average rainfall at 25 inches per year at lake level, and up to 40 inches per year on

surrounding ridges. Average evaporation rates are estimated at 65 inches per year. Grizzly Ranch now has a fully functioning automated weather station that provides climatic data.

The earliest recorded information on flooding in Plumas County was in 1805, when a major rain event flooded most of the county. Thousands of Native Americans lost their lives and hundreds of rancherias on the banks of rivers were washed away and destroyed. The annals of the Hudson Bay Company show that the year 1818 was also a year of excessive storms and tremendous floods in Plumas County. Other wet seasons reported by early pioneers include 1849-50 and 1852-53, when the Sacramento Valley was one vast sea of water and access to Plumas County was blocked at mountain passes, limiting transport of food and supplies to settlers. The winter of 1861-62 will long be remembered throughout California for its devastating floods that surged down from the Sierra Nevada, sweeping away everything in its path. In Plumas County, bridges and mining claims were severely damaged or destroyed in 1862, as they were following intense storms in 1881. Long time residents consistently report a shift to milder temperatures and reduced snowpack over the last 20 years in the Plumas County area.

4.3 Geology

The geologic history of the Sierra Nevada is quite complex. The northeastern Sierra Nevada is a large west-tilted block bounded on the east by steep normal faults. The Sierra has been a topographically high area since early Mesozoic geologic time, roughly 200 million years ago. However, the present cycle of mountain building and erosion began in the Pliocene era some 10 million years ago. During this uplift, the major westward tilting of the mountain block took place. The land mass is now pulling apart in an east-west direction caused by an upwelling of magma from the upper mantle that is forcing an extension of the Sierra Nevada to the west. Differential block movements have caused large changes in elevation from east to west over short horizontal distances in the vicinity of Grizzly Ranch. Major west-flowing streams were rejuvenated or incised in new locations where old valleys were filled by volcanic rocks.

A complex system of faults gives rise to the topography surrounding the Grizzly Ranch property today. The Hot Springs Fault (HSF), which is a primary fault, trends north-northwest and nearly bisects the property. The HSF extends from Lake Davis to south of Sierra Valley. The Crocker Mountain Fault trends northwest across the property from the base of Crocker Mountain, and the Grizzly Fault is a more northerly trending fault along Big Grizzly Creek. Near the southern property boundary, a northeast trending secondary fault truncates against the HSF.

Numerous northeast trending faults are also present in the mountain blocks bounding Lake Davis to the northwest, but none are mapped in the project area. It is anticipated that crosscutting faults are present in the area but may be obscured by alluvium. Intermittent streams tributary to Big Grizzly Creek may be developed along northeast trending fractures of faults.

Several rock types occur on or adjacent to the project site. The main types include;

1) Recent alluvium sand and gravel deposited in stream channels and Big Grizzly Creek,
2) Holocene and Pleistocene fan deposits consisting primarily of alluvial sandy clays and silts,
3) Pleistocene lake-bed sediments consisting primarily of silts and clays finer-grained than the fan deposits,
4) Miocene and Pliocene volcanic rock consisting primarily of andesitic flow rock, plugs, tuffs, dike and breccia. Most extensive rock type over the site. Harder rock occurs on steeper slopes, and

5) Mesozoic granitic rocks consisting primarily of equi-granular gray to light pink massive- the oldest material on the site, located in the north and western margins of the property.

Generally, granitic rocks of the Mesozoic age and Jurassic-Cretaceous quartz diorite underlie most of the project area while alluvium and Tertiary metavolcanics (basaltic andesite) overly the deeper granitic rocks up to 250 feet deep. The volcanics are generally overlain by topsoil alluvium and, below 5,100 feet, by lacustrine lake deposits from the Pleistocene Lake Beckwourth. The ridge to the west of the property is composed of Mesozoic age granitic rocks, while that of the east is primarily Miocene-Pliocene age andesite intrusions. Hydrothermally altered rocks have been identified at the surface along Big Grizzly Creek just northwest of the property, which indicates that the rocks most likely extend under alluvium in the project area.

The largest area of recent stream alluvium is in the Big Grizzly Creek basin. The alluvium is mostly fine-grained sediments deposited in the adjacent meadows and floodplains, but could include some coarser stream deposits. Several volcanic intrusions into granitic rock formations were identified just west of the Grizzly Ice Pond. Minor mineralization was noted in places at intrusive contact. Numerous springs and seeps were also observed along the contact points near the creek.

4.4 Soils

The Natural Resource Conservation Service surveyed and characterized the soils of Plumas County in 2001. The Plumas Series is the dominant soil group in the area. The series is a group of very deep, well-drained soils, which are formed in mixed alluvium. Plumas soils are largely located on alluvial fans, which is consistent with soils found in the Big Grizzly Creek drainage and elsewhere on Grizzly Ranch.

In general, soils on the property are dominantly granular materials overlying highly weathered bedrock with soil-like properties. Clay soils with significant shrink/swell properties are present in the northwest portion of the project and near the irrigation pond. Localized areas of hard granitic bedrock are anticipated in the west end of the property. The area adjacent to Big Grizzly Creek is primarily comprised of alluvium which overlays granitic and fractured volcanic outcrops at depths ranging from 3 to 6 feet in depth in some locations.

The soil surface generally consists of 6 to 24 inches of brown to dark brown, loose to medium dense, silty to clayey sand. Small areas in the southern portion of the site are mapped as altered silicic tuff. The profile of the site consists of inter-bedded strata of varying soil types ranging from silty and clayey sand and sandy clayey sand and sandy clays to sandy silt. Site soils have a low to moderate potential for erosion from surface run-off. Possible exceptions would be sandy soils in the extreme northwest portion of the site overlying granitic bedrock. These soils have a moderate to high erosion potential since they are not cohesive.

4.5 Hydrology, Hydrogeology and Wetlands

The project is located within the Grizzly Creek sub-watershed, which is a tributary to the Middle Fork Feather River. The watershed drains approximately 2,000 acres or 3.13 square miles of land. The Grizzly

Creek sub-watershed can be divided into 32 hydrologic basins ranging in area from about 7 acres to 309 acres within Grizzly Ranch.

The majority of hydrologic features in the basin are intermittent and ephemeral drainages and/or swales with spring/seeps, and associated adjacent wetland areas. The primary source of hydrology for these basins is spring runoff from snowmelt and groundwater discharge from springs and seeps. Fifteen spring/seep complexes have been identified within the project; however, few of these provide any significant flow downstream. Most are seeps where the area around the spring is saturated, but flow is not discharging as surface flow. The channels are primarily supported by spring runoff and surface precipitation events, and ground water discharge to a lesser degree.

Big Grizzly Creek above the Ice Pond

Big Grizzly Creek is main surface water resource on Grizzly Ranch. It flows approximately ½ mile through the western portion of the property from north to south at approximately 5,100 feet in elevation. The creek originates at the outfall of Lake Davis dam which is located northwest of Grizzly Ranch and eventually enters the Middle Fork Feather River south of the property. Several unnamed intermittent and ephemeral streams drain into Big Grizzly Creek from the northeast to southwest across the property. Since the flows in Big Grizzly Creek are regulated at the dam by DWR, water flows year round and minimum flows are set at 10 cfs. Water quality is generally good with cold stream temperatures and adequate nutrients to support a productive cold-water fishery (see Section 7.0).

The depositional floodplains contain coarse-grained material from gravel to moderate cobble, which is piled in bars within that zone, and up into the first terrace. Larger cobble is deposited even further away from the channel, evidence of high historical flows (prior to the construction of Lake Davis) that transported large bedrock material from upstream sources. Though surface water in this watershed originates on the east side of the Sierra crest, it ultimately drains into the Pacific Ocean through the Feather River system and the California State Water Project.

Areas east of the Sierra crest in Plumas County, such as Grizzly Ranch, have many features that are conducive to good ground water production. These include complex systems of fractures and faults, and the widespread presence of volcanic and unconsolidated sedimentary deposits. The intermittent drainages, springs, and wetlands found on the project function as groundwater discharge areas for the most part, but research suggests that Big Grizzly Creek and the intermittent tributaries may be “losing” streams through parts of the property, where the drainages leave steep slopes and enter alleviated basin, thereby recharging ground water at various locations. The predominance of northeast striking faults, as previously described,

supports the notion that groundwater recharge occurs in the northeast portion of the project, and that the groundwater eventually discharges into Big Grizzly Creek through surface and subsurface flow.

5.0 Biological Setting

5.1 Fishery and Aquatic Biota

The eastern portion of Plumas County has been a fishing haven for decades due to excellent aquatic habitat and healthy fish populations at some locations. The area became renown during the 1930's when fishing parties would come from the Bay Area on the California Zephyr Rail Line. Anglers continue to come to Plumas County for excellent lake and stream fishing.

Interviews with long time Plumas County residents describe fishing as excellent in northern reaches of Big Grizzly Creek through Grizzly Valley before the dam was constructed. At that time, the creek flowed through the Valberti Ranch and supported rainbow, brown and brook trout, and catfish. Residents recall trout as large as 5 pounds. A rough dirt road was used to access the best fishing spots. At the lower reaches of the creek, the trout migrated upstream from the Middle Fork Feather River to spawn in Big Grizzly Creek as far as the Ice Pond dam. The creek below Grizzly Valley was described as good stream habitat with abundant shade, logs and other woody debris and a good mix of substrate of gravel, cobble and a little sand.

Today, Big Grizzly Creek supports a productive cold-water fishery. This is despite the Lake Davis poisoning and subsequent fish kill in Big Grizzly Creek in 1997. In July 1998, the CDFG began restocking Lake Davis with over a million trout including hundreds of trophy-sized rainbow trout to rebuild the recreational trout fishery. They also restocked Big Grizzly Creek below the dam in 1998 and 1999 with fingerling and sport-sized rainbow and brown trout plus a few broodstock rainbows and browns in 1999. Though native strains of trout were wiped out, hatchery trout have repopulated the creek due to excellent habitat conditions. Both rainbow and brown trout currently reside in the creek.

Phytoplankton and zooplankton are important biotic components of aquatic ecosystems. Phytoplankton are microscopic single cell algae that live in aquatic environments. They are the base of the food chain in most aquatic habitats. They are preyed upon by zooplankton that makes up much of the food base for trout and other fish species. Zooplankton found in Lake Davis includes cladocerans, rotifer, and copepods. Species of aquatic insects found at the lake include caddishflies, mayflies, dragonflies, and water striders. The poisoning in 1997 of Lake Davis wiped out most of these species. No data is currently available for Big Grizzly Creek.

Benthic invertebrates are also important components to aquatic ecosystems but are difficult and expensive to monitor. Therefore, they were not sampled as part of this monitoring program. But studies carried out at Lake Davis indicate the presence of several species of midge larvae. Microcrustaceans include daphnids and ostracods. Leeches are also periodically abundant in Lake Davis. Aquatic snails and clams have been collected, as have nonnative crayfish. The latter have both been observed in Big Grizzly Creek but no data is available to assess the population density or the seasonal variation in numbers.

Amphibians: CDFG field crews have observed the Pacific tree frog in Big Grizzly Creek. Water snakes have been observed in Lake Davis. More comprehensive data on amphibian populations for this region were not found. The amphibian population may recover at a slower rate than the fishery following poisoning.

5.2 Wildlife Resources

Grizzly Ranch is located in the migratory corridor of the Doyle herd of black tail deer. Large numbers of deer migrate in the spring from the east in Doyle, traveling west to meadows and valleys near the Grizzly Road corridor. Long time residents report that hundreds of black tailed deer historically used the Grizzly Road corridor each year, from Highway 70 to Lake Davis, as summer range for foraging and fawning. It was common to see large groups of deer grazing and fawning in Grizzly Valley and in meadows near Grizzly Ranch. Deer populations have greatly decreased since the 1960's due to fragmentation of migratory corridors, highway traffic, residential development, and domestic dogs.

Wildlife species that occur in the Grizzly Ranch area typify those of eastside pine habitats. Two species of big game use the general area; black-tail deer and black bear. Upland game includes the western gray and Douglas squirrels, cottontails, hares, and blue grouse. Common non-game mammals include beaver, muskrat, coyotes, mountain lions, badger, martens, fishers, bobcats, shrews, moles, mice, gophers, and raccoons.

Fourteen species of waterfowl, including numerous species of ducks and geese, have been sited in the vicinity of Grizzly Ranch. Common bird species are hummingbirds, woodpeckers, flycatchers, jays, dippers, kingfishers, herons, chickadees, warblers, sparrows, nuthatches, and finches. More recently, ravens and mountain quail are abundant. Common birds of prey found in the area include red-tailed hawks, northern harriers, American kestrel, golden eagles, great-horned owls, bald eagles, osprey, and northern goshawk. Special status wildlife species that potentially could be found in the area are listed in Appendix A.

5.3 Vegetation Resources

The plant life in Grizzly Ranch is characterized as east side pine complex. Several vegetation zones exist across the property and the distribution of vegetation types is a function of elevation, aspect, soils, hydrology, precipitation and historic land use. Vegetation zones commonly found along Big Grizzly Creek include the riparian and upland Jeffery Pine zones.

Riparian zones along Big Grizzly Creek are composed of emergent wetland and riparian taxa. Dominant species include willow and alder with dense stands of nut sedge and beaked sedge, mountain timothy, annual bluegrass, and clover. Spike rush, perennial grasses, and cottonwoods are common on adjacent floodplains. On drier terrace sites near the creek, dominant species include bluegrass, cheatgrass, phlox, Alsike clover, and buttercup with a few Jeffrey pines. In wet swales that feed Big Grizzly Creek, common species are western serviceberry, some willows, perennial grasses, sedges, sparse Jeffery pine, and a few small areas of black oak.

Upland Jeffery Pine zones are located on dryer slopes along the creek corridor, where the overstory is composed of a moderately dense canopy of ponderosa and Jeffrey pine, with lesser amounts of incense cedar and white fir. The understory is primarily comprised of low sagebrush, rabbitbrush, buckbrush and bitterbrush in open canopy areas, and mule ears, squaw carpet and a mix of annual and perennial grasses. Dry south-facing slopes that were previously impacted by wildfire include big sagebrush with lesser amounts of bitterbrush, mule ears and annual grasses. Ridge areas support scattered pines at higher elevations. Special status plant species that could potentially occur in the area are listed in Appendix A.

East Side Pine Complex includes Jeffery pine, yellow pine, incense cedar and white fir

5.4 Special Status Species

Special status species are those that are protected under the federal Endangered Species Act, the California Endangered Species Act and the California Environmental Quality Act as well as those that are identified as sensitive by the California Native Plant Society (CNPS) and the US Forest Service. A special status species list was compiled based on the results of a November 2004 search of California Department of Fish and Game Natural Diversity Database and the California Native Plant Society (CNPS) Electronic Inventory for the Blairsden, Clio, Gold Lake, Crocker Mountain, Portola, Calpine, Grizzly Valley, Mount Ingalls, and Johnsville U.S. Geological Survey quadrangles. The US Fish and Wildlife Service electronic inventory for the Portola quadrangle was also consulted. Appendix A identifies special status species that may potentially occur or are known to occur in habitats similar to those found in or adjacent to the creek.

Prior to 2005, no rare or endangered plants or wildlife species have been reported or sighted within the Portola Quadrangle, which includes the entire Grizzly Ranch property. In addition, no threatened or endangered species of fish or species of special concern in Lake Davis or the lower reach of Big Grizzly Creek has been reported.

5.5 Plant and Wildlife Surveys

Reconnaissance plant and wildlife surveys were conducted in 2005 at Grizzly Ranch's effluent pipeline project site on Big Grizzly Creek. The site is located just downstream of the Walton's Ice Pond. These surveys confirmed earlier findings that no rare or endangered species were reported in the area. Species identified in the 2005 surveys are listed in Appendix B (plant taxa) and Appendix C (animal taxa). Specific results are presented below.

No special status plants were observed in the pipeline area. The plant species observed during the surveys are listed in Appendix B.

The wildlife survey revealed that the yellow warbler, a CDFG Species of Special Concern, was observed foraging among alders and willows immediately adjacent to the pipeline corridor. It is likely that this bird also nests in this area. Other species that probably occur in the area include the white-headed woodpecker, a USFWS Species of Concern, and the American dipper, a common bird that has been designated as a species of local concern. The state-endangered willow flycatcher has not been documented to occur in the vicinity of the pipeline, however, suitable willow thicket habitat along Grizzly Creek is present, including some areas immediately downstream of the corridor. Osprey, which is a California Species of Concern, commonly visits Big Grizzly Creek and two active nests were identified in the vicinity of Grizzly Ranch along the creek. The osprey is commonly seen at Lake Davis during the spring and summer. The birds arrive at nesting areas in March and April. Intense human activity, such as logging, in the vicinity of nesting osprey has been shown to negatively influence nest productivity. Bald eagle are periodically sited while foraging near Lake Davis and at the confluence of Big Grizzly Creek and the Middle Fork Feather River.

6.0 Northern Pike Eradication

6.1 Background

Northern pike, *Esox lucius*, is an exotic fish species that was first discovered in 1989 at Frenchman Lake, which is approximately 20 miles east of Lake Davis. The long-lived, fast-growing, and highly predaceous pike eat mostly fish, and trout are an easy prey. The California Department of Fish and Game (CDFG) poisoned the lake and the Middle Fork Feather River in Sierra Valley with the organic pesticide rotenone in 1991, successfully eradicating the pike.

Northern pike were later discovered in Lake Davis in August 1994. CDFG voiced their concern that Lake Davis and other California lakes could lose their trout fishery if the exotic pike were not eradicated. In addition, there was concern that pike will migrate through the Middle Fork Feather River and eventually into the Bay Delta and Pacific Ocean. The CDFG believes this would create additional predation on and competition with several state or federally listed sensitive fish, including Chinook salmon, steelhead, delta smelt and the Sacramento splittail. CDFG believes that the successful establishment of pike in the Delta could jeopardize the State's multi-million dollar commercial and recreational salmon fishery.

In 1997, the CDFG treated Lake Davis to eradicate the pike despite the objections from the local governments and citizens of Portola. This was the first time CDFG used this treatment in a drinking water supply lake. Local citizens were concerned about the persistence of the chemicals in the water and lake sediments as well as the potential for long-term contamination of ground water in the vicinity of the lake.

6.2 Chemical Treatment

Despite these concerns, 16,000 gallons of the registered piscicides Nusyn-Noxfish and 32 tons of ProNoxfish powder were used to eradicate the pike. The liquid formulation Nusyn-Noxfish contains rotenone, organic emulsifiers and solvents, and synergist piperonyl butoxide (PBO). ProNoxfish powder consists of ground-up plant roots, rotenone and does not contain emulsifiers, solvents and carriers. Both chemicals were applied to Lake Davis and tributaries on October 15, 1997. CDFG reported that the application of these chemicals throughout the reservoir would result in the presence of rotenone, PBO, rotenolone, xylene, naphthalene, methylnaphthalene, and trichloroethylene.

Rotenone is a large organic compound that affects the ability of gill-breathing organisms to utilize oxygen at the cellular level. It doesn't persist in the water column for long, but attaches to fats or organics in soil and settles out. PBO is a synergist used in a wide variety of pesticides and was developed in 1947 using naturally occurring safrole as the key raw ingredient. Synergists are chemicals that, while lacking pesticidal properties of their own, enhance the pesticidal properties of other active ingredients. PBO is used in conjunction with pesticides such as pyrethrins, pyrethroids, rotenone and carbamates. It tends to persist longer than the rotenone, which has a shorter half-life. PBO is considered moderately toxic to fish and highly toxic to other aquatic organisms. Rotenone was detoxified with potassium permanganate for 43 days following the poisoning at the dam. Discharge from the lake was treated before it was released into Big Grizzly Creek.

6.3 Residual Chemical Effects

Following chemical treatment, water and sediment samples were collected by CDFG at several sample sites and were tested for rotenone, volatile organic compounds (VOC), semi-VOCs and PBO. The results of monitoring are discussed below.

The project had several unforeseen and undesired impacts. Most serious was the unanticipated fish-kill that extended about four miles downstream in Big Grizzly Creek. This was largely the result of un-neutralized rotenone in the reservoir discharge. Discharge had been reduced to 5 cfs for the duration of the period of toxicity, and potassium permanganate was metered into the discharge to neutralize the rotenone following poisoning. But unmanageable variations in rotenone concentration resulted in poor detoxification at the dam, which allowed untreated rotenone to enter Big Grizzly Creek and cause the fish-kill. Since detoxification takes 30 minutes to be effective, CDFG anticipated some potential fish mortality in the first ½ mile below the dam, but not the four-mile area that was reported. Mortality was observed down to the Ice Pond, just below the Grizzly Ranch property. Original estimates called for 14 days of treatment in Big Grizzly Creek, but the detoxification was carried on for 43 days following the lake poisoning. The chemicals used to poison pike did not dissipate as quickly as expected due to cold water temperatures and poor chemical mixing. Cages of rainbow trout were used in Big Grizzly Creek to monitor the success or failure of detoxification.

The time required for natural degradation of rotenone in water is typically less than three to four weeks, depending on water temperature, sunlight, wind and wave action. Warmer water temperature can accelerate the detoxification process to 14 days or less if temperatures are over 55º F. Since the poisoning was carried out in October, water temperatures were lower than optimal, and residual chemicals persisted for several months longer than anticipated. Rotenone concentrations in Lake Davis were sufficient to eliminate the northern pike but residues persisted up to 48 days after application in the water. In sediment samples, these chemicals persisted for 55 days after treatment.

The dead fish and the chemicals caused a temporary odor, which was mitigated by closing the lake and recreation facilities to the public. CDFG projected the lake would be closed for up to 4 weeks following treatment, but they fell far short of the actual period which was from October 1997 to July 1998 due to the persistence of residual chemicals in water and sediment samples.

PBO was detected in the lake for 39 weeks after treatment, which was much longer than anticipated. It tends to persist longer than the rotenone, which has a shorter half-life and can be mildly toxic to aquatic organisms.

Minute concentrations of VOCs were detected in Lake Davis for one week following the application of Nusyn-Noxfish. The semi-VOCs were detected for up to two weeks following treatment, so these chemicals dissipated faster than rotenone. No VOCs were detected in the sediments, while three semi-VOCs were found in sediments and persisted 55 days after treatment.

The only water quality parameter that was affected by treatment was a short-term impact on dissolved oxygen (DO). DO was within acceptable limits for aquatic life within three weeks following treatment.

6.4 Effects on Aquatic Biota

Fish vary in their susceptibility to rotenone. Trout and pike are very sensitive, while brown bullheads are less sensitive. The application rate of 2 mg/L was expected to kill most fish except a few residual bullheads. Following the fish-kill in Big Grizzly Creek, CDFG stocked the creek in 1998 and 1999 with fingerling and sport-sized rainbow and brown trout plus a few broodstock rainbows and browns in 1999.

Zooplankton and larval and adult aquatic insects were not expected to survive the treatment, but most mollusks and macroinvertibrates (clams, snails and crayfish) would not be affected. In addition, amphibian larva, tadpoles and metamorphosing salamanders were not expected to survive, but adults would not be affected at the concentrations used. CDFG stated that natural processes and the survival of eggs would quickly repopulate the reservoir with aquatic invertebrates following treatment.

CDFG reported that birds and mammals are not affected by rotenone either by drinking the treated water, or by consuming dead fish or other aquatic fauna that contain rotenone residue. The indirect affect would be a temporary increase in food supply due to dead fish followed by a reduced food supply for resident and migrating species until the fish are restocked

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6.5 Effects on Groundwater

In early 1998, testing of the lake water showed the continuing presence of the chemicals administered during the poisoning, which catalyzed additional geologic and ground water studies around the lake. The water in several wells downstream from the lake were monitored to detect the presence of the poison and to determine if they were hydrologically connected to the lake. CDFG reported that rotenone leaches vertically less than 2 cm in most soil types and in other similar applications, no ground water effects were reported. Results from additional studies showed that ground water wells to the south and east of the lake do not appear to be threatened by the 1997 poisoning of Lake Davis because the groundwater in these areas is higher in elevation than the lake. Therefore, they flow into the lake.

An exception to this flow regime exists below the dam and down Grizzly Road where water levels in wells are lower than the water surface in Lake Davis. In this area, there is a potential for sub-surface flow of water out of the lake into drinking water aquifers. Semi-annual monitoring of wells close to the lake near Grizzly Road was recommended for a 10-year period. These wells were most likely to intercept detectable concentrations of potential contaminants of concern since less dispersive mixing would have taken place over the shorter flow distance. Since rotenone is an organic compound, it is difficult to know its absorptive properties in various sub-surface geologic materials. Monitoring results to date indicate no residual trace of rotenone or any other chemicals used in the poisoning of Lake Davis.

6.6 Chemical Treatment Proposed for 2007

In May 1999, northern pike were discovered once again in Lake Davis. With the resurgence pike, additional treatment is planned for fall 2007. CDFG is preparing an Environmental Impact Report to present impacts and alternatives, which will be distributed for public review in the near future. The preferred alternative includes the use of rotenone. Based on the agency's failure to contain rotenone in the lake in 1997, CDFG has spent several years evaluating what went wrong and how to best avoid a reoccurrence in 2007.

Several options are being considered to avoid or minimize the risk of downstream impacts. These include:

- Chemical neutralization with a reduced discharge (1-5 cfs),
- Use of activated carbon filtration at the dam of a minimal discharge (1-2 cfs),
- Route discharge into a holding tank for neutralization then release at a low flow (1-2 cfs), and
- Curtail controlled discharge entirely for the duration of any toxicity and avoid the use of potassium permanganate entirely. DWR contends that even with no flow, the fish in Big Grizzly Creek could survive for a month in pools and pockets of deep water, from dam seepage and downstream spring fed sources.

Some additional alternatives and safeguards that are being considered are listed below.

- Conduct chemical treatment in September or early October, before the water temperature in the lake drops below 55ºF. Chemicals work slower in colder water.

- Lower the volume of water in the lake to 20,000-30,000 acre-feet prior to treatment. In 1997, the volume was over 40,000 acre-feet. Larger water volumes require more chemicals for treatment, which increases the risk of downstream contamination.

- Restrict the flow discharging into Big Grizzly Creek following poisoning to 1-2 cfs. It takes 30 minutes for neutralization to take place, so less water means quicker treatment. The range of kill would also be confined to a couple hundred yards below the dam in the worst-case scenario. In 1997, the discharge was 5 cfs, which the neutralization process could not handle.

- DWR recently completed a study and prepared a CEQA Mitigated Negative Declaration to allow for retrofitting the existing graters on the outlet side of the dam with a 1 mm filter screen called a strainer. This new device would insure containment of pike in the lake during poisoning and would not allow eggs or fry to pass through the outlet valve until pike eradication was complete.

The effect of the proposed 2007 treatment on Big Grizzly Creek can only be estimated, but CDFG is optimistic that with safeguards in place and a better implementation plan that the fishery will not be impacted. The discharge into Big Grizzly Creek would be increased from 10 cfs to 100-180 cfs from January-August 2007 to drain down the lake. In September following chemical treatment, the discharge will be between ¼-2 cfs for at least a month, depending upon the treatment alternative selected. The success or failure of the next round of chemical treatment will depend on how carefully the process is planned and carried out.

7.0 Big Grizzly Creek Water Quality Analysis

7.1 Habitat and Hydrology

The fishery of Big Grizzly Creek is notable for its wild trout population and related angling benefits. The creek continues to provide good habitat for cold-water fish and other aquatic organisms despite the chemical treatment of Lake Davis in 1997. Since the construction of the dam, scouring high flows have been virtually eliminated due to the regulated flow regime managed by DWR. Releases for recreation, fish and wildlife are adjusted annually based on the May 1st water surface elevation of Lake Davis but minimum flows to sustain aquatic habitat downstream and to meet adjudicated water rights are set at 10 cfs. In addition to the releases for these purposes, the reservoir is operated to prevent spill over the dam due to concerns over fish mortality. This necessitates large releases of up to 250 cfs in the early spring of some years to increase storage capacity in the lake for snowmelt. As a result, spill has been negligible since 1986.

Generally, Big Grizzly Creek is well armored with bedrock, cobble and riparian vegetation, creating a stable physical environment with excellent water quality, which is unique for eastern Plumas County drainages. The creek was historically considered a self- sustaining wild trout stream, where spawning took place yearly in the creek to maintain the population. After the poisoning of the creek, CDFG stocked the creek with rainbow and brown trout to reintroduce trout to the area. The creek is a valuable resource since it provides good habitat for trout and other aquatic species, and has tremendous aesthetic and recreational value.

7.2 Water Quality Testing

A water quality study was carried out in 2005, and results are presented in this section. The objective of the analysis was to characterize the physical and chemical state of water and streambed sediments in Big Grizzly Creek and to identify the presence or absence of key chemical constituents residual to the Lake Davis poisoning. Physical and chemical parameters can be used to evaluate habitat value for trout and other aquatic biota. Chemical data were obtained from this study, while physical creek data and fisheries survey data were provided by the CDFG in study carried out in 2005 by Charles Brown.

Physical and chemical indicators are commonly used to measure and evaluate the health of aquatic habitats over time. The criteria for selecting these indicators are based on scientific, practical and programmatic considerations. Scientific validity is the foundation for determining whether data can be compared with reference conditions or other sites. An indicator must not only be scientifically valid, but its application must be practical when placed within the constraints of a monitoring program. Of primary importance is that the indicator must be able to address the question posed by the monitoring program.

Though this investigation includes data collection at one point in time and is not a monitoring program per se, the analysis is organized to facilitate a potential long term monitoring program where these data represent the baseline to assess trends. The physical and chemical indicators selected for this habitat investigation are standard parameters that are used for conducting water quality and streambed analyses.

Though not a standard constituent for sediment sampling, piperonyl butoxide (PBO) was included in the analysis to capture any potential residual affects that may be stored in the streambed fines and gravels from the Lake Davis poisoning. PBO persisted for 10 months in water samples in Lake Davis following the poisoning. CDFG reported that rotenone, rotenolone, xylene, naphthalene, methylnaphthalene, and trichloroethylene (semi-VOCs) would also be present immediately following the poisoning but these chemicals are supposed to dissipate in 4-6 weeks. For this study, sediment testing included both PBO's and semi-VOCs, as shown in Table 1. VOCs were not tested since they volatilize quickly making detection after several years unlikely. An assessment study to identify concentrations of MTBE in Lake Davis was conducted by DWR in 1997. The study revealed that low concentrations of MTBE were present in the lake. Therefore, water samples were tested for the presence of MTBE in Big Grizzly Creek as part of this analysis.

Biological parameters were not included in this investigation due to the past and future poisoning planned by CDFG to eradicate pike in Lake Davis. The 1997 poisoning removed most of the aquatic biota in Big Grizzly Creek above the Ice Pond so sampling to characterize a habitat in transition has limited value. To evaluate long term recovery, biological studies are recommended two years after the 2007 poisoning to obtain a post-poisoning baseline condition for macroinvertibrates, zooplankton and benthic invertebrate communities. These data are available for Lake Davis in the 1996 EIR, prior to treatment, but not for Big Grizzly Creek.

7.3 Sampling Methods

Water quality and streambed sediment grab samples were collected in 2005 by Grizzly Meadows Environmental Consulting at two permanent stations along Big Grizzly Creek to characterize the water quality condition of the creek. Site 1 was located at the upstream northern border of the property and Site 2 was located downstream just above the Ice Pond at the southern edge of the property. Water samples were collected at both Site 1 and Site 2 while only one sediment/soil sample was collected at Site 2. Sample bottles were labeled and sent to Western Environmental Testing Laboratory (WET Lab), Reno, Nevada for analysis.

The study plan also included collection of physical data to monitor water temperature and ambient air temperature from June 15- October 15 at two stations along Big Grizzly Creek. Two HOBO thermometer probes were installed in the creek in June 2005. The location was flagged and GPS coordinates were identified. The probes record temperature continuously in one-half hour intervals, and the data is later downloaded into a computer software program for analysis at the end of the monitoring season. Unfortunately, field crews were not able to locate either probe in fall 2005. They were lost to either vandalism or they became dislodged and were carried downstream in high flows and therefore, water temperature data is not available for the 2005 season. New equipment was purchased and will be installed more securely in spring 2006 to provide data for the 2006 field season. A data form to store both ambient air and water temperature data and a map showing the sampling locations was created.

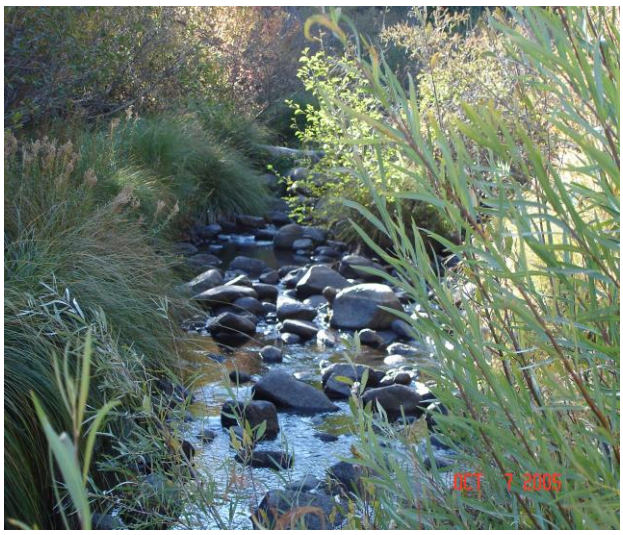
7.4 Chemical Constituents and Results

A summary of constituents sampled for water quality and sediment are listed in Table 1. All of these analytes are considered chemicals of concern in freshwater systems and are fairly standard tests for fish habitat assessment. An exception is PBO, as previously discussed. Analytical results from the laboratory tests are included in Appendix F.

Table 1: Water Quality and Sediment Constituents

Analysis	Constituents	Water Samples	Sediment Samples
Heavy Metals	Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc (13 priority pollutants)	√	√
Hardness	$CaC0^3$	√	
Inorganics	Total phosphorus	√	
	Nitrate nitrogen (NO^3)	√	√
	Total Kjeldahl nitrogen		√
	Piperonyl butoxide (PBO)		√
Organic Compounds	MTBE (methyl-tert-butyl-ether)/ BTEX (benzene, toluene, ethylbenzene, and xylene	√	
	Semi-volatile organic compounds (pesticides)		√
	Fecal coliform (E. coli)	√	
Physical Water Parameters[1]	Water temperature (F°), dissolved oxygen (mg/L), electric conductivity (µs), pH, turbidity (NTU)	√	

[1] Data obtained from the CDFG study, Brown 2005.



Dense riparian vegetation, pools and riffles on Big Grizzly Creek

Table 2 presents the results of laboratory testing for chemical constituents in the water quality samples at Site 1 and Site 2.

Table 2: Chemical Water Quality Data for Big Grizzly Creek- 5/12/05

Constituent/Parameter	Site 1	Site 2	Detection Limit	RWQCB Objectives [1]
Hardness	41	42	1 mg/L as $CaC0^3$	NA
pH	7.79	7.78	0.1	6.5-8.5
Heavy Metals (mg/L)				
Antimony	<0.010	<0.010		0.006
Arsenic	<0.030	<0.0300	0.001	0.01
Beryllium	<0.0010	<0.0010	0.0025	0.1
Cadmium	<0.0010	<0.0010	0.0025	0.00022
Chromium	<0.0050	<0.0050	0.0005	
Copper	<0.050	<0.050	0.002	0.0056
Lead	<0.010	<0.010	0.0065	0.065
Mercury	<0.00010	0.00020	0.0002	0.0014
Nickel	<0.010	<0.010	0.02	0.470
Selenium	<0.020	<0.020	0.001	0.012
Silver	<0.0050	<0.0050	0.005	0.01
Thallium	<0.050	<0.050		0.02
Zinc	<0.010	<0.010	0.05	0.1
Trace Organics (µg/L)				
MTBE/ BTEX	ND	ND	5.0	
Fecal coliform (E. coli) cfu/100mL	4.0	2.0		
Inorganics				
Total Phosphorus	0.011	0.040	0.1	0.05
Nitrate Nitrogen (NO^3)	0.028	0.027	0.5	45.0

[1] Regional Water Quality Control Board Central Valley Region (RWQCB)
Blank fields= Numerical water quality objectives not adopted by the RWQCB for pesticides and some heavy metals
ND= Non-detectable
NA= Non applicable
Analytical units are in mg/L unless otherwise specified

Table 3 presents the results for chemical constituents in the sediment sample. Samples were collected in May of 2005 at Site # 2.

Table 3: Chemical Sediment Data - 5/12/05

Constituent/Parameter	Site 2[1]
Heavy Metals (mg/kg)	
Antimony	<1.5
Arsenic	<15
Beryllium	0.18
Cadmium	<0.50
Chromium	5.7
Copper	8.9
Lead	5.0
Mercury	<0.10
Nickel	3.3
Selenium	<2.5
Silver	<2.5
Thallium	<2.5
Zinc	24
Trace Organics (µg/kg)	
SVOCs (pesticides)	ND
Inorganics (mg/kg)	
Nitrate Nitrogen (NO^3)	0.66
Total Kjeldahl Nitrogen	140
Piperonyl Butoxide (PBO)	ND

[1] Sediment samples were collected at site 2 only- Units are mg/kg

7.5 Physical Parameters and Results

In the absence of new temperature data due to the loss of the Hobo probes, results from a 2004 CDFG study are presented in Table 4 to characterize physical parameters for Big Grizzly Creek. Data were collected at four stations along Big Grizzly Creek and parameters included pH, temperature, dissolved oxygen, turbidity, and electric conductivity. CDFG also collected fish population data (described below) at the same four sampling stations. For our purposes, only physical data from Station # 3 was used for this report due to its close proximity to the Grizzly Ranch property. It is located a couple hundred yards upstream from the northern boundary with Grizzly Ranch.

Table 4: Physical Water Quality Data- CDFG Study- 10/2004

Physical Constituent/Parameter	Site 3[1]	RWQCB Objectives [2]
Dissolved Oxygen (mg/L)	8.4 mg/L	>7 mg/L
Water Temperature (C°)	58.1°F	NA
Electric Conductivity (µs)	111.5µs	<235µs
pH	8.4	6.5-8.5
Turbidity	6.7 NTU	NA

[1] Site 3 is located on Big Grizzly Creek approximately ½ mile north of Grizzly Ranch
[2] Regional Water Quality Control Board Central Valley Region (RWQCB)

7.6 Fish Studies and Toxicology

The DWR is conducting an instream flow monitoring program along Big Grizzly Creek to evaluate the effects of Lake Davis operation on populations of trout in Big Grizzly Creek. Fish population data was collected by CDFG in 1976, 1981, 1986, 1988, 1991, and 1994 through 2004 to estimate standing stocks of brown and rainbow trout at four stations. Fish were captured with an electroshocker, weighed, and measured. Age, growth rates and condition factors were calculated to provide baseline information to measure the effects of habitat change on trout populations over time. Water quality parameters were also collected (Table 4) as previously discussed. Results are discussed in the next section.

The DWR initiated the Outflow Curtailment Impact Study in October 2005 in collaboration with CDFG. The purpose of the 4-day study was to conduct a preliminary evaluation of a "flow cessation option", as an alternative to downstream chemical detoxification or other water treatment following poisoning of Lake Davis in 2007. During the 4-day interruption of release from Lake Davis, flow in Big Grizzly Creek was reduced from 10 cfs to 0.1 cfs uncontrolled release (seepage from the dam and groundwater recharge). This low flow condition persisted throughout almost all of the upper 4-mile study reach. The fishery study included qualitative observation of fish habitat and behavior, documentation of adverse fishery impacts observed, and monitoring of basic water quality parameters (temperature and DO) at previously established monitoring stations (Table 5). Monitoring was divided into two Big Grizzly Creek reaches; the 4-mile reach below the dam to the head of the Ice Pond, and the 2-mile section below the Ice Pond dam to the confluence with the Feather River. Future implementation of such a strategy will likely require a longer time period for discharge, so these results are tentative and subject to extrapolation.

Table 5. Water Temperature and Dissolved Oxygen Data For Station 3- CDFG October 2005

Date/Time	DO (mg/L)	Saturation (%)	Water Temperature (c)
10/3/05 PM *(Baseline)*	8.80	82.0	12.3
10/4/05 AM *(Baseline)*	8.80	76.6	9.4
10/4/05 PM	7.90	71.4	11.0
10/5/05 AM	8.10	66.9	6.7
10/5/05 PM	7.75	66.0	8.8
10/6/05 AM	8.10	64.4	5.6
10/6/05 PM	8.35	70.1	7.7
10/7/05 AM	8.30	67.1	6.2

A comparison of known LC_{50} toxicity values for rainbow trout and other fresh water aquatic species for constituents sampled is presented in Table 6. LC_{50} refers to the concentration of a chemical that is lethal to 50% of organisms when administered as a single exposure. This provides a point of reference to assess the condition of water quality in Big Grizzly Creek for supporting healthy populations of trout and other aquatic biota. Data from Table 6 were derived from agency standards and guidelines, an extensive literature search, and professional judgment from the author.

Table 6: Comparison of known LC_{50} toxicity values for rainbow trout and other freshwater aquatic species for select heavy metals and organic compounds[1]

Constituent	LC_{50} Toxicity	Species	Life Stage	Duration
Heavy Metals				
Arsenic	23-26 mg/L	Rainbow trout	Adult	96 hrs
Barium	410 mg/L	Daphnia magna	Adult	48 hrs
Cadmium	0.001 mg/L	Rainbow trout	juvenile	96 hrs
Chromium +3	0.495 mg/L	Rainbow trout	eggs	30 days
Chromium +3	4.4 mg/L	Rainbow trout	Juvenile	96 hrs
Chromium +6	3.4 mg/L	Rainbow trout	embryo	96 hrs
Chromium +6	20.2 mg/L	Rainbow trout	juvenile	96 hrs
Copper	0.06-0.8 mg/L	Rainbow trout	juvenile	96 hrs
Iron	9.6 mg/L	Daphnia magna	Adult	48 hrs
Lead	1.2 mg/L	Rainbow trout	Eggs	96 hrs
Lead	0.0146 mg/L	Rainbow trout	Post hatch	96 hrs
Magnesium	660.5 mg/L	Rainbow Trout	Fry	96 hrs
Mercury	0.005 mg/L	Rainbow trout	Juvenile	96 hrs
Nickel	2.3 mg/L	Daphnia magna	Adult	96 hrs
Selenium	3.1 mg/L	Rainbow trout	Juvenile	96 hrs
Silver	0.0065 mg/L	Rainbow trout	Juvenile	96 hrs
Zinc	0.43 mg/L	Rainbow trout	Juvenile	96 hrs
Organic Compounds				
MTBE	510 mg/L	Fish	Juvenile	96 hrs
Benzene	5.3 mg/L	Rainbow trout	Juvenile	96 hrs
Toluene	310 mg/L	Daphnia magna	Adult	24 hrs
Ethylbenzene	4.2 mg/L	Rainbow trout	Juvenile	96 hrs
Xylene	8.05 mg/L	Rainbow trout	Juvenile	96 hrs

[1] Sources are included in the reference section

7.7 Photographic Monitoring

Photographic monitoring is a widely used and inexpensive technique to track changes in most aquatic and terrestrial habitat types. Photographs taken at the same location and at the same time each year can be compared to assess changes in stream morphology, riparian vegetation, and floodplain characteristics.

Seven permanent photopoint stations were identified and mapped with GPS at appropriate intervals on Big Grizzly Creek for this purpose. Baseline photographs were taken in 2005 at each station and are stored in a database to facilitate future comparative analysis. It is not necessary that photo monitoring be repeated each year, but rather after activities that cause a disturbance or a change in stream conditions. The photographs taken in 2005 will serve as a baseline condition from which future photographs will be compared, following implementation of Grizzly Ranch Conservancy's creek improvement plan. A copy of the photopoint monitoring data form for 2005 is provided in Appendix D.

8.0 Results and Discussion

8.1 Fisheries Studies

Results from many years of monitoring fish populations and water quality in DWR's instream flow monitoring program indicate that the wild trout fishery in Big Grizzly Creek is resilient and healthy due to high quality habitat and good water quality. The restocking in 1998 following the fish-kill, and natural reproduction thereafter has resulted in complete restoration of the population. CDFG studies have shown a shift from rainbow to brown trout dominance following the stocking. Past studies though have suggested that rainbow trout are better suited to the cold water temperatures and flow regime in Big Grizzly Creek, and will eventually prevail over the brown trout population once stability has been reached.

Results and observations from the DWR Outflow Curtailment Impact Study suggest that temporary dewatering of lower Big Grizzly Creek has some negative impacts to fish and other aquatic life. Though not as severe than those observed from the unsuccessful downstream chemical detoxification in 1997, the study has some limitations.

Firstly, it is unlikely that the 4-day study was long enough to completely drain bank storage and achieve stable streamflow. Thus, the modest surface flow observed may have receded further over subsequent days if controlled release were not restored. Secondly, the reliance on seepage from the dam through weep-holes to maintain streamflow is based on the assumption that chemical piscicides will not contaminate these water sources. DWR states that the best available information suggests that rotenone will not penetrate into the reservoir substrate, but if discharge was contaminated, the small volume of discharge could be quickly detoxified on-site. To repeat this study for a longer duration is desirable but due to water rights and minimum flow permit requirements, it is doubtful this would be feasible in 2006. So, CDFG and DWR will continue to evaluate alternatives to minimize downstream impacts.

Instream water temperatures appeared significantly cooler than baseline temperatures due to increased overnight cooling of the low water volume. DO decreased significantly in the few pools nearest the dam, but decreased only slightly at more distant sampling points. Trout appeared crowded and more prone to predation in pools in the upper reach but otherwise, no obvious stress or mortality was observed due to water quality changes. Trout were able to survive in pools and no widespread mortality was observed in either reach of the study area.

8.2 Water Quality Test Results

Results from water quality tests in Big Grizzly Creek reveal:

1. Heavy metals sampled at Site 1 and Site 2 are well below standards set by the Regional Water Quality Control Board.
2. MTBE was not detectable at either sampling site.
3. Both phosphorus and nitrate were below regulatory standards at both sampling sites.
4. Fecal coliform levels were reported at 4.0 cfu/100ml at Site 1 and 2.0 cfu/100ml at Site 2. For surface water, these values are very low. In an area that is grazed by livestock, coliform levels of 100,000 cfu/100ml or more are not uncommon.

8.3 Sediment Test Results

Results from sediment tests in Big Grizzly Creek reveal:

1. Heavy metals sampled at Site 2 are relatively low. There are no set standards for heavy metals in aquatic habitats. Regulatory standards are focused on waste and disposal issues at landfills where high concentrations of metals can leach out into soils.
2. Semi-VOCs were not detected in the soil sample.
3. Nitrogen tests are within acceptable limits for soil samples.
4. PBO was not detected in the soil sample.

8.4 Physical Test Results

Results from physical monitoring in Big Grizzly Creek reveal:

1. Dissolved oxygen, water temperature, electric conductivity, pH and turbidity were all well within the standards set by the RWQCB.
2. The accepted temperature threshold for rainbow trout is 65ºF. Fish become stressed and mortality can occur when temperatures rise above this temperature for extended periods of time. The temperature recorded from the CDFG study for Big Grizzly Creek was 58.1ºF, which is well below the threshold. Since DWR discharges from the lowest outflow valve on the dam, water temperatures are generally very cold and dissolved oxygen levels are good. More information on temperature during warmer months will be collected this summer when data are downloaded from Hobo Thermometers that have recently been installed.

Based on the chemical and physical data obtained from this study, the water resources of Big Grizzly Creek appear to be of excellent quality and should continue to support a healthy and productive trout fishery. The poisoning of the creek in 1997 killed most brown and rainbow trout above the Ice Pond, but CDFG's trout stocking program in1998-1999 has quickly repopulated the fishery. Evidence of successful spawning since 1999 has precluded the need to restock the creek, so nature is taking its course and the fishery is slowly returning to a wild and self-sustaining population. Additional precautions will be taken at Lake Davis if chemical treatment is carried out in 2007. Grizzly Ranch should be apart of the public review process to express concerns on flow volumes for water intake and a potential fish-kill due to proposed low water volumes in September 2007.

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APPENDIX A

POTENTIAL OCCURANCE OF SPECIAL STATUS SPECIES IN BIG GRIZZLY CREEK

Potential Occurrence of Special Status Species in Big Grizzly Creek

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Mammals			
Brachylagus idahoensis pygmy rabbit	FSC, CSC	Sagebrush, bitterbrush, & pinyon-juniper habitats in Modoc, Lassen & Mono counties. Tall dense, large-shrub stages of sagebrush, greasewood, & rabbitbrush. May avoid heavily grazed areas.	**Not present.** Study Area is not within the range of this species.
Corynorhinus townsendii pallescens Townsend=s big-eared bat	FSC, CSC	Lives in a wide variety of habitats but most common in mesic sites. Needs appropriate roosting, maternity, and hibernacula sites free from human disturbance.	**Low potential.** Typical roosting habitat not present within Study Area. May occasionally forage in the Study Area.
Euderma maculatum spotted bat	FSC, CSC	Occupies a wide variety of habitats from arid deserts and grasslands through mixed conifer forests. Feeds over water and along washes. Needs rock crevices in cliffs or caves for roosting.	**Low potential.** Typical roosting habitat not present within Study Area. May occasionally forage in the Study Area.
Gulo gulo luteus California wolverine	CSC	Uses caves, logs, and burrows for den sites. Requires water source. Hunts in areas that are more open. Disperses long distances.	**Not present.** Typical habitat is not present in the Study Area.
Lasiurus blossevillii western red bat	FS	Locally common in California from Shasta County to Mexican border. Roosts in forests and woodlands at many elevations and feed over grasslands, shrublands, open woodlands, and forests.	**Low potential.** Typical roosting habitat not present within Study Area. Adjacent forests may provide roost habitat.
Lepus americanus tahoensis Sierra Nevada snowshoe hare	FSC	Occurs in boreal zones of riparian communities. They typically occupy altitudes between 5000 and 8000 feet.	**Low potential.** Willows along the creek provides limited habitat. Study area is at the lower limit of this species= elevation range.
Martes americana American (pine) marten	FSC	Prefers mixed evergreen forests with more than 40% crown closure. Particularly likes old-growth conifers and snags with cavities for dens.	**Low potential.** The Study Area is surrounded by low quality habitat; presence of the equestrian facility likely precludes presence.
Martes pennanti pacifica Pacific fisher	CSC, FSC	Primarily inhabits mixed conifer forests composed of Douglas fir and associated conifers. They prefer heavy stands of mixed species of mature timber.	**Low potential.** Pacific fisher are likely absent from the central part of their historic range. Known only South of Yosemite in the Sierra, and from the Trinity/Klamath Mountains in Northern California.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Myotis evotis long-eared myotis	FSC	Primarily a forest associated species. Day roosts in hollow trees, under exfoliating bark, rock outcrop crevices, and buildings. Other roosts include caves, mines and under bridges.	**Low potential.** Although present in the surrounding forests, typical roosting habitat not present within Study Area.
Myotis thysanodes fringed myotis	FSC	Associated with a wide variety of habitats including mixed coniferous-deciduous forest and redwood/sequoia groves. Buildings, mines, and large snags are important day and night roosts.	**Low potential.** Although potentially present in the surrounding forests, typical roosting habitat not present within Study Area.
Myotis volans long-legged myotis	FSC	Generally associated with woodlands and forested habitats. Large hollow trees, rock crevices, and buildings are important day roosts. Other roosts include caves, mines, and buildings.	**Low potential.** Although present in the surrounding forests, typical roosting habitat not present within Study Area.
Myotis yumanensis Yuma myotis	FSC	Known for its ability to survive in urbanized environments. Also found in heavily forested settings. Day roosts in buildings, trees, mines, caves, bridges and rock crevices. Night roosts associated with man-made structures.	**Low potential.** Although present in the surrounding forests, typical roosting habitat not present within Study Area.
Myotis ciliolabrum small-footed myotis bat	FSC	Commonly found in arid uplands of California above 6000-foot elevation. Feeds on a variety of small flying insects. Seeks cover in caves, buildings, mines, crevices, and occasionally under bridges.	**Low potential.** Study Area is below the elevation range of the species. Typical roosting habitat not present within Study Area.
Taxidea taxus American badger	CSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils & open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	**Low potential.** The proposed project will be constructed in aquatic and streamside habitat, where burrowing mammal prey are largely absent.
Vulves vulpes necator Sierra Nevada red fox	FSC	Dense vegetation and rocky areas are used for cover and den sites. Prefers forests interspersed with meadows or alpine fields.	**Low potential.** The Study Area is surrounded by low quality habitat; presence of the equestrian facility likely precludes presence.
Birds			
Accipter gentilis northern goshawk	FSC, CSC	Prefers dense, mature conifer and deciduous forest usually near open space. Usually nests on north facing slopes near water.	**Low potential.** Individuals may use the Study Area for foraging; human disturbance precludes nesting attempts.
Accipiter cooperi Cooper's hawk	CSC	Typically nests in woodlands and forests. May occur in most habitats in migration and winter.	**Low potential.** Individuals may use the Study Area for foraging; human disturbance likely precludes nesting attempts.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Accipiter striatus sharp-shinned hawk	CSC	Typically nests in forests. May occur in most habitats in migration and winter.	**Low potential.** Individuals may use the Study Area for foraging; human disturbance likely precludes nesting attempts.
Aquila chrysaetos golden eagle	CSC	Nests in isolated large trees and cliffs. Forages in more open country on small to medium-sized mammals.	**Low potential.** Individuals may use the Study Area for foraging; human disturbance likely precludes nesting attempts.
Asio flammeus short-eared owl	CSC	Associated with grasslands, sparse scrub, and wetland habitats, where it nests on the ground.	**Low potential**. Although this owl is present in Sierra Valley, the Study Area does not provide suitable open habitat.
Asio otus Long-eared owl	CSC	Found in woodlands and forests.	**Low potential**. Known to occur a few miles south of the Study Area. Human activity probably prevents this species from nesting in the vicinity of the project.
Cinclus mexicanus American dipper	SLC	Forages on aquatic insects in perennial rock streams.	**High potential.** Suitable foraging habitat within the Study Area.
Cypseloides niger black swift	FSC, CSC	Requires steep cliffs or ocean bluffs with ledges, cavities, or cracks for nest sites. Nests are almost always behind waterfalls.	**Low potential.** May forage in Study Area; however, no suitable nesting habitat is present.
Dendroica petechia Yellow warbler	CSC	Associated with riparian habitat, particularly willow and alder thickets in montane areas, and willow-cottonwood riparian at lower elevations.	**Present**. This species was observed foraging in willows immediately adjacent to the pipe route.
Empidonax traillii willow flycatcher	SE	Inhabits extensive thickets of low, dense willows on edge of wet meadows, ponds, or backwaters; 2000-8000 elev. Requires dense willow thickets for nesting/roosting. Low, exposed branches are used for singing posts/hunting perches	**Moderate potential.** Dense willow stands along Grizzly Creek (primarily downstream of the Study Area) provide suitable habitat; however, surveys of high quality habitat several miles west of the Study Area had negative results.
Falco mexicanus prairie falcon	CSC	(Nesting) inhabits dry, open terrain, either level or hilly. Breeding sites located on cliffs. Forages far.	**Low potential.** No cliffs in the Study Area, however, this species may forage near the site.
Falco peregrinus anatum American peregrine falcon	FD, SE, CFP	Winters throughout Central Valley. Requires protected cliffs and ledges for cover. Feeds on a variety of birds, and some mammals, insects, and fish.	**Low potential.** No cliffs in the Study Area, however, this species may forage near the site.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Grus canadensis tabida greater sandhill crane	ST, FSC	(Nesting & wintering) nests in wetland habitats in northeastern California; winters in the central valley. Prefers grain fields within 4 mi. of a shallow body of water used as a communal roost site; uses irrigated pasture as loaf sites	**Not present.** Winters in Sierra Valley, approximately 5-10 miles southeast of the Study Area. Study Area does not provide suitable habitat.
Haliaeetus leucocephalus bald eagle	FPD, FT, SE, CFP	Requires large bodies of water, or free-flowing rivers with abundant fish adjacent snags or other perches. Nests in large, old growth, or dominant live tree with open branches.	**Low potential.** No suitable nesting habitat within the Study Area. Individuals foraging along the Feather River, or in nearby reservoirs or lakes (Lake Davis) may pass through the Study Area.
Melanerpes lewis Lewis=s woodpecker	FSC	Uncommon winter resident occurring on open oak savannahs, broken deciduous and coniferous habitats.	**Low potential.** Cottonwood or aspen stands in other areas of the creek may provide wintering habitat for this species.
Otus flammeolus flammulated owl	FSC	Prefers mature stands of ponderosa pines and Jeffrey pines with Douglas fir understory.	**Low potential.** Summer residents may forage near the Study Area, but human disturbance probably precludes nesting attempts.
Pandion haliaetus osprey	CSC	Associated with lakes, rivers, bays, and coastal areas. Nests at top of snag, live tree, or man-made equivalent.	**Low potential.** Although an active nest was observed several hundred feet downstream of the Study Area, this species may only rarely forage in the vicinity of the proposed project.
Picoides albolarvatus white-headed woodpecker	FSC	Strongly associated with pine forests of the Transition and lower Canadian life zones. Breed primarily between 4000 to 7500 feet in elevation.	**High potential.** Pine forest occurs adjacent to the Study Area.
Selasphorus rufus rufous hummingbird	FSC	Found in a wide variety of habitats that provide nectar-producing flowers. A common migrant and uncommon summer resident of California.	**Low potential.** Migrating individuals may forage in the Study Area.
Strix nebulosa great gray owl	SE	Largest owl in North America. Extremely rare, prefers dense mature forest at edges of meadows. Known from Plumas County south to Yosemite Park.	L**ow potential.** Wet meadows and riparian corridors near the Study Area provide suitable foraging habitat.
Strix occidentalis occidentalis California spotted owl	FSC, CSC	Mixed conifer forest, often with an understory of black oaks & other deciduous hardwoods. Canopy closure >40%. Most often found in deep-shaded canyons, on north-facing slopes, and within 300 meters of water.	**Low potential.** Although present in the surrounding forests, typical roosting and nesting habitat not present within Study Area.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Reptiles and Amphibians			
Rana boylii foothill yellow-legged frog	FSC, CSC	Found in or near rocky streams in a variety of habitats. Feed on both aquatic and terrestrial invertebrates.	**Low potential.** According to Barry (2005), this species is not present in eastern Plumas County.
Rana muscosa mountain yellow-legged frog	FC, CSC	Found in sunny riverbanks, meadow streams, and isolated ponds of the High Sierra usually higher than 4500 feet in elevation. Always encountered within a few feet of water. Tadpoles may require up to two years to completely development.	**Low potential.** Study Area is near the lower extent of its elevation range; fish in Grizzly Creek likely preclude presence.
Invertebrates			
Desmona bethula amphibious caddis fly	FSC	Found in first-order streams, in open wet meadow areas and vernal pools; occasionally found in beaver ponds on second-order streams. Larvae leave at night to feed on riparian vegetation.	**Low potential.** Grizzly Creek is not a first-order stream.
Plants			
Astragalus lentiformis lens-pod milk vetch	List 1B	Great Basin scrub, lower montane coniferous forest. Endemic to Plumas County. Shallow, volcanic soils among sagebrush, sometimes with Jeffrey pine. 1450-1925m. Flowers May-July.	**Low potential.** No suitable habitat immediately adjacent to the creek. No members of the genus Astragalus were observed in the Study Area during the surveys.
Astragalus pulsiferae var. *suksdorfii* Suksdorf=s milk-vetch	List 1B	Great Basin scrub, lower montane coniferous forest, pinyon and juniper woodland. Volcanic or clay soil, often gravelly or rocky. 1300-1930m. Flowers April-August.	**Low potential.** No suitable habitat immediately adjacent to the creek. No members of the genus Astragalus were observed in the Study Area during the surveys.
Botrychium crenulatum scalloped moonwort	List 2	Bogs and fens, meadows, lower montane coniferous forest, freshwater marsh. Moist meadows, near creeks. 1500-2670m. Fertile June-July	**Low-Moderate potential.** Suitable habitat adjacent to the creek. Not observed during surveys.
Botrychium minganense Mingan moonwort	List 2	Lower montane coniferous forest. Creek banks in mixed conifer forest. 1500-2275m. Fertile July-August.	**Moderate potential.** Suitable habitat adjacent to the creek. Not observed during surveys.
Carex lasiocarpa slender sedge	List 2	Bogs and fens, marshes and swamps. In California, known only from Lassen and Plumas Counties. Sphagnum bogs, freshwater marsh, and probably other moss-dominated habitats as well. 1800-2100m. Flowers June-July.	**Moderate potential.** Suitable habitat adjacent to the creek. *Carex utriculata* was the only *Carex* sp. observed in the Study Area.
Carex sheldonii Sheldon=s sedge	List 2	Lower montane coniferous forest, marshes, swamps, and riparian scrub. Mesic sites, along creeks and in wet meadows. 1065-1755m. Flowers May-August.	**Moderate potential.** Suitable habitat adjacent to the creek. *Carex utriculata* was the only *Carex* sp. observed in the Study Area.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Ivesia aperta var. *aperta* Sierra Valley ivesia	List 1B	Great Basin scrub, pinyon and juniper woodland, lower montane coniferous forest, meadows. Usually in loamy soils derived from volcanics. Grassy areas within sagebrush scrub or other communities. 1475-2300m. Flowers June-September.	**Low potential.** No suitable habitat in or adjacent to the creek. Not observed during surveys.
Ivesia serioleuca Plumas ivesia	List 1B	Great Basin scrub, lower montane coniferous forest, meadows, vernal pools. Vernally mesic areas; usually volcanic substrates. 1450-2000m. Flowers May-September.	**Low potential.** Marginal habitat adjacent to the creek. Not observed during surveys.
Lupinus dalesiae Quincy lupine	List 1B	Lower montane coniferous forest, upper montane coniferous forest. Dry open or shaded slopes, summits, and trails. Plants often found in disturbed soils. 695-2500m. Yellow flowers May-August.	**Low potential.** No suitable habitat in or adjacent to the creek. Not observed during surveys.
Polygonum polygaloides ssp. *esotericum* Modoc County knotweed	List 1B	Great Basin scrub, vernal pools, lower montane coniferous forest, meadows and seeps. Only known from Modoc and Sierra Counties. Edges of seasonal lakes and ponds with Deschampsia, Navarretia, etc. 1480-1690m. Flowers May-August.	**Low potential.** Suitable habitat adjacent to the creek, though outside of known range. Not observed during surveys.
Potamogeton filiformis slender-leaved pondweed	List 2	Marshes and swamps. Shallow, clear water of lakes and drainage channels. 300-2310m. Flowers May-July.	**Low- potential.** Suitable habitat of shallow, clear water in the creek, seasonal high velocity flows diminish the habitat. Not observed during surveys.
Pyrrocoma lucida sticky pyrrocoma	List 1B	Lower montane coniferous forest, meadows, and seeps. Alkaline flats, clay soils. 700-1880m. Flowers July-October.	**Low potential**. Marginal habitat adjacent to the creek. Not observed during surveys.
Scirpus subterminalis water bulrush	List 2	Marshes and swamps. Montane lake margins, in shallow water. 750-2335m. Flowers July-August.	**Low potential.** Suitable habitat consisting of shallow, water in the creek, seasonal high velocity flows may diminish the habitat. No members of the genus Scirpus observed during surveys.
Scutellaria galericulata marsh skullcap	List 2	Marshes and swamps, lower montane coniferous forest, meadows and seeps. Swamps and wet places. 1,000-2100m. Flowers June-September.	**Moderate potential.** Suitable habitat adjacent to the creek. Not observed during surveys.

SPECIES	STATUS*	HABITAT REQUIREMENTS	POTENTIAL FOR OCCURRENCE
Stachys palustris ssp. *Pilosa* marsh hedge nettle	List 2	Bogs and fens, meadows and seeps, marshes and swamps. Mesic meadows, lake margins, marshes, fens. 1200-1525m. Flowers June-August.	**Low potential.** Outside the known range of the species, though suitable habitat adjacent to the creek. Not observed during surveys.
Utricularia intermedia flat-leaved bladderwort	List 2	Bogs and fens, meadows and seeps, marshes and swamps. Mesic meadows, lake margins, marshes, fens. 1200-2700m. Flowers July-August.	**Low- potential.** Suitable habitat consisting of shallow water in the creek, seasonal high velocity flows diminish the quality of the habitat. Not observed during surveys.

*** Key to status codes:**
Status codes used above are:

FE	Federal Endangered
FT	Federal Threatened
FC	Federal Candidate
FPD	Federal Proposed Delisted
FSC	U.S. Fish and Wildlife Service Federal Species of Concern
SE	State Endangered
CFP	CDFG Fully Protected Animal
CSC	CDFG Species of Special Concern
SLC	Species of Local Concern
FS	Sensitive US Forest Service sensitive species
List 1A	CNPS List, Plants presumed extinct in California
List 1B	CNPS List, Plants rare, threatened or endangered in California and elsewhere
List 2	CNPS List, Plants rare, threatened or endangered in California, more common elsewhere

APPENDIX B

PLANT TAXA OBSERVED DURING SURVEYS IN 2005-2006

Plant Species Observed on the Grizzly Ranch Discharge/Intake Site

May through July 2005 and June 1 & July 21, 2006

Scientific Name	Common Name
Achillea millefolium	yarrow
Alnus incana ssp. *tenuifolia*	alder
Alopecurus aequalis	foxtail
Amelanchier utahensis	serviceberry
Artemisia douglasiana	mugwort
Artemisia tridentata ssp. *vaseyana*	mountain sagebrush
Aster eatonii	Eaton's aster
Bromus tectorum	cheatgrass
Capsella bursa-pastoris	shepherd's purse
Carduus nutans	musk thistle
Carex praegracilis	clustered field sedge
Carex utriculata	beaked sedge
Castilleja applegatei	paintbrush
Ceanothus prostratus	squaw carpet
Chrysothamnus visidiflorus	rabbitbrush
Cirsium vulgare	bull thistle
Collinsia parviflora	blue-eyed Mary
Convolvulus sp.	Morning glory
Cornus sp.	dogwood
Cyperus laevigatus	nut sedge
Danthonia intermedia	mountain oatgrass
Delphinium nudicaule	red larkspur
Descurainia sophia	tansy mustard
Eleocharis macrostachya	spikerush
Elymus glaucus	blue wildrye
Epilobium brachycarpum	willow-herb
Epilobium ciliatum ssp. *ciliatum*	northern willow-herb
Equisetum arvense	common horsetail
Equisetum laevigatum	smooth horsetail
Erigeron inornatus	California rayless daisy
Erodium cicutarium	storksbill
Galium aparine	goose grass
Galium trifidum	bedstraw
Gnaphalium canescens	cudweed
Grindelia nana	gumweed
Hordeum jubatum	barley
Hydrophyllum occidentalis	hydrophyllum
Juncus balticus	Baltic rush
Juncus bufonius	toad rush
Juncus xiphioides	iris leaved rush
Lactuca serriola	prickly lettuce
Lemna sp.	duckweed

Scientific Name	**Common Name**
Lepidium perfoliatum	perfoliate peppergrass
Lithophragma parviflorum	small flowered lithophragma
Lolium multiflorum	Italian ryegrass
Lupinus argenteus	Tahoe lupine
Madia minima	heminzonella
Melica subulata	melic
Mentha arvensis	field mint
Mimulus guttatus	monkeyflower
Montia linearis	linear-leaved montia
Nemophila pedunculata	nemophila
Phlox gracilis	phlox
Pinus jeffreyi	Jeffrey pine
Plagiobothrys hispidulus	popcorn-flower
Poa annua	annual bluegrass
Poa pratensis	Kentucky bluegrass
Poa secunda	bluegrass
Polygonum aviculare	polygonum
Populus balsamifera	black cottonwood
Potentilla gracilis ssp. nuttallii	slender cinquefoil
Prunus virginiana var. *demissa*	western chock-cherry
Ranunculus californicus	buttercup
Rosa woodsii	rose
Rumex crispus	curly dock
Salix lemmonii	Lemmon's willow
Salix ligulifolia	ligulate willow
Salix lutea	yellow willow
Salix scouleriana	Scouler's willow
Sidalcea oregana ssp. *spicata*	bog mallow
Solidago spectabilis	goldenrod
Sphaeralcea muroana	globe mallow
Stachys ajugoides var. *rigida*	hedgenettle
Taraxacum officinale	dandelion
Thalictrum sp.	rue
Tragopogon porrifolius	salsify
Trifolium dubium	little hop clover
Trifolium hybridum	Alsike clover
Trifolium longipes	long-stalked clover
Typha latifolia	cattail
Verbascum thapsus	turkey mullein
Vicia americana	American vetch
Wyethia mollis	mule's ears

APPENDIX C

ANIMAL TAXA OBSERVED DURING SURVEYS IN 2005

Wildlife Species Observed in Big Grizzly Creek- July 2005

Species	Study Area Habitat Association	Comments
osprey **Pandion haliaetus**	Jeffrey Pine Forest (nesting)	Active nest observed several hundred feet downstream of Study Area; CDFG Species of Special Concern
hairy woodpecker **Picoides villosus**	Jeffrey Pine Forest	Common in region; probably does not nest near corridor
western wood-pewee **Contopus sordidulus**	Jeffrey Pine Forest	Common in region; probably does not nest near corridor
northern rough-winged swallow **Stelgidopteryx serripennis**	Jeffrey Pine Forest, wetland/riparian	Several observed foraging along Grizzly Creek; suitable nesting habitat not present in Study Area
American robin **Turdus migratorius**	Jeffrey Pine Forest, wetland/riparian	Abundant in region; potentially nests near corridor
yellow warbler **Dendroica petechia**	wetland/riparian	Suitable nesting habitat immediately adjacent to corridor; CDFG Species of Special Concern
spotted towhee **Pipilo maculatus**	wetland/riparian	Common in region; potentially nests near corridor
song sparrow **Melospiza melodia**	wetland/riparian	Common in region; potentially nests immediately adjacent to corridor
Brewer's blackbird **Euphagus cyanocephalus**	wetland/riparian	Common in region; potentially nests near corridor
pine siskin **Carduelis pinus**	Jeffrey Pine Forest	Common in region; potentially nests near corridor

APPENDIX D

PHOTOPOINT MONITORING DATA TABLE

GRIZZLY CREEK IMPROVEMENT PROJECT
PHOTOPOINT MONITORING DATA SHEET

Date 4/4/05 **Time** 10:30 AM **Photographer** D. Lindquist

Weather Conditions Clear, cool, calm winds

Notes Flows= 26cfs

PHOTO RECORD

Photopoint	GPS Coordinates	Photo Direction[1]	Picture #	Notes
1-Hobo Down	WP 37 N39.84241 W120.43019	A	001	
		U	002	
		D	003, 004, 005	
2-River Bend	WP 40 N39.84367 W120.42879	A	006	
		U	007	
		D	008,009	
3-Fish Barrier	WP 38 N39.84368 W120.42892	A	010	
		U	011	
		D	012,013	
4-Lower Bar	WP 39 N39.84491 W120.42974	A	014	
		U	015,016,017,018	
		D	019	
5- Mid Bar	WP 42 N39.84554 W120.43030	A	020	Wide floodplain
		U	021,022,023	
		D	024,025,026	
6-Upper Bar	WP 43 N39.84576 W120.43031	A	027	Wide floodplain
		U	028	
		D	029,030,031	
7-Hobo Up	WP44 N39.84680 W120.43036	A	032	
		U	033,034	
		D	035,036,037	

[1]Direction: A=Across; U-Upstream; D=Downstream

APPENDIX E

PERSONAL CONTACTS

PERSONAL CONTACTS

Key agency, academic, and residents consulted for this study are listed below.

Name	Affiliation
Doug Rischbieter	Fish Biologist, California Department of Water Resources
Dave Bogener	Wildlife Biologist, California Department of Water Resources
Julie Cunningham	Lake Davis Coordinator, California Department of Fish and Game
Laurie Powers	Fish Biologist, California Department of Fish and Game
Bob Orange	Warden, California Department of Fish and Game
Bob Schultz	Hydrologist, US Forest Service
Richard Seely	Fire Ranger, US Forest Service
Amelio Folchi	Long time resident
Betty Folchi	Long time resident
Richard Hardy	Long time resident
Tim Kurdupski	Trout Unlimited
John Williamson	Trout Unlimited
Terry Benoit	Feather River Coordinated Resource Management
Dave Longanecker	Fish Biologist, Pacific Gas and Electric Company

APPENDIX F

LABORATORY TESTING ANALYTICAL RESULTS