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## REC 6 FISHERIES HABITAT EVALUATION

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### 1.0 EXECUTIVE SUMMARY

Analysis of fisheries habitat for recreational angling opportunities was completed by reviewing the results of the CAWG 1, Characterize Stream and Reservoir Habitats (SCE 2003b) and CAWG 5, Water Temperature reports (SCE 2003c). Stream habitats and reservoir habitats were individually evaluated within these studies. The stream habitats in the study area were divided into three separate groups based upon their drainage areas. The three drainage basins were the South Fork San Joaquin River (SFSJR) drainage, the San Joaquin River (SJR) drainage, and the Big Creek drainage. The reservoir habitats were identified and habitat was assessed on an individual basis.

Fish population information from the CAWG 7, Characterize Fish Populations report (SCE 2003e) was reviewed to provide information on available fisheries within the study area. Recreational information from the REC 8 Angling Opportunities and Experience Assessment report (SCE 2003d) was used to focus analysis on popular recreation areas within the study area.

The following is a list of general observations based on the assessment of the CAWG reports:

- Habitat classifications for study waters varied greatly due to slope and geomorphic composition.
- Large woody debris and appropriate cover are present in each drainage basin in the study area.
- Most stream reaches are confined by a barrier or diversion.
- The quality and quantity of spawning habitats in streams varies greatly throughout the study area.
- Reservoir thermal structures ranged from developed to mixed due to size and depth of the water body.
- Tributary spawning access from study water bodies varied due to water level, diversion access, and presence of barriers.

### 2.0 STUDY OBJECTIVES

The study objectives for the REC 6, Fisheries Habitat Evaluation report are to characterize stream and reservoir habitats and temperatures for fish using the CAWG 1 (SCE 2003b) and CAWG 5 (SCE 2003c) studies. The CAWG 1 study objective is to characterize stream and reservoir habitat for aquatic organisms, and the relevant CAWG 5 study objective is to characterize water temperatures for aquatic organisms.

The focus of this report is on information related to warm and coldwater game fish pursued by recreational anglers. The REC 8, Report, Angling Opportunities and Experience Assessment (SCE 2003d) was used to focus analysis on popular recreation areas within the study area.

### **3.0 STUDY IMPLEMENTATION**

#### **3.1 STUDY ELEMENT STATUS**

#### **3.2 STUDY ELEMENTS COMPLETED**

Review of the CAWG 1, Characterize Stream and Reservoir Habitats (SCE 2003b) and CAWG 5, Water Temperature (SCE 2003c) reports provided the necessary information for this study analysis. The CAWG 1 report provided detailed habitat descriptions of stream reaches and reservoirs within the study area. The CAWG 5, Water Temperature report provided detailed descriptions of the seasonal temperatures of the stream reaches and reservoirs within the study area.

#### **3.3 OUTSTANDING STUDY ELEMENTS**

This report presents a summary of the results of the CAWG 1 and CAWG 5 studies. There are no outstanding study elements. The results from this report will be evaluated to determine if there is a need for additional mitigation, or potential for practical enhancement measures to benefit habitats for fish sought by recreational anglers.

### **4.0 STUDY METHODOLOGY**

The detailed methodologies used are provided in the CAWG 1, Characterize Stream and Reservoir Habitats (SCE 2003b) and the CAWG 5, Water Temperature (SCE 2003c) reports.

#### **4.1 HABITAT**

Habitat evaluated as part of the CAWG studies in each drainage basin included streams, tributaries, and impoundments. The habitat characteristics described in the evaluation of study streams include stream characteristics and Rosgen channel type classifications, vegetation/cover, barriers to migration, and spawning habitat. The habitat characteristics described in the evaluation of study reservoirs include thermal structure, habitat characteristics, and tributary spawning access.

The following is a general overview of the fisheries habitat and water temperatures within study waters described in the CAWG studies. The CAWG 1 (SCE 2003b) and CAWG 5 (SCE 2003c) reports describe the habitat characteristics for each study stream reach and reservoir in detail.

The CAWG 1 study utilizes Rosgen Level 1 channel type and descriptive classifications to describe the studied reaches. Study streams varied greatly due to slope and

geomorphic composition. The classifications help to identify the physical characteristics of the habitats. Study stream channel and habitats were characterized for each stream reported in the CAWG 1 report.

Cover types available for fish included large woody debris, rocks and boulders, surface turbulence and vegetation (SCE 2003b). Habitat depth was not included as a cover type category, however, depth was recorded and can be a valuable source of fish cover. Habitat descriptions are provided in the CAWG 1 report for each reach studied.

Most stream reaches were confined by barriers or a diversion (SCE 2003b). Upstream migration in most study streams is affected by such barriers. Specific barrier characteristics are described within the CAWG 1 report by reach.

