State of California
The Resources Agency
Department of Water Resources
Division of Planning and Local Assistance
Resource Restoration and Project Support Branch

Miners Ravine
Habitat Assessment

October 2002

Gray Davis	**Mary D. Nichols**	**Thomas M. Hannigan**
Governor	**Secretary for Resources**	**Director**
State of California	**The Resources Agency**	**Department of Water Resources**

STATE OF CALIFORNIA
Gray Davis, Governor

THE RESOURCES AGENCY
Mary D. Nichols, Secretary of Resources

DEPARTMENT OF WATER RESOURCES
Thomas M. Hannigan, Director

Vernon T. Glover Deputy Director	Steve Macaulay Chief Deputy Director	Jonas Minton Deputy Director
L. Lucinda Chipponeri Deputy Director	Peter Garris Deputy Director	Peggy Bernardy Chief Counsel

DIVISION OF PLANNING AND LOCAL ASSISTANCE

Mark Cowin……………………………………………………………………………………Division Chief

This report was prepared under the supervision of

Mark Meeks……...……………………………….Chief, Resource Restoration and Project Planning Branch

and

Ted Frink……………………………………………………………..Chief, Resource Restoration Section

By

Chris Lee…………………………………………………………………………..…Environmental Scientist

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

1. Introduction

Miners Ravine Creek is a tributary of the Dry Creek system, which has been identified as a component of CALFED's Sacramento Regional Ecological Management Zone (EMZ). The CALFED Bay-Delta Program is a cooperative effort among the public and State and federal agencies with management and regulatory responsibility in the Bay-Delta system (San Francisco Bay and Sacramento and San Joaquin Delta hydrologic regions). It was formed in 1994 as part of the Bay-Delta Accord to address the water management and environmental problems associated with the Bay-Delta system, including ecosystem restoration, water quality, water use efficiency, and levee system integrity. The mission of the CALFED Program is to develop a long-term, comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system (CALFED 2001).

There are 14 EMZs in CALFED's Ecosystem Restoration Program (ERP) covering the Bay-Delta. One of the strategic goals of the ERP is to protect and/or restore functional habitat in the Bay-Delta for ecological and public values. One of the components of restoring habitat in the Bay-Delta is improving fish passage (CALFED 2001).

The Fish Passage Improvement Program (FPIP) began in December 1999 as part of a coordinated CALFED Program called the Integrated Storage Investigations. Under the California Department of Water Resources (DWR), the FPIP will help the CALFED ERP reach the goal of increasing anadromous salmonid populations in the Bay-Delta and its tributaries. The mission of FPIP is to improve migration passage and access to historic spawning and rearing habitat. This is a critical step towards improving riverine habitat conditions and ultimately increasing native fish populations (CALFED 2001, DWR 2002). The FPIP has developed prioritization criteria for addressing structures that impede migration to salmonids (Table 1).

The objective of this habitat assessment is to determine the quality and quantity of habitat for anadromous fish species on Miners Ravine and to document natural and man-made structures in the creek that may be impediments for salmonid migration. The survey was initiated in response to CALFED goals for the Sacramento EMZ and the Hidden Valley Homeowners Association's inquiry to the FPIP on the viability of improving fish passage at Cottonwood Dam.

2. Watershed Setting

Miners Ravine is a tributary to Dry Creek, located in Placer County. Dry Creek is a tributary of the Sacramento River via the Natomas Main Drain (Map 1). Several tributaries of Dry Creek are fairly extensive; Miners Ravine is approximately 15.65 miles (26.07 kilometers) in length on a U.S.G.S. 7.5 minute topographical map. The watershed drains approximately 20 square miles (Swanson 1992).

The headwaters for Miners Ravine are in the western foothills of the Sierra Nevada near Newcastle, at approximately 1,200 feet (365.8 meters) elevation. Miners Ravine is a perennial, ungauged stream. High flows occur during the fall and spring rainy season. Average annual rainfall is 30 inches (76.2 centimeters) near the headwaters and 25 inches (63.5 centimeters) at the confluence with Dry Creek. Springs and urban runoff contribute to summertime flows in the system (Swanson 1992, Bishop 1997).

2.1 Urbanization and the Floodplain

Bishop (1997) states that three key facts about Miners Ravine are clear:

> 1) The natural channel is small relative to the larger floodplain, therefore flooding outside the channel occurs fairly often; 2) the watershed produces runoff rapidly due to slow permeability of the soils; and 3) the channel position within the valley is not fixed…it shifts across the floodplain due to erosion and sedimentation.

The channel and floodplain convey floodwater and sediment through the watershed. Flooding, erosion, and sedimentation are natural processes of all creeks. Generally, residential development of homes, bridges, and landscaping in and near the creek have not been designed to be compatible with these processes. These incompatibilities not only lead to loss of property but also degrade the natural resources in the riparian floodplain (Swanson 1992, Bishop 1997).

Urbanization in the watershed has reduced floodplain storage. Construction of impervious area has increased runoff. This increases erosion, which in turn affects water quality and the organisms found in and near Miners Ravine (Swanson 1992, Bishop 1997).

2.2 Wildlife of Miners Ravine

There are still open space areas surrounding Miners Ravine where significant native vegetation exists and creates habitat for numerous fish and wildlife species. Despite the urbanization in the area, stands of riparian forests, oak woodlands, vernal pools, herbaceous understory, wetlands, and native grasslands persist (Swanson 1992, Bishop 1997).

These areas provide habitat corridors for raccoons (*Procyon lotor*), black-tailed deer (*Odocoileus hemionus*), beavers (*Castor canadensis*), Wood Ducks (*Aix sponsa*), Red-Tailed Hawks (*Buteo jamaicensis*), Scrub Jays (*Aphelocoma californica*), Acorn Woodpeckers (*Melanerpes formiciorus*), Great Blue Herons (*Ardea herodias*), Pacific tree frogs (*Hyella regilla*), western pond turtles (*Clemmys marmorata marmorata*), Chinook salmon (*Oncorhyncus tshawytscha*), western fence lizards (*Sceloporus occidentalis*) and many other terrestrial and aquatic species endemic to the area. Unfortunately, there are many non-native species present, including pampas grass (*Cortaderia jubata*), yellow star thistle (*Centaurea solstitalis*), broom (*Cytisus sp.*), largemouth (*Micropterus salmoides*) and spotted bass (*Micropterus punctulatus*), green sunfish (*Lepomis cyanellus*), and bullfrogs (*Rana catesbeiana*), to name a few (Alden and others 1998).

There is also habitat available in the watershed for species designated by the State and federal governments as endangered and threatened (Table 2). The federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardi*) may be found in vernal pools along the creek. The federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphis*) may be found in the blue elderberry shrubs (*Sambucus mexicana*) within the watershed (DFG 2002).

2.2.1 Salmonids

Fall-run Chinook salmon (*Oncorhynhcus tshawytscha*) of the Central Valley Evolutionarily Significant Unit (ESU), which are federally listed as candidate species, and Central Valley steelhead (*Oncorhynchus mykiss*), which are federally listed as threatened, have been recorded spawning in Miners Ravine historically. Both fish are also State Species of Special Concern. In the 1950s there were up to a thousand salmon spawning in the Dry Creek system, about 10% of which utilized Miner's Ravine (Gerstung 1964). There is not much information on the current number of salmon using Miners Ravine is (see Section 8.Biological Inventory Results).

Historically, salmon were able to use the upper reaches of Miners Ravine for both spawning and rearing activities. Cottonwood Dam, which was built during the 1950s, is generally recognized as a complete barrier to salmonid migration and is considered the uppermost limit for anadromous species in Miners Ravine. Loss of habitat due to various human-influenced activities (dams, logging practices, development, etc.) is the main cause of Pacific salmon population declines (NOAA 1998).

2.2.1.1 Chinook Salmon

The Central Valley ESU of Fall-run Chinook salmon includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries, east of Carquinez Strait, California (U.S Department of Commerce 1999). Adult fall-run Chinook salmon of the Dry Creek system typically migrate upstream from September to December, with seasonal rains and temperature playing a major role in the timing of the run. According to California Department of Fish and Game Senior Fishery Biologist John Nelson, spawning usually occurs from October to the end of December.

Fall-run Chinook salmon are typically ocean-type salmon, adapted to spawning in lowland reaches of large rivers and their tributaries (other runs of Chinook salmon are considered stream-type because they tend to spend more time in fresh water). They typically spawn in shallow, fast moving water, preferring a substrate of coarse gravel and cobble. A female will select a site to build her nest, or redd, dependent upon the suitable available habitat. Generally, individuals will select gravel with a median diameter between 7 and 100 millimeters (0.3 to 3.9 inches) (but will use gravel up to 305 millimeters [11.8 inches] in diameter), with the size of the fish and gravel available being a major determining factor (Vyverberg and others 1997). The female will first "nose" the area to determine the suitability of the substrate. Then she will turn on her side and begin flexing her body violently, causing the gravel to be lifted and carried slightly downstream. This will produce a hollow area for her to deposit her eggs. The redds are typically 40 to 160 square feet (3.7 to 14.8 square meters) in size. The female will deposit from 3,000 to 7,000 eggs in several pockets within the redd. They will then be fertilized by a male and then covered with gravel by the female. The adults will generally die within a few days after spawning but may survive up to several weeks (Groot and Margolis 1991, Vyverberg et.al. 1997, NOAA 1998, Moyle 2002).

Fall-run Chinook salmon juveniles emerge from the gravel December through March. Generally, embryos hatch 40 to 60 days after fertilization. Once they break through the egg case, they are called alevins. The alevins remain in the gravel for an additional 30 to 50 days or until the egg sac is completely absorbed. Temperature can play a large role in the amount of time spent at each of these critical life stages. After emerging from the gravel, they are considered fry and may spend 1 to 8 months in the creek before migrating to the estuary (Groot and Margolis 1991, NOAA 1998, Moyle 2002).

They will remain at the estuary until they are large enough to eat small fish and move to the open ocean. Generally, Chinook salmon will spend 2 to 5 years in the ocean before returning to their natal waters. Occasionally, some salmon will return early, perhaps after only 5 to12 months at sea, these are called "Jacks" or "Jills" dependent upon their sex. Although these fish are generally small compared to other salmon in the river, they are sexually mature and can spawn (Groot and Margolis 1991, NOAA 1998, Moyle 2002).

2.2.1.2 Steelhead

The Central Valley Steelhead ESU includes all naturally spawned populations of steelhead (and their progeny) in the Sacramento River and San Joaquin River and their tributaries. Excluded are steelhead from San Francisco Bay and San Pablo Bay and their tributaries (U.S. Department of Commerce 1998). Steelhead of the Central Valley ESU, including those found in the Dry Creek system, are considered winter run steelhead. They start entering fresh water in August, peaking in late September though October. They will stay in the mainstem of the river until fall rains make flows high enough for them to enter the tributaries for spawning. According to Rob Titus, Fishery Biologist for the California Department of Fish and Game, spawning, which is highly dependent on flow and water temperatures, generally starts at the beginning of the year.

As with all salmonids, steelhead habitat requirements are quite specific. Steelhead spawn in cool, clear, well oxygenated water. The gravel they spawn in typically ranges from 1to130 millimeters (0.04 to 5.1 inches) in diameter. Steelhead females prepare a redd much the same way as any other salmon, by fanning the gravel with their tales. The redds are typically around 70 square feet (6.5 square meters) in size and a female may deposit anywhere from 200 to 12,000 eggs depending upon her size and maturity, with 3,500 being the average. Unlike salmon, steelhead are iteroparous, meaning that adults may spawn more than once (NOAA 1998, Moyle 2002).

Eggs usually hatch in 3 to 4 weeks and fry emerge from the gravel 2 to 3 weeks later. Water temperature plays a major role in emergence time. Steelhead typically spend at least a year in fresh water, but may stay up to 3 years if water temperatures and available food are optimal. They will then typically spend 1 to 2 years in the ocean before returning to fresh water to spawn. Another curious life history pattern is the half-pounder, which is an immature steelhead that returns to fresh water after only 2 to 4 months in the ocean (NOAA 1998, Moyle 2002).

2.2.2 Beavers

Beavers have long co-existed with salmon, and their presence can cause both positive and negative impacts on salmon. On the whole, their presence is considered of great benefit to both water quality and salmon life history patterns, particularly juveniles (Kocik and Ferreri 1998). Beaver activities play a key role in creating and maintaining conditions of many headwater streams, wetlands, and riparian systems that have assured successful salmon rearing, particularly in arid regions (Vanicek 1993, NOAA 1998).

Beaver ponds also increase water storage in banks and floodplains. This has a variety of beneficial outcomes to riparian habitats. The water table is increased, and summer flows are enhanced, which creates more cold water during the summer for salmonids. By storing spring and summer storm runoff, streams have a more even flow throughout the year, which helps to reduce downstream flooding and damage from rapid increases in stream flow. Beaver ponds also enhance the overall habitat development by increasing the surface area of water, enhancing vegetation growth by increasing the amount of groundwater available for riparian plants, and expanding wetland areas (Olson and Hubert 1994, NRC 1996).

Beaver ponds also improve habitat quality in streams by decreasing bank erosion by reducing the channel gradient during high flows and by settling out and trapping sediment. Olson and Hubert (1994) found that sediment loads were reduced by 90% after flowing through a creek that had 5 miles (8.0 kilometers) of well-developed riparian habitat and beaver dams. Beaver ponds also provide a sink for nutrients from tributary streams and create conditions that promote anaerobic decomposition and denitrification, which result in nutrient enrichment and increased production downstream from the pond as well as increased nutrient retention time and enhanced invertebrate (prey) production in the pond (NRC 1996).

By ponding water, beaver dams create rearing and over-wintering habitat that offers juvenile salmonids protection from high winter flows (NRC 1996). Survival of juvenile salmonids depends on pools and slow water habitat where juveniles can avoid being swept downstream during high flows (Nilsson and Dynesius 1994).

Beaver dams can impede salmon migration, but studies by Olson and Hubert (1994) show that adult trout were able to pass over dams during high flows and can also travel upstream and downstream through most beaver dams during all seasons.

3. Methods

A stream habitat assessment was conducted during the winter of 2001 and spring of 2002 on Miners Ravine. The survey began at the confluence of Secret Ravine and Miners Ravine, which together form Dry Creek. The habitat survey involved 15 field days, conducted from November 11, 2001 through February 27, 2002. The primary surveyors were Chris Lee and Rick Kuyper from FPIP. The total length of creek surveyed was 12.9 miles (20.8 km) of mainstem channel (Map 2).

The habitat assessment conducted on Miners Ravine Creek generally followed methods outlined in the California Department of Fish and Game's (DFG) *California Salmonid Stream Habitat Restoration Manual* (Flossi and others 1998). The assessment was conducted by a two-person team, a third person came along during inclement weather as a safety precaution.

4. Habitat Inventory Components

The standardized habitat inventory form found in the manual was used as a guide for the habitat assessment conducted on Miners Ravine (Flossi and others 1998). Detailed measurements were taken at every third example of each habitat type. Information was collected regarding habitat type (pool, glide, and riffle complexes), including depth, substrate, water velocity, and instream habitat. Data were also collected on structures within the creek to determine if they were barriers to salmonid migration. Information regarding observance of salmonids or carcasses was also recorded.

4.1 Flow

Flow is the movement of water and/or other substances from place to place in the stream. Flow varies with the topography of the land, climate, season, vegetation, and the drainage area of the watershed. Changes in the flow affect water depths, sediment loads, and substrate composition. Flow, or discharge (volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as cubic meters per second [m^3/sec], or cubic feet per second [cfs]), directly affects the composition of the habitat and its stability. Flow can also affect riparian vegetation, which in turn provides important cover for fish and erosion control for bank stability (Bell 1990, Flossi and others 1998, Bain and Stevenson 1999). Flow was measured in cubic feet per second using a Marsh-McBirney Flomate 2000 flowmeter.

4.2 Habitat Type

Habitat types are land or aquatic units consisting of an aggregation of similar structural and functional habitats that show like responses to disturbance (Bell 1990, Bain and Stevenson 1999). For Miners Ravine, we used the Level II approach found in the manual for habitat typing (Flossi and others 1998). We recorded three different habitat types: riffles, flatwater (which we called glides), and pools. Measurements within the habitat types were conducted using hip chains, tape measures, and stadia rods. We measured the first occurrence of each habitat type, and every third occurrence thereafter.

4.3 Embeddedness

Embededdness reflects the degree to which the larger particles of the substrate (boulders, cobble, and gravel) are covered or surrounded by fine sediment such as sand, silt, or clay. The fine particles fill the interstitial spaces of the larger particles and impede flow through the substrate. Those interstitial areas are important habitat for macroinvertebrates, small fish, spawning sites, and egg incubation (Bell 1990, Flossi and others 1998, Baines and Stevenson 1999, Bates 2001). Embeddedness was measured visually for Miners Ravine.

4.4 In-stream Cover

One of the most critical components of salmonid habitat is cover, particularly for rearing juveniles. In-stream shelter, whether it be woody debris, undercut banks, or submerged vegetation, plays a vital role in protecting salmonids from predation, provides areas where they can rest from current, and also decreases competition for favored habitat by creating segregation of those habitats (Bell 1990, Flossi and others 1998, Bain and Stevenson 1999, Moyle 2002). The type of shelter and estimated percent of coverage were recorded.

4.4 Substrate Composition

Substrate composition is the mineral and/or organic components that form the bed of the creek (Flossi and others 1998, Bain and Stevenson 1999). Substrate composition ranged from boulder-sized elements down to sand/silt/clay. In those habitats that were measured, substrate was recorded through visual observations of percentage values into four categories: boulder, cobble, gravel, and sand/silt/clay. The manual was consulted for particular size breakdown of the elements encountered (Table 3) (Flossi and others 1998).

4.5 Canopy

The canopy cover is the riparian, or streamside, vegetation that projects over the creek. Riparian vegetation contributes to the input of nutrients, organic matter, large woody debris, and reduction in solar heating. It also provides a potential buffer from nutrient input from agricultural sources and other human-influenced pollution (Bell 1990, Flossi and others 1998, Bain and Stevenson 1999). Bishop (1997) conducted evaluations on riparian habitat in the Dry Creek Drainage (Table 4). During the FPIP survey, we concluded that original observations from 1997 are representative of the riparian conditions observed in 2001/2002. We also noted new encroachment into the riparian and flood zone by ongoing urbanization. Estimated canopy cover by reach was noted during the survey.

5. Biological Inventory

Biological sampling during stream surveys is used to determine composition of species found in the stream (Bain and Stevenson 1999). Biological sampling has been done periodically by DFG and others on Miners Ravine (Hansen 1985, Vanicek 1993, Hobgood 1996, Nelson 1997, Titus 2001); past results will be discussed below. Observances of live adult salmon and carcasses were conducted during the habitat survey.

6. Data Analysis

Data from the habitat surveys were entered into Microsoft Excel spreadsheets for analysis (Appendix A). The following tables and figures were formulated to summarize the data:

- Flow by habitat type (Figure 1)
- Habitat types (glides, pools, riffles) (Table5)
- Embeddedness by habitat type (Table 6)
- Dominant in-stream cover type by habitat type (Table 7/Figure 2)
- Mean in-stream cover by habitat type (Figure 3)
- Dominant substrate by habitat type (Table 8)
- Maximum pool depth by habitat type (Table 9)

7. Habitat Inventory Results

Flow averaged 1.39 cubic feet per second (cfs) during the survey period (figure 1). Because this is an unregulated stream, several seasons of data would need to be collected, with variable types of water years, in order to make any type of conclusion regarding flow on Miners Ravine.

Table 5 summarizes the habitat types encountered during the survey. Riffles and glides had virtually the same occurrence rate of 43%, pools comprised 14% of the units surveyed. There was a slightly higher level of variability with the total length of the habitats, with glides accounting for 44% of the habitat surveyed, pools 35%, and riffles 21%.

Table 6 shows the embeddeddness of the substrate found in the various habitat types. The embeddedness of the pool tail outs in riffle areas is extremely high, with a mean of 54%.

Table 7 summarizes the in-stream shelter encountered by habitat type. Overhanging branches were the dominant cover type for glide habitats, accounting for 27% of the in-stream cover. Large woody debris was the dominant cover type for pool habitats, present in 53% of the pools. Boulders were the dominant cover in riffle habitats, found in 57% of the riffles sampled. Boulders were the dominant cover found during the habitat assessment, occurring in 26% of all the habitats surveyed. The second and third most prevalent cover types were overhanging branches at 21% and large woody debris at 20%.

Figure 2 summarizes the mean percent of in-stream cover for each habitat type. Glides had a 13% mean cover per habitat; pools 7%; and riffles 11%.

Table 8 summarizes the substrate found in each habitat type sampled. Overwhelmingly, sand/silt/clay was the dominant substrate found in all three habitat types-in 69% of the glides, 78% of the pools, and 51% of the riffles.

Table 9 summarizes maximum depth (2 feet deep or deeper) per habitat type. Of the glides measured, 65% had maximum depths 2 feet or deeper, pools had 89%, and riffles 35%.

There are several beaver dams on Miners Ravine that probably impede migration for both adults and juveniles during various flow regimes. These dams have been built up over time and have withstood several years of storm events. As a result, the transport of sediments has been greatly affected, allowing the fines more time to settle out and create tremendous embeddedness in much of the system.

8. Biological Inventory Results

Biological inventories have been conducted by the DFG and others on certain sections of Miners Ravine from the early 1960s until present. Information regarding habitat assessment by DFG personnel or other anecdotal information for Miners Ravine will be summarized in this section. The only biological inventory information FPIP recorded was visual observations of salmon and carcasses (Table 10). No redds were observed during the habitat surveys.

Gerstung (1965) conducted salmon surveys during November and reported 3 live salmon and 7 carcasses. He estimated the run to be around 100 fish, estimating that spawning was 80 percent complete by November of 1964. According to Gerstung, most of the fish migrated upstream on October 30, 1964 after heavy rains. Gerstung reported that he estimated the number of fall run salmon to be around 100, which was similar to the previous year. Salmon surveys from February 16, 1965 until March 12, 1965 yielded 11 live fish and 17 carcasses. Three carcasses and 2 live fish were found at Cavitts-Stallman Bridge, and 4 carcasses and 3 live fish were found at Hidden Valley (Cottonwood Dam). Downstream migrant data included 28 salmon fry.

According to current resident Barbara Pepper, one of Hidden Valley's first caretakers, Gordon Cook, told Bill Grenfell (homeowner) that he used to spear salmon with a pitchfork, near Cottonwood Dam. Pepper said this would have been in the 1960s.

In 1965, DFG carcass surveys counted 27 adult Chinook salmon (Gerstung).

Hansen (1985), a DFG Fishery Biologist, surveyed Miners Ravine approximately 1.5 miles upstream from its confluence with Antelope Creek. No live fish or redds were seen, but 6 carcasses were recovered.

Vanicek (1993) observed 10 carcasses in Miners Ravine 100 meters upstream from the Secret Ravine confluence during a fisheries habitat evaluation survey of the Dry Creek drainages.

In a November 26, 1996 Memo, DFG Game Warden Gary Hobgood told John Nelson, DFG Senior Fishery Biologist, that he observed 4 live salmon just upstream from the Sunrise Bridge (1996).

Nelson (1997) surveyed near the confluence of Miners Ravine and Secret Ravine. His report stated that salmon spawning gravel in Miners Ravine was extremely limited in quantity and was extremely embedded (>50%) in the 1.5-mile reach surveyed. He also noted that rain accounted for approximately 30% of available habitat (by increasing volume) of Dry Creek tributaries and was highly influential on determining when salmon could access the creeks. Adult salmon generally ascend Dry Creek from October to December, depending on when fall rains increase runoff and decrease water temperature. DFG used to plant approximately 100,000 fall-run Chinook salmon fry in the Dry Creek drainage annually, from the early 1980s until 1993. These were generally excess fry taken from Nimbus hatchery. Surplus fry from Feather River Hatchery were occasionally planted in Secret Ravine and its tributaries in the late 1980s (Preston 1987).

The Dry Creek Steelhead Study Status Report for 1997-1998 (DFG 1998) states that Secret and Miners ravines are the primary spawning and rearing areas in the system.

Titus (2001), DFG Fishery Biologist, reported juvenile steelhead in Miners Ravine at Dick Cook Road (upstream of Cottonwood Dam). He further stated that habitat conditions at sample locations appeared suitable for juvenile steelhead rearing and that juvenile fish present in March (above the dam) provided evidence of suitable spawning conditions. He also observed juvenile Chinook salmon from the mouth of the creek up to the fourth bicycle-trail bridge during late March to early April of 1999.

The Dry Creek Conservancy (DCC) was formed in 1996 to preserve and restore the biological resources of the Dry Creek Watershed (DCC 2001). Since 1997, volunteers have observed salmon in Dry Creek, Secret Ravine, Miners Ravine, Antelope Creek, Cirby Creek, and Linda Creek. In 2001, volunteers observed 26 live salmon and 18 carcasses in Miners Ravine. Gregg Bates, Director of the DCC, summarized the data collected from 1997 to 2001 (Table 11).

9. Discussion

Fall-run Chinook salmon and steelhead have been historically present in Miners Ravine, with numbers up to 100 fish per year according to DFG records. Occasionally, they still migrate into its waters in search of spawning habitat. However, suitable spawning areas are becoming harder for these fish to find.

Migratory barriers, natural and unnatural, are one of the main reasons for the depletion of spawning areas. Dams convert portions of riverine habitat into lakes. This alters downstream flow rates for water and sediment. In addition, movement of aquatic organisms is impeded. Water quality is also affected, which causes long-term changes to downstream channels, riparian zones, and floodplains (NRC 1996, Nilsson and Dynesius 1994). There are several other man-made and natural barriers in the system that are at least partial barriers to migrating fish (Table 12).

Encroachment of homes within the floodplain creates additional problems in the watershed. Landscaped backyards come to the edge of the creek in many locations. The run-off from landscaped yards may contain chemicals from fertilizers, animal waste, and other contaminants that have a detrimental effect on water quality, which could affect all life stages of salmonids (Meyer 1989, NRC 1996). These encroachments also affect the natural process of erosion, which in turn decreases the recruitment of gravel back into the system. Creek banks near homes are armored with riprap and allow only fine sediment into the creek (Swanson 1992).

Glides comprised 44% of the total length of habitat surveyed, pools 35%, and riffles 21%. Of the glides measured, 65% had a depth of 2 feet or greater, and 89% of the pools measured had a depth of 2 feet or greater. Approximately 60% of the length of the habitat surveyed had a depth of 2 feet or deeper. It appears there is enough deep water refuge for migrating adults and juveniles during the fall and winter months. Even if summertime temperatures and/or the amount of water present in the system are not optimal for Chinook salmon or steelhead juveniles, they would still be able to migrate downstream, as long as there are no barriers preventing them from doing so. However, additional surveys would be required in order to determine water depths, temperature, and flows to make more definitive conclusions about summer habitat conditions in Miners Ravine.

Observations regarding spawning substrate revealed less than optimal conditions for salmon and steelhead. Embeddedness of the substrate is an issue in this system. Only 12 of 87 (14%) of the riffles surveyed had 25% or less embeddedness. Generally, embeddedness above 20% is considered unsuitable for spawning activities (West 1984, Bell 1990, Salo and Cundy 1987, Flossi and others 1998). The visual assessment of embeddedness is not highly accurate according to Bain and Stevenson (1999). Small patches of suitable spawning gravel were observed during the survey. In addition, cobble or gravel was not the dominant substrate found in riffles. Silt, sand, and clay comprised 51% of the substrate found in the riffles. More accurate surveys may be required, such as pebble counts, to make more definitive conclusions about the amount and quality of spawning substrate in the system.

The mean percent of in-stream cover was very low for all three habitat types-13% for glides, 7% for pools, and 10% for riffles-the Salmonid Stream Habitat Restoration Manual indicates optimal in-stream cover for pool complexes would be 100% (Flossi and others 1998). The low percentage indicates poor quality cover, which affects the ability of individuals to take refuge from both terrestrial and aquatic predators, refuge from high flow velocities, as well as refuge from bright sunlight (Reiser and Bjornn 1979, Vanicek 1993, Moyle 2002).

Cottonwood Dam is thought by many to be a complete migratory barrier for anadromous salmonids in Miners Ravine. According to Titus, steelhead may be able to get around it during high flows if a side channel is formed. Titus observed steelhead upstream of Cottonwood Dam in December 1998 and March of 1999, near Dick Cook Road.

The best habitat observed is upstream of Cottonwood Dam, near Dick Cook Road. The area had high canopy cover, areas of underlain bedrock creating deeper pools, higher concentrations of gravel, and did not appear to have as much sedimentation and embeddedness as other areas of the creek. This conclusion is based more on visual observances and not quantified measurements because only every third habitat type was measured for these types of parameters. This is near the area Titus observed adult and juvenile steelhead, thereby indicating that at least limited spawning and rearing habitat is still present in the system.

More than 80 beaver dams were encountered along the approximately 13 miles surveyed. It appears that one of the overwhelming factors contributing to the abundance of beavers along the creek is the elimination and/or exclusion of predators by urbanization along the watershed.

There are at least 19 structures downstream of Cottonwood Dam that are potential passage barriers to anadromous fish. Any restoration efforts for anadromous fish in Miners Ravine should concentrate on impediments from downstream to upstream. If structures are proposed for modification or removal, then the habitat gained by such action should be qualified and quantified regarding its benefits to anadromous fish species. Generally, the habitat between each of these structures would need enhancement in the form of in-stream cover complexity, suitable spawning gravel,and increased riparian canopy to benefit native anadromous salmonids.

10. Recommendations

Based upon the results of the FPIP habitat assessment survey, the following actions would provide additional useful information and/or enhance the suitability of habitat for anadromous salmonids in Miners Ravine:

1) Use additional methodologies for substrate sampling for more refined qualitative and quantitative results.

2) Create a plan for adaptive management measures for some of the larger beaver dams in the system.

4) Eradicate non-native invasive species.

5) Further evaluate potential barriers to determine if they impede fish passage and to recommend possible solutions.

6) Increase in-stream cover complexity for entire creek.

7) Increase suitable spawning substrate for entire creek.

8) Monitor water temperature during extreme periods of July and August to establish meaningful temperature information.

9) Educate landowners on ecosystem friendly erosion and flood protection measurements.

11. Cited References

Alden, Peter, Fred Hearth, Richard Keen, Amy Leventer, and Wendy B. Zomlefer. 1998. National Audubon Society Field Guide to California. Chanticleer Press, Inc.

Bain, Mark B. and Nathalie J. Stevenson, Eds. 1999. Aquatic Habitat Assessment Common Methods. American Fisheries Society.

Bates, Gregg. 2001. Secret Ravine Adaptive Management Plan. Dry Creek Conservancy.

Bell, M.C. 1990. Fisheries Handbook of Engineering Requirements and Biological Criteria. U.S. Army Corps of Engineers. Fish Passage Development and Evaluation Program. Portland, OR.

Bishop, Debra Colleen. 1997. Master of Science Thesis: An Evaluation of Dry Creek and Its' Major Tributaries in Placer County, California. CSU Sacramento.

CALFED. 2001. Ecosystem Restoration Program Draft Stage 1 Implementation Plan.

California Department of Fish and Game. 1965. Interdepartmental memo.

California Department of Fish and Game. 2002. California Natural Diversity Database. Wildlife and Habitat Analysis Branch.

Department of Water Resources. 2002. Fish Passage Improvement Program Fact Sheet.

Finlayson, Brian. 1977. Evaluation of City of Roseville Wastewater Treatment Facilities, Dry Creek Basin, Placer County, California. California Department of Fish and Game Environmental Services Branch. Laboratory Memorandum Report 77-4

Flossi, Gary, Scott Downe, James Hopelain, Michael Bird, Robert Coey, and Barry Collins. California Salmonid Stream Habitat Restoration Manual.1998. Third Edition. California Department of Fish and Game.

Gerstung, Eric. 1964. Inter-Departmental Memorandum. California Department of Fish and Game.

Groot, C. and L. Margolis, Eds. 1991. Reprinted 1998. Pacific Salmon Life Histories. Department of Fisheries and Oceans. Biological Sciences Branch. Pacific Biological Station, Nanaimo British Columbia, Canada.

11. Cited References (continued)

Hansen, Phil. 1985. Inter-Departmental Memorandum. California Department of Fish and Game.

Hobgood, Gary. 1996. California Department of Fish and Game Interdepartmental Facsimile.

Kocik, John F. and C. Paola Ferreri. 1998. Juvenile Production Variation in Salmoinds: Population dynamics, habitat in the role of spatial relationships. CAN J. Fisheries and Aquatic Science. 55(S1): 191-200.

Meyer, Fred. 1989. Inter-Departmental Memorandum. California Department of Fish and Game.

Moyle, Peter B. 2002. Inland Fishes of California. University of California Press.

National Research Council. 1996. Restoration of aquatic ecosystems. National Academy Press. Washington, D.

National Ocean and Atmospheric Administration (NOAA). 1998. Proposed recommendations, essential fish habitat, Pacific salmon fishery management plan. http://www.nwr.noaa.gov/1sustfsh/sal-efhf.htm.htm

Nelson, J. 1997. Dry Creek, Secret Ravine and Miners Ravine, Placer County. Memorandum of Nov. 17, 1997 to Nick Villa. Calif. Dept. of Fish and Game, Region 2, Rancho Cordova CA.

Nilsson, C. and M. Dynesius. 1994. Ecological effects of river regulation on mammals and birds: a review. Regulated Rivers: Research and Management 9: 45-53.

Olson, R. and W. Hubert. 1994. Beaver: Water Resources and Riparian Habitat Manager. University of Wyoming, Laramie, Wyoming.

Preston, Lawrence G. 1987. Feather River Hatchery Surplus Chinook Fingerling Plant Receipts. Calif. Dept. of Fish and Game Memorandum.

Reiser, D.J., and T.C. Bjornn. 1979. Influence of Forest and Rangeland Management on Anadromous Fish Habitat in Western North America; Habitat Requirements of Anadromous Salmonids. General Technical Report PNW-96. U.S.D.A. Forest Service, Pacific Northwest Forest and Range Experiment Station.

11. Cited References (continued)

Salo, Ernest O., and Terrance W. Cundy. Eds. 1987. Streamside Management: Forestry and Fishery Interactions. University of Washington Institute of Forest Resources.

Swanson, Mitchell L. 1992. The Miners Ravine Creek Watershed Enhancement and Restoration Plan for the Reduction of Flood Hazards and the Enhancement and Protection of Environmental Resources. Mitchell Swanson and Associates.

Titus, Robert G. 2001.Inter-Departmental Memorandum. California Department of Fish and Game.

U.S Department of Commerce. 1998. National Oceanic and Atmospheric Administration. 50 CFR Part 227. Endangered and Threatened Species; Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California.

U.S Department of Commerce. 1998. Status Review of Chinook Salmon from Washington, Oregon, and California. NOAA-NWFSC Technical Memorandum, NMFS-NWFSC-35.

U.S Department of Commerce. 1999. National Oceanic and Atmospheric Administration. 50 CFR Part 223. Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionary Significant Units (ESUs) in California; Final Rule.

Vyverberg, Kris, Bill Snider, and Robert G. Titus. 1997. Lower American River Chinook Salmon Spawning Habitat Evaluation: An Evaluation of Attributes Used to Define the Quality of Spawning Habitat. California Department of Fish and Game. Environmental Services Division.

West, J.R. 1984. Enhancement of Salmon and Steelhead Spawning and Rearing Conditions in the Scott and Salmon Rivers.Humboldt State University. Pacific Northwest Stream Habitat Management Workshop, Arcata.

Vanicek, D. 1993. Fisheries Habitat Evaluation, Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine. Prepared for EIP Associates.

12. Personal Communications

Bates, Gregg. Director, Dry Creek Conservancy. Email: dcc@unlimited.net

Hobgood, Gary. 1601 Lake and Streambed Alteration Coordinator. California Department of Fish and Game. (916) 983-5162

Pepper, Barbara. Hidden Valley Homeowners Association. (916) 791-7436 Email:barbarap@quiknet.com

Nelson, John. Senior Fishery Biologist. California Department of Fish and Game.(916) 358-2944. Email:jnelson@dfg.ca.gov

Titus, Robert G., Ph.D. Fishery Biologist. California Department of Fish and Game. Native Anadromous Fish and Watershed Branch. (916) 227-6390. Email:titus@dfg2.ca.gov

13. Appendices
Appendix A Tables

Table 1: Fish Passage Improvement Program criteria for identifying priority projects that provide cost effective, multiple aquatic ecosystem, and water use benefits

Fish Passage Improvement Program Criteria
Level I
1. Central Valley/ Bay Area
2. Below “Rim” dams (flood control, water, power supply)
3. Benefits native salmonids
4. Located within critical habitat
5. First downstream impediment
6. Established program or stakeholder supported
Level II
1. Barrier has existing non-functional passage facility
2. Will not impact flood protection
3. Water supply impacts can be mitigated
4. Benefits ESA listed salmonids
5. Historical habitat for listed species
6. Identified interagency priority
7. Existing good quality habitat above barrier
8. Significant habitat gain within historical/ critical habitat

Appendix A Tables (continued)

Table 2: Endangered and threatened species that occur, or have the potential to occur within Miners Ravine watershed

Scientific Name	Common Name	Status		
		State	CNPS	Federal
Animals				
Accipiter cooperii	Cooper's Hawk	SC		
Agelaius tricolor	Tricolored Blackbird	SC		
Ardea alba	Great Egret	S4		
Ardea herodias	Great Blue Heron	S4		
Athene cunicularia	Burrowing Owl	SC		
Buteo swainsonii	Swainson's Hawk	ST		
Clemmys marmorata marmorata	Northwestern Pond Turtle	SC		
Elanus leucurus	White-Tailed Kite	SC		
Scaphiopus hammondi	Western Spadefoot	SC		
Invertebrates				
Branchinecta lynchi	vernal pool fairy shrimp			FT
Desmocerus californicus dimorphis	valley elderberry longhorn beetle			FT
Lepidurus packardi	vernal pool tadpole shrimp			FE
Lnderiella occidentalis	California linderiella	SC		
Plants				
Balsamorhiza macrolepis var. macrolepis	big-scale balsamroot		1B	
Calystegia stebbinsi	Stebbins's morning glory	SE	1B	FE
Ceanothus roderickii	pine hills ceanothus	SR	1B	FE
Chlorogalum grandiflorum	red hills soaproot		1B	
Clarkia blioba brandegeae	Brandegee's clarkia		1B	
Cordylanthus mollis ssp. Hispidus	hispid bird's-beak		1B	
Downingia pusilla	dward downingia		2	
Galium californicum ssp. Sierrae	El Dorado bedstraw	SR	1B	FE
Gratiola heterosepala	Boggs Lake hedge-hyssop	SE	1B	
Helianthemum suffrutescens	Bisbee Peak rush-rose		3	
Juncus leiospermus var leiospermus	Red Bluff dwarf rush		1B	
Legenere limosa	legenere		1B	

Appendix A Tables (continued)

Table 2. Endangered and threatened species that occur, or have the potential to occur within Miners Ravine watershed (continued)

Scientific Name	Common Name	Status		
		State	CNPS	Federal
Plants (continued)				
Navarretia myersii spp. Myersii	pincushion navarretia		1B	
Orcuttia viscida	Sacramento orcutt grass	SE	1B	FE
Senecio layneae	Layne's ragwort	SR	1B	FT
Wyethia reticulata	El Dorado County mule ear		1B	

Legend:

CNPS

1B=Rare or Endangered in California and elsewhere.
2=Rare or endangered in California, more common elsewhere.
3=Plants for which we need more information-Review list.

Federal

E=Listed as endangered under the federal Endangered Species Act.
T=Listed as threatened under the federal Endangered Species Act.

State

E=Listed as endangered under the California Endangered Species Act.
R=Listed as rare under the California Native Plant Protection Act.
SC=Species of special concern in California. Species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.
S4=Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK
T=Listed as threatened under the California Endangered Species Act.

Appendix A Tables (continued)

Table 3: Substrate particle size criteria according to the Department of Fish and Game’s Salmonid Habitat Restoration Manual (1998)

Substrate Particle Size	
Particle Size	Inches
Boulder	>10”
Cobble	2.5-10”
Gravel	0.08-2.5”
Sand	<0.08”
Silt/Clay	N/A
Bedrock	N/A

Appendix A Tables (continued)

Table 4: Riparian habitat of Miners Ravine by reach (modified from Bishop, 1997)

Reach	Location	Habitat Description	%Cover
1	Confluence with Dry Creek to Sierra College BLVD.	Oak hillsides, grassland, riparian forest scrub, large stands of Himilayan blackberry.	>25
2	Sierra College BLVD to Ashby Lane	Lawns, landscaping to thickly vegetated riparian, native riaparian understory, Himilayan blackberry, German ivy, pampas grass.	>50
3	Ashby Lane to Barton Road	Mostly complex riparian forest with mixed age classes of trees, some non-native species like Himilayan Blackberry.	>50
4	Barton Road to Tall Pine Lane	Live oaks, grey pines, Himilayan blackberry, pampas grass, eucalyptus, and bamboo.	>25
5	Tall pine Lane to Carolinda Drive	Oak/grey pine woodlands, large stands of Himilayan blackberry.	>25
6	Carolinda Drive to Itchy Acres Road	Mixed riparian, Himilayan blackberry, landscaping vegetation, planted Redwoods, pampass grass, lawns.	>25
7	Itchy Acres Road to Miners Ravine Road	Little riparian cover, mostly non-native species including German ivy, periwinkle, and Himilayan blackberry.	>25
8	Miners Ravine Road to Leibinger Road	Remnant riparian, alders, willows, wetland species, Himilayan blackberry, Redwoods, oleander.	>25
9	Leibinger Lane to 1st crossing of Auburn-Folsom Road	Mixed riparian forest, lawn and landscaping to the creek.	>25

Appendix A Tables (continued)

Table 4. Riparian habitat of Miners Ravine by reach (continued) (modified from Bishop, 1997)

Reach	Location	Habitat Description	%Cover
10	1st crossing of Auburn-Folsom Road to 2nd crossing of Auburn-Folsom Road	Mixed riparian forest, dominated by lawns and landscaping to creek, Himilayan blackberry, escapement of ornamentals along creek.	>25
11	2nd crossing of Auburn-Folsom road to Oakview Drive	Remnant oak forest, large stands of Himilayan blackberry, giant reed grass.	>25
12	Oakview Drive to Moss Lane	Oak forest, grey pines, large stands of Himilayan blackberry, pampas grass, lawns and landscaping to creek.	>25
13	Moss Lane to Willow Valley Place	Large stands of Himilayan blackberry, mixed riparian forest.	>25
14	Willow Valley Place to Dick Cook Road	Oak forest, grey pines, large stands of Himilayan blackberry.	>25
15	Dick Cook Road to 3rd crossing of Auburn-Folsom Road	Oak forest, mixed riparian forest, large stands of Himilayan blackberry.	>50
16	3rd crossing of Auburn-Folsom Road to LoMida Lane	Oak forest, mixed riparian canopy, large stands of Himilayan blackberry.	>25
17	LoMida Lane to Horseshoe Bar Road	Willows, oaks and cottonwoods, wetland type species.	>25
18	Horseshoe Bar Road to Whiskeybar Road	Remnant oak forest, large stands of Himilayan blackberry, lawns and landscaping to creek.	>25
19	Whiskeybar Road to Newcastle Road	Mixed riparian forest, large stands of Himilayan blackberry.	>25

Appendix A Tables (continued)

Table 5: Summary of habitat types, lengths, and percent surveyed compared to all habitats surveyed

Habitat Type	Total	Number Surveyed	Percent Surveyed	Percent of All Habitat Types	Length (feet) of Habitat Types Surveyed	Percent of All Habitat Types Surveyed
Glides	258	86	33%	43%	9255	44%
Pools	85	28	33%	14%	7246	35%
Riffles	262	87	33%	43%	4312	21%

Appendix A Tables (continued)

Table 6: Embeddedness by habitat type

Habitat Type	Mean Embeddedness
Glides	66%
Pools	83%
Riffles	54%

Appendix A Tables (continued)

Table 7: Summary of dominant instream cover by habitat type

Habitat	In-stream Cover by Percentage											
Type	1-5 B	6+ B	BC	BL	BUB	ESV	LSV	LWD	OB	RW	SUB	SWD	UB
Glides	13%	2%		1%			6%	20%	27%	2%	1%	10%	15%
Pools	7%	3%			3%	3%	7%	53%	32%			3%	28%
Riffles	57%	5%	13%		2%		4%	13%	18%				8%
All Habitats	26%	3%	4%	.4%	1%	.4%	5%	20%	21%	.8%	.4%	4%	12%

Legend (adopted from DFG):
1-5 B= One to five boulders
BC= Bubble Curtain
BUB= Bare undercut bank
LWD= Large woody debris (>12” diameter and 6’ long)
RW= Root wad
SWD= Small woody debris (<12")
UB= Stable undercut bank with no root mass
6+B= Six or more boulders per 50 feet
BL= Bedrock ledge
ESV= Extensive submerged vegetation
OB= Overhanging branches in or near water
SUB= Stable undercut bank with root mass, and less than 12” undercut

Appendix A Tables (continued)

Table 8: Dominant substrate per habitat type

Habitat Type	Substrate			
	Boulders	Cobble	Gravel	Sand/Silt/Clay
Glides	0.11	0.11	0.09	0.69
Pools	0.08	0.07	0.02	0.78
Riffles	0.21	0.15	0.14	0.51

Appendix A Tables (continued)

Table 9: Maximum pool depth per habitat type

Habitat Type	Max Depth <2’	Max Depth 2’ or >
Glides	35%	65%
Pools	11%	89%
Riffles	65%	35%

Appendix A Tables (continued)

Table 10: Salmon and carcasses observed during DWR habitat survey

Date		Location		Carcass/Salmon	Sex	Fl(cm)	Adipose	Tagged
		Latitude	Longitude					
2001	20-Nov	38.75908	-121.25575	Carcass	F	76	Intact	No
	28-Nov	38.76074	-121.25191	Carcass	M	109	Intact	No
		38.76065	-121.25048	Carcass	M (Jack)	58	Intact	No
		38.76027	-121.25029	Carcass	M	79	Clipped	No
		38.76019	-121.24978	Salmon	M	Approx. 90	Intact	No
	30-Nov	38.76117	-121.24825	Carcass	M	74	Intact	No
		38.76072	-121.24686	Carcass	M	91	Intact	No
		38.76019	-121.24654	Salmon	M	Approx. 90	Intact	No
		38.75751	-121.24688	Carcass	F	84	Intact	No
		38.75699	-121.24675	Carcass	M	81	Intact	No
		38.75683	-121.24669	Carcass	F	75	Intact	No
		38.75548	-121.24512	Carcass	M (Jack)	44	Intact	No
		38.75548	-121.24512	Carcass	Unknown	Tail only	Intact	No
		38.75507	-121.24405	Carcass	F	74	Intact	No
		38.75480	-121.24389	Carcass	M (Jack)	42	Intact	No
		38.75480	-121.24389	Salmon	M	Approx. 90	Intact	No
	3-Dec	38.75480	-121.24368	Salmon	Unknown	Approx. 60	Intact	No

Appendix A Tables (continued)

Table 11: Salmon and Carcasses observed by Dry Creek Conservancy in Miners Ravine (modified from DCC spreadsheets, 2002)

Year		Reach			
		MR1		MR2	
		Salmon	Carcass	Salmon	Carcass
1997	16-Nov				
	20-Nov				
	23-Nov				
	24-Nov			12	2
	30-Nov				
	2-Dec			0	3
	4-Dec				
	7-Dec				
	14-Dec				
	18-Dec				
	22-Dec				
1998	8-Nov				
	15-Nov	8	0		
	16-Nov				
	20-Nov				
	22-Nov				
	23-Nov				
	28-Nov				
	29-Nov				
	30-Nov				
	6-Dec				
	7-Dec				
	13-Dec				
	14-Dec				
	15-Dec				
	22-Dec				
1999	7-Nov				
	9-Nov			1	0
	13-Nov				
	14-Nov	11	0		
	17-Nov			11	0
	21-Nov	0	0		
	24-Nov			2	2
	28-Nov	6	2		

Appendix A Tables (continued)

Table 11. Salmon and Carcasses observed by Dry Creek Conservancy in Miners Ravine (modified from DCC spreadsheets, 2002) (continued)

Year		Reach			
		MR1		MR2	
		Salmon	Carcass	Salmon	Carcass
1999 (cont.)	1-Dec			1	0
	4-Dec	0	0		
	5-Dec				
	8-Dec			0	0
	11-Dec	0	0		
	12-Dec				
2000	28-Oct				
	5-Nov				
	8-Nov				
	11-Nov				
	12-Nov				
	14-Nov			16	0
	15-Nov	Data lost*			
	18-Nov				
	19-Nov			9	6
	20-Nov				
	21-Nov				
	22-Nov				
	25-Nov				
	26-Nov				
	29-Nov			2	3
	3-Dec				
	4-Dec				
	6-Dec				
	10-Dec				
	11-Dec				
	13-Dec				
	16-Dec				
	17-Dec				
	18-Dec				
2001	29-Oct			0	0
	3-Nov				
	4-Nov	0	0		
	5-Nov			0	0
	10-Nov				

Appendix A Tables (continued)

Table 11. Salmon and Carcasses observed by Dry Creek Conservancy in Miners Ravine (modified from DCC spreadsheets, 2002) (continued)

Year		Reach			
		MR1		MR2	
		Salmon	Carcass	Salmon	Carcass
2001 (cont.)	11-Nov				
	14-Nov				
	16-Nov			8	0
	17-Nov				
	19-Nov				
	20-Nov	0	1		
	21-Nov			0	0
	23-Nov				
	25-Nov	1	0		
	26-Nov				
	27-Nov				
	28-Nov	2	9	7	2
	30-Nov				
	1-Dec				
	3-Dec	1	1		
	4-Dec				
	5-Dec	0	0		
	7-Dec			4	0
	9-Dec	0	1		
	11-Dec				
	13-Dec				
	14-Dec			0	1
	15-Dec				
	18-Dec				
	19-Dec				
	20-Dec			0	0
	22-Dec				
	25-Dec				
	27-Dec				

*Data was lost, observer said it was similar to previous years numbers.

MR1=Miners Ravine from confluence with Secret Ravine to Roseville Parkway overcrossing.

MR2=Miners Ravine from Roseville to Sierra College Boulevard.

Appendix A Tables (continued)

Table 12: Potential migration barriers to anadromous fish on Miners Ravine

Habitat	Potential Barrier	Latitude	Longitude	Comments
Pool 8	Beaver Dam	38.75976	-121.25400	Beaver dam approximately 2.5 feet high with a 6 inch deep pool below it during normal flows. Salmon were observed above this structure after two successive storm events. May be a barrier during low flows.
Pool 18	Beaver Dam	38.75449	–121.24190	(Photo 4) Beaver dam approximately 3 feet high, pool below 1 foot deep. May be a barrier at low flows.
Pool 19	Beaver Dam	38.75273	–121.24187	Beaver dam approximately 2.5 feet high, pool below 1 foot deep. May be barrier at low flows.
Pool 20	Beaver Dam	38.75176	–121.24198	Beaver dam approximately 2.5 feet high with many branches extending out and above dam, pool below 1 foot deep. May be barrier at low flows.
Pool 21	Beaver Dam	38.75184	–121.23991	Beaver dam is approximately 3.5 feet high, pool below 1 foot deep. May be a barrier at low flows.
Pool 22	Beaver Dam	38.75171	–121.23830	(Photo 5) Beaver dam is approximately 4.5 feet high and 100 feet wide. No salmon or carcasses were seen above this structure on 12/03/01. Reconnaissance surveys were undertaken at this structure (and for 1000 yards upstream) on 12/13/01, 12/18/01, and 01/02/02 and no salmon or carcasses were observed.
Pool 27	Beaver Dam	38.75748	–121.22975	Beaver dam is approximately 2.5 feet high; pool below is 1 foot deep. May be barrier at low flows.

Appendix A Tables (continued)

Table 12. Potential migration barriers to anadromous fish on Miners Ravine (continued).

Habitat	Potential Barrier	Latitude	Longitude	Comments
Culvert	Culvert	38.75627	–121.22430	Box culvert underneath Sierra College Boulevard has approximately 6 inches of water running though it and may be a barrier at low flows.
Pool 31	Beaver Dam	38.75744	–121.21631	Beaver dam is approximately 3 feet high; pool below is 1 foot deep. May be a barrier at low flows.
Pool 37	Concrete Dam	38.75835	-121.20649	Concrete dam 3 feet high, pool below is 1.5 feet deep. May be a barrier at low flows.
Riffle 68	Waterfall	38.75963	–121.19931	(Photo 7)Waterfall approximately 6 feet high, pool below approximately 1.5 feet deep, probably a barrier at high flows. Side channel completely choked with woody debris, but probably passable if removed. Wood was too waterlogged to move.
Pool 42	Concrete Dam	38.75835	–121.20649	Concrete dam approximately 3 feet high, pool below only 1 foot deep. May be a barrier at low flows.
Pool 49	Beaver Dam	38.75838	–121.19009	(Photo 8)Beaver dam approximately 3.5 feet high; pool below is only one foot deep. May be a barrier at low flows.
Glide 93	Log Jam	38.75321	–121.18080	Log jam may be a barrier at low flows. Homeowner diverted side channel appears passable.
Pool 54	Beaver Dam	38.75279	–121.18037	Beaver dam is approximately 4 feet high, pool below only 2 inches deep. May be a barrier at high flows.
Pool 55	Waterfall	38.75185	–121.17961	Waterfall is approximately 2.5 feet high, pool below only 1 foot deep. May be a barrier at low flows.
Pool 56	Waterfall	38.75087	–121.17689	Waterfall is approximately 2.5 feet high; pool below is 2 feet deep. May be a barrier at low flows.

Appendix A Tables (continued)

Table 12. Potential migration barriers to anadromous fish on Miners Ravine (continued).

Habitat	Potential Barrier	Latitude	Longitude	Comments
Riffle 103	Culverts	38.75307	–121.17195	Two of the three culverts under Leibinger Lane are blocked by debris, may be barriers at high flows. Flow is concentrated to third culvert, which may be a velocity barrier during normal flows.
Riffle 114	Waterfall	38.75263	–121.16431	Waterfall is approximately 3 feet high; pool below is 2 feet deep. May be a barrier at low flows.
Cottonwood Dam	Concrete Dam	38.76408	–121.15918	(Photo9)Concrete dam approximately 20 feet high and 100 feet in width. Complete barrier to anadromous fish during high flow conditions.
Riffle 157	Flashboard Dam	38.78379	–121.14950	(Photo 10)Concrete apron under bridge, during normal flows has only 6 inches of water flowing over it. Flashboard dam above apron requires a 3 foot jump, with only 4-6 inches of water below dam. Appears to be a barrier under normal flow conditions.
Glide 170	Flashboard Dam	38.78833	–121.14917	Dam is approximately 2.5 feet high; pool below is only 1 foot deep. May be a barrier at low flows.
Pool 69	Beaver Dam	38.78926	–121.14377	(Photo 11) Beaver dam is approximately 4 feet high; pool below is only 2 feet deep. May be a barrier at low flows.
Riffle 166	Waterfall	38.79279	–121.14017	Two successive 2 foot waterfalls, pool depth below each only 6 inches deep. May be a barrier at low flows.
Pool 72	Beaver Dam	38.79082	–121.14037	Beaver dam approximately 2.5 feet high, pool depth below only 1 foot deep. May be a barrier at low flows.
Pool 73	Low-Flow Crossing	38.79316	–121.14024	(Photo 12) Crossing approximately 3 feet high, pool below only 6 inches deep. May be a barrier at low flows.

Appendix A Tables (continued)

Table 12. Potential migration barriers to anadromous fish on Miners Ravine (continued).

Habitat	Potential Barrier	Latitude	Longitude	Comments
Riffle 175	Flashboard Dam	38.79819	–121.13535	Flashboard dam is approximately 1.5 feet high, pool below is 6 inches deep. May be a barrier at low flows.
Riffle 180	Culverts	38.79893	–121.13187	Culverts under Auburn-Folsom Road. One culvert is completely blocked off by debris at the intake. The other culvert may be a barrier for juveniles at low flows.
Riffle 187	Culvert	38.80026	–121.13016	(Photo 13) Culvert under Placer Canyon Road approximately 80 feet in length, filled with rocks. Approximately 8 inches of water flowing though, may be a barrier at low flows.
Waterfall	Waterfall	38.80095	–121.12988	Two foot jump over rocks, pool below has 6 inches of water in it at normal flows. May be a barrier at low flows.
Pool 77	Beaver Dam	38.80291	–121.12818	(Photo 14) Beaver dam is 8 feet high; pool below is 2 feet deep. May be passable in high flow conditions if a side channel is formed.
Riffle 222	Flashboard Dam	38.81192	–121.12524	(Photo 15) Dam is approximately 4 feet high; pool below is approximately 1 foot deep. May be a barrier at low flows.
Pool 84	Beaver Dam	38.81499	–121.12454	Beaver dam is approximately 4 feet high; pool below is one foot deep. May be a barrier at low flows.
Riffle 235	Flashboard Dam	38.81747	–121.12566	(Photo 16) Dam is approximately 4 feet high; pool below the dam is 2 feet deep. There is a culvert like opening mid dam that is probably a velocity barrier at normal flows. Higher flows may wash over the dam and provide passage for adult salmonids
Riffle 239	Beaver Dam	38.81873	–121.12585	Beaver dam is approximately 3.5 feet high; pool below is approximately 1 foot deep. May be a barrier at low flows.

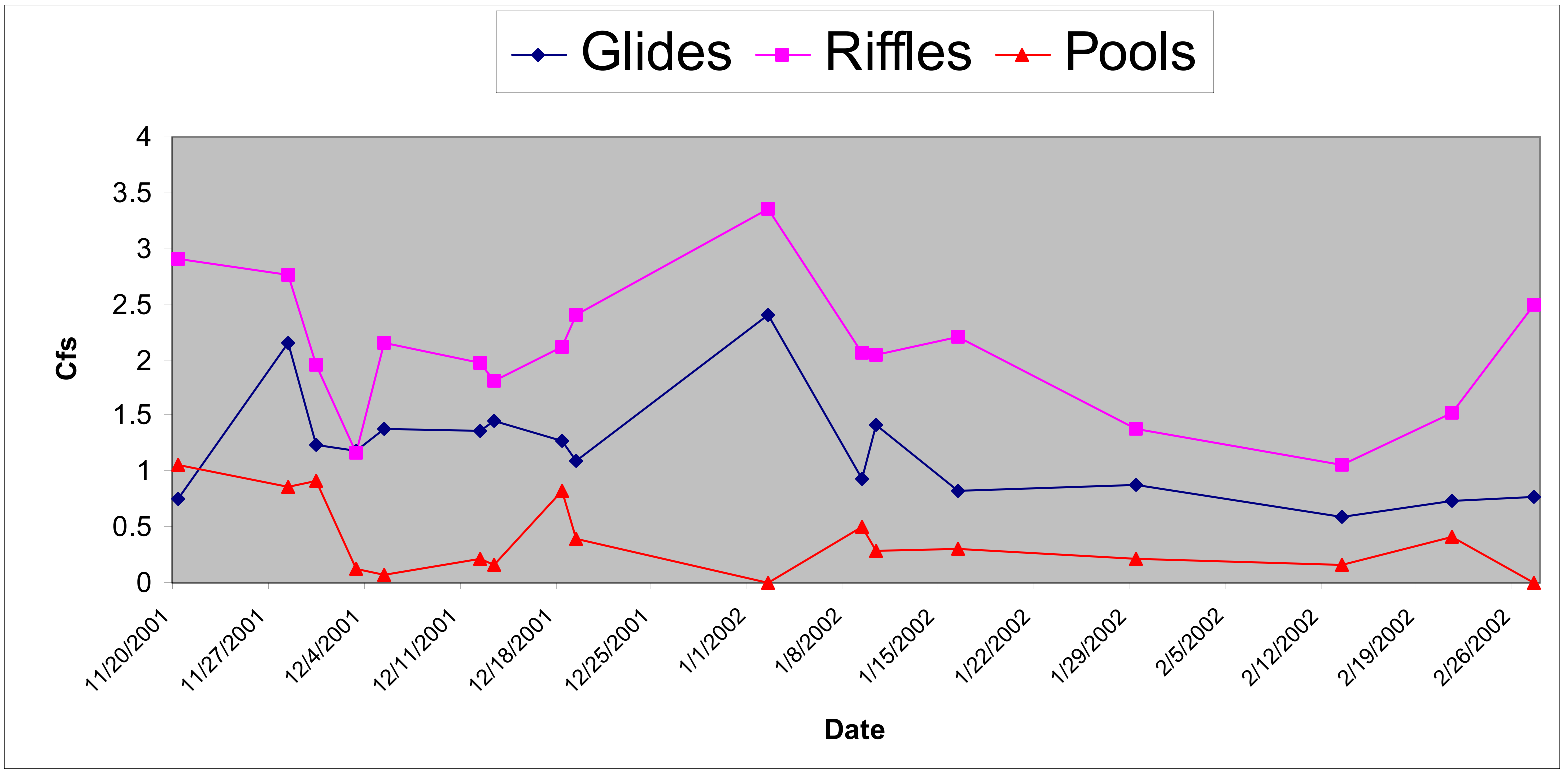
Appendix A Tables (continued)

Table 12. Potential migration barriers to anadromous fish on Miners Ravine (continued).

Habitat	Potential Barrier	Latitude	Longitude	Comments
Pool 85	Beaver Dam	38.81667	–121.12496	Beaver dam is approximately 4.5 feet high; pool below is 2 feet deep. May be a barrier at low flows.
Riffle 248	Culverts	38.82211	–121.12688	Culverts under Auburn-Folsom Road. One culvert is blocked by debris; the other culvert does not appear to be a barrier at low flows.

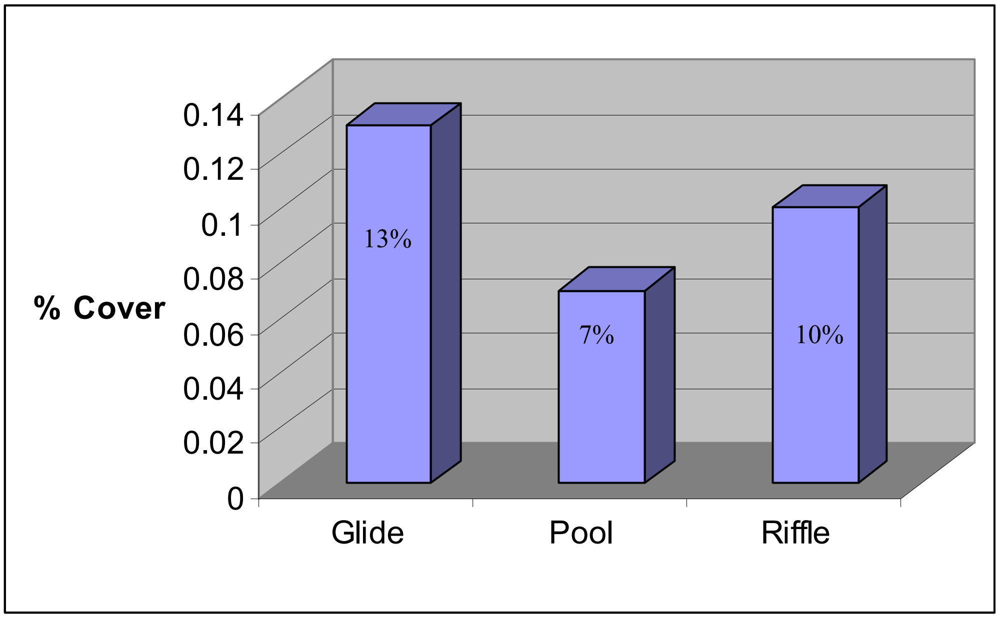
Appendix B Figures

Figure 1: Mean flow during habitat survey



Appendix B Figures (continued)

Figure 2: Mean instream cover by habitat type



Appendix D Photos


Photo 1-Confluence of Miners and Secret Ravine


Photo 2-Pool 1/Riffle 1


Photo 3-Glide 1


Photo 4-First Salmon Observed


Photo 5-Pool 18 Beaver dam approximately 3 Feet high, may be a barrier at low flows.


Photo 6-Pool 22 Beaver dam is approximately 4.5 feet high and 100 feet wide, with many protruding Branches.

Appendix D Photos (continued)

Photo 7-Riffle 68-Waterfall 6 feet high, pool below is 1 foot deep. Side channel blocked by debris.

Photo 8- Pool 49-Beaver dam approximately 3.5 high, may be a barrier at low flows.

Photo 9- Cottonwood Dam-Dam is 20 feet high and appears to be a complete barrier at normal flows.

Photo 10-25 foot long concrete apron under bridge.Flashboard dam above apron requires 3 foot jump, pool has 6 inches of water in it.

Photo 11- Pool 69-Beaver dam is approximately 4 feet high, pool below is 2 feet deep. May be a Barrier at low flows.

Photo 12- Pool 73-Crossing approximately 3 feet high, pool below is 6 inches deep. May be a barrier at low flows.

Appendix D Photos (continued)

Photo 13- Culvert at Placer Canyon Road is approximately 80 feet in length, filled with rocks. May be a barrier at low flows.

Photo 14-Beaver dam is 8 feet high , pool below is 2 feet deep. May be passable is a side channel is formed.

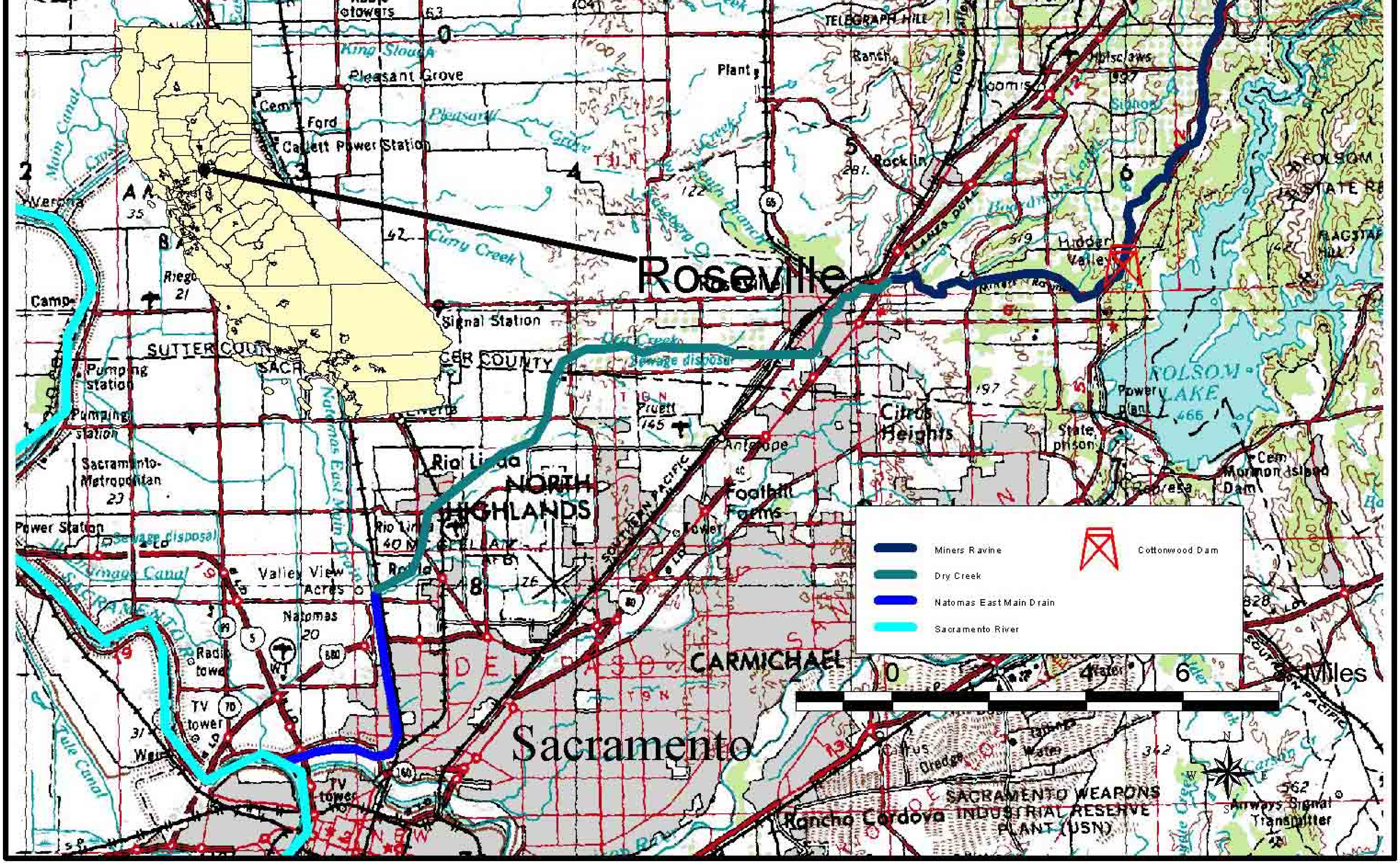
Photo 15- Dam is approximately 4 feet high, pool below is approximately 1 foot deep, may be a barrier at low flows.

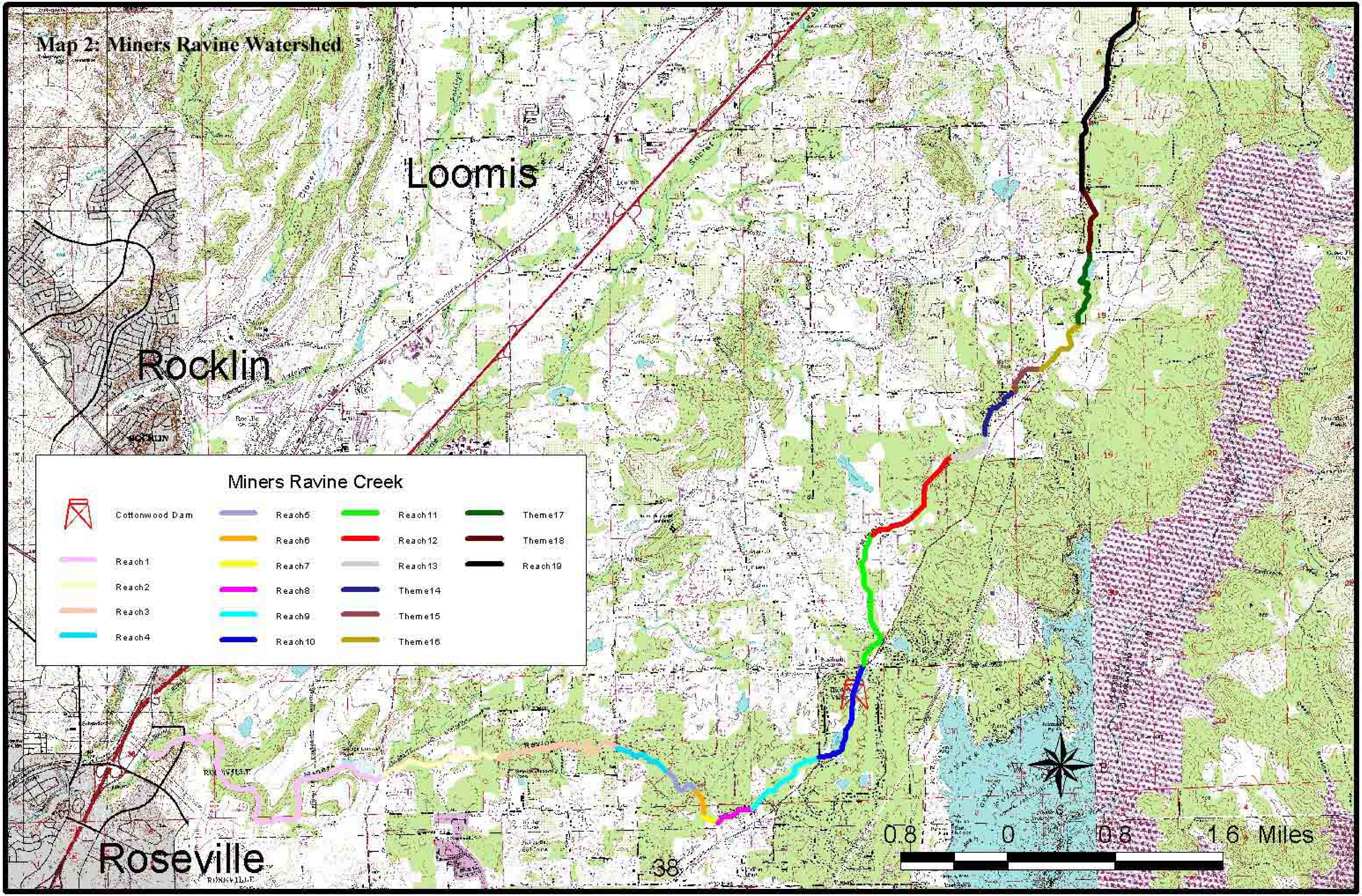
Photo 16- Dam is approximately 4 feet high. The pool below the dam is 2 feet deep.

Photo17- Concrete apron is a 2.5 foot jump, pool below is 1 foot deep. Apron is 15 feet long and has 6 inches of water flowing over it.

Photo 18- Culvert is perched, approximately 2 feet, and has a rusted metal apron with large holes in it. Pool below is 1 foot deep.

Map 1: Connectivity of Miners Ravine to the Sacramento River





Map 2: Miners Ravine Watershed
Loomis
Rocklin
Roseville
Miners Ravine Creek
Cottonwood Dam
Reach1
Reach2
Reach3
Reach4
Reach5
Reach6
Reach7
Reach8
Reach9
Reach10
Reach11
Reach12
Reach13
Theme14
Theme15
Theme16
Theme17
Theme18
Reach19
0.8 0 0.8 1.6 Miles

Map 3:Potential barriers of Miners Ravine