Spawning habitats in streams vary greatly throughout the study area (SCE 2003b). Gravel characteristics were addressed by the CAWG 1 assessment. Study area spawning habitats vary from excellent to poor, depending on the specified reach.

Tributary spawning access from study water bodies varied due to water levels, diversion access, and presence of barriers (SCE 2003c). Reservoirs ranged from fully accessible to no upstream access. Specific spawning access results can be found in the CAWG 1 report.

## **4.2 TEMPERATURE**

Temperatures were monitored during 2000 and 2001. The year 2000 was an above normal water-year and air temperatures were warmer than average based on historical temperature exceedances. The year 2001 was a dry water-year type and air temperatures were warmer than average, as well. Although both years were warmer than average, 2001 for the most part, was warmer than 2000. Water temperatures in streams respond to these conditions and air temperature is one of the most important factors influencing the temperature of surface waters (SCE 2003c).

Preliminary temperature criteria were established in order to examine the potential effects of temperature on fish populations. The number of days that a daily mean temperature exceeded 19°C was used to indicate days when trout growth may be potentially affected by warm temperatures. The number of days that daily maximum temperatures exceeded 24°C was used to indicate the number of days in which temperatures were potentially warm enough to begin to affect trout survival. The number of days in which observed daily mean temperatures exceeded preliminary temperature criteria for target aquatic species (i.e., daily mean of 19°C and daily maximum of 24°C for trout), when a diversion was in operation, are presented for each stream or stream segment in the Executive Summary of the CAWG 5 (SCE 2003c) report.

Reservoir thermal structure is important, since it may provide beneficial temperature conditions for both warm and coldwater fish. In stratified reservoirs, a warm upper layer (epilimnion) forms that provides warm water habitat for such warmwater fish as bass. A deep cold water layer (hypolimnion) also forms, which provides suitable temperatures

for coldwater fish throughout the warm summer months. Thermal stratification conditions ranged from developed to mixed, depending upon the size and depth of the water body (SCE 2003c). Seasonal thermal mixing occurred in the larger water bodies during the fall through spring and continuous mixing occurred in the smaller water bodies. Specific details of thermal stratification can be found in the CAWG 1 report for each impoundment.

Dissolved oxygen (DO) levels were recorded as part of the reservoir temperature monitoring during 2000 and 2001. The ranges of DO levels are presented for each of the major reservoirs.

#### **4.3 ANGLING ASSESSMENT**

The REC 8, Angling Opportunities and Experience Assessment (SCE 2003d) report provided an evaluation of angling opportunities in the study area. A fisheries habitat evaluation is provided in this report (REC 6) for the fishing locations identified in Table REC 8-1 (Appendix C) "Angling Survey Locations for 4/27/02 to 05/24/02" of the REC 8 Report, and other known fishing locations within the study area.

### **5.0 STUDY RESULTS AND ANALYSES**

The stream habitats in the study area were sorted into three drainage basins. These three drainage basins were the South Fork San Joaquin River (SFSJR) drainage, the San Joaquin River (SJR) drainage (including Stevenson Creek), and the Big Creek drainage.

The fish population information for the study streams is summarized from Table CAWG 7 ES-1 (Appendix C) of the CAWG 7 report (SCE 2003e).

A summary of the fisheries habitat information for Lake Edison is in Appendix A. Information for Appendix A was included in the Vermilion Valley Hydroelectric Project (FERC Project No. 2086) Final Application for New License for Minor Project-Existing Dam (SCE 2001). A summary of the fisheries habitat information for Portal Forebay is in Appendix B. Information for Appendix B was included in the Portal Hydroelectric Power Project (FERC Project No. 2174) Application for New License for Major Project-Existing Dam (SCE 2003a).

Rivers and tributaries, major reservoirs, and forebays within the study area are presented separately in the report. The angling survey locations from the REC 8 report are presented in Figures REC 8-1a through 1e (Appendix D) (SCE 2003d). Fish population sample sites are shown in Figures CAWG 7 Map 8 through 17 (Appendix D) (SCE 2003e).

## 5.1 RIVERS AND TRIBUTARIES

### 5.1.1 SFSJR – UPSTREAM OF FLORENCE LAKE

Fish habitat information for the SFSJR upstream of Florence Lake was collected in preparation of the CAWG 7 report (SCE 2003e) and temperature information is presented in Section 5.2.1 of the CAWG 5 report (SCE 2003c).

Brown, rainbow, and rainbow x golden trout hybrids are found in the SFSJR upstream of Florence Lake. Although not collected in our surveys, golden trout have been planted in the SFSJR drainage upstream of Florence Lake.

The SFSJR immediately upstream of Florence Lake is a popular fishing location. A campground is located immediately upstream of Florence Lake near the confluence with Boulder Creek.

#### *SFSJR – Upstream of Florence Lake – Angling Assessment*

The SFSJR immediately upstream of Florence Lake is a moderate velocity, and low gradient river. There is a mixture of habitats present, including riffles, runs and pools. Most of the pools are between one and three feet deep, with some much deeper. Boulder/cobble and bedrock, as well as depth, provide most of the cover for fish. The substrate is mostly bedrock and boulder.

Water temperature in the SFSJR upstream of Florence Lake is cool, and suitable for coldwater fish, such as trout. In the SFSJR upstream of Florence Lake, monthly mean water temperatures ranged from 7.4°C to 14.2°C in June through October of 2000, and 7.4°C to 15.6°C in June through October of 2001. Water temperatures did not exceed a daily average of 17°C or a daily maximum of 20°C during the May to October monitoring periods of 2000 and 2001.

### 5.1.2 SFSJR – FLORENCE LAKE TO SJR CONFLUENCE

The SFSJR mainstem extends from Florence Lake to the San Joaquin River confluence. The fish habitat information for the SFSJR is presented in Section 2.3.2 of the CAWG 1 report (SCE 2003b) and temperature information is presented in Section 5.2.2 of the CAWG 5 report (SCE 2003c).

Brown and rainbow trout are the only fish species found in the SFSJR between Florence Lake and the San Joaquin River confluence (SCE 2003e).

The SFSJR near Jackass Meadow Campground, and Mono Hot Springs are popular stream fishing locations. An angling assessment for each site is presented in the following section.

### *Jackass Meadow Campground – Angling Assessment*

Jackass Meadow Campground is a popular fishing location and was a survey location for the REC 8 Report. The campground is located immediately downstream of the Florence Lake Dam. Near Jackass Meadow Campground, the SFSJR is a low velocity, low gradient river. There are a mixture of habitats including riffles, runs and pools. Most of the pools are between one and three feet deep. Boulder/cobble substrate, woody debris, depth, and surface turbulence provide most of the cover for fish. The substrate is mostly sand, with patches of gravel.

Water temperatures near Jackass Meadow Campground are cool and suitable for brown and rainbow trout. The monthly mean water temperatures ranged from 11.3°C to 14.2°C in June through October of 2000, and from 12.7°C to 14.7°C in June through October of 2001. Water temperatures did not exceed a daily average 16°C or a daily maximum of 19°C during the May to October monitoring periods of 2000 and 2001.

### *Mono Hot Springs Area – Angling Assessment*

The Mono Hot Springs area of the SFSJR is a popular fishing and recreation destination. A survey kiosk for the REC 8 report was located in the Mono Hot Springs campground near the SFSJR.

The segment of the SFSJR near Mono Hot Springs is comprised of a low gradient, mostly incised channel. The segment is composed predominantly of pool and riffle habitat, but had a mixture of complex habitat types. The most frequent average pool depths were in the two to three-foot range, although there were many pools that were much deeper. Most cover was provided by depth, bedrock and boulder/cobble. Boulder and bedrock were the dominant substrates.

Water temperatures in the SFSJR near Mono Hot Springs are cool and suitable for trout. Monthly mean water temperatures ranged from 9.2°C to 16.0°C in June through October of 2000, and 10.5°C to 17.3°C in June through October of 2001. Water temperatures did not exceed a daily average of 19°C or a daily maximum of 21°C during the May to October monitoring periods of 2000 and 2001.

#### 5.1.3 SFSJR TRIBUTARIES

The fish habitat information for the SFSJR tributaries is presented in Section 2.3.3 of the CAWG 1 report (SCE 2003b) and temperature information is discussed in Section 5.2.3 of the CAWG 5 report (SCE 2003c).

Brown, rainbow, brook, and rainbow trout x golden trout hybrids were found in the SFSJR tributaries, although the fish species present varied by stream. Rainbow trout x golden trout hybrids were found in Hooper Creek and Warm Creek; brook trout were found in Bolsillo, Camp 62 and Chinquapin, and Crater Creeks (including the Crater Creek diversion channel); brown trout were found in Bear Creek; and both brown and rainbow were found in Mono Creek. No fish was found in Tombstone Creek above the diversion (although, brown trout were found below the diversion), or throughout North

Slide and South Slide Creeks. With the exception of Mono Creek between Vermilion Valley Dam and Mono Diversion, the SFSJR tributaries are lightly fished.

Mono Creek between Vermilion Valley Dam and Mono Diversion is a popular SFSJR tributary fishing location. An angling assessment for the site is presented in the following section.

#### *Mono Creek – Vermilion Valley Dam to Mono Diversion – Angling Assessment*

Mono Creek from Vermilion Valley Dam to Mono Diversion is a popular fishing location and was a survey location in the REC 8 report. The campground is located downstream of the Vermilion Valley Dam, and immediately upstream of Mono Diversion. There are wild brown and stocked rainbow trout in Mono Creek near the campground.

Mono Creek from Vermilion Valley Dam to Mono Diversion is a low gradient channel. The segment was composed predominantly of run and riffle habitat. Most cover was provided by bedrock and boulder/cobble. Boulder and bedrock were the dominant substrates.

Water temperatures in Mono Creek between Vermilion Valley Dam and Mono Diversion are cool and suitable for trout. Monthly mean water temperatures ranged from 9.9°C to 11.3°C in June through October of 2000, and 10.4°C to 15.8°C in June through October of 2001. Water temperatures did not exceed a daily average of 17°C or a daily maximum of 19°C during the monitoring periods of 2000 and 2001.

#### 5.1.4 SAN JOAQUIN RIVER MAINSTEM

The fish habitat information for the SJR Mainstem is presented in Section 2.3.4 of the CAWG 1 report (SCE 2003b) and temperature information is discussed in Sections 5.3.1, 5.3.2, and 5.3.5 of the CAWG 5 report (SCE 2003c).

The SJR between the SFSJR confluence and Mammoth Pool was not sampled for the CAWG 7 study. Brown and rainbow trout were found in the SJR between Mammoth Pool Dam and Mammoth Pool Powerhouse (Mammoth Reach) and in the SJR between Dam 6 and Powerhouse 3 (Stevenson Reach). Other species found in the Stevenson Reach include hardhead, Sacramento pikeminnow, Sacramento sucker, and prickly sculpin. Sacramento sucker were also found in the Mammoth Reach of the SJR.

Angling assessment is not provided for any specific locations in the SJR mainstem due to the limited stream access and light fishing pressure. The SJR mainstem was not surveyed as part of the REC 8 report.

#### 5.1.5 SAN JOAQUIN RIVER AND SHAVER LAKE TRIBUTARIES

The fish habitat information for the SJR Tributaries is presented in Section 2.3.5 of the CAWG 1 report (SCE 2003b), and temperature information is discussed in Section 5.3.3 and 5.4.5 of the CAWG 5 report (SCE 2003c). The SJR and Shaver Lake tributaries

include Rock Creek, Ross Creek, Stevenson Creek, and North Fork Stevenson Creek. Big Creek, which is also a tributary to the SJR, is presented in the next section.

Rock Creek, Stevenson Creek and North Fork Stevenson Creek are popular SJR and Shaver Lake tributary fishing locations. An angling assessment for all three sites is presented in the following section. Ross Creek was not sampled, as it was mostly dry due to water diversion upstream of the SCE Project, at the time sampling was to take place.

#### *Rock Creek – Angling Assessment*

Rock Creek is a popular fishing and camping location. The confluence of Rock Creek and the SJR is located downstream of Mammoth Pool Reservoir. There are brown and rainbow trout in Rock Creek. Rainbow trout are stocked in Rock Creek.

Rock Creek is a steep, granitic stream on the northwest side of the San Joaquin River located downstream of Mammoth Pool Reservoir. It has mostly step pool, cascade and bedrock sheet habitats, with small components of other pool habitats. Above the diversion, most of the average pool depths were in the two to three foot depth range. Below the diversion the pools were slightly deeper, with most of the average pool depths in the three to four foot depth range. Cover in the reach above and below the diversion was primarily depth, boulder/cobble and bedrock. The dominant substrate in the reach above the diversion was primarily boulders, with a smaller amount of bedrock.

Water temperatures in Rock Creek are generally cool and suitable for trout, although warm water temperatures in the summer months may potentially affect trout growth (water temperatures at the bottom of the reach exceeded a daily mean of 19°C for 19 days in 2000, and 72 days in 2001). Monthly mean water temperatures in Rock Creek ranged from 10.1°C to 18.2°C in June through October of 2000, and 12.6°C to 20.2°C in May through October of 2001. Water temperatures did not exceed a daily average of 22°C or a daily maximum of 24°C during the monitoring periods of 2000 and 2001.

#### *Stevenson Creek – Angling Assessment*

Stevenson Creek downstream of Shaver Lake Dam is a popular fishing and recreation location. There is a campground near Stevenson Creek near Railroad Grade Road. The confluence of Stevenson Creek and the SJR is located downstream of Dam No. 6. There are rainbow trout in Stevenson Creek.

Stevenson Creek downstream of Shaver Lake is a granitic stream channel with a moderate to very steep gradient. The dominant habitat types were cascade and pools, with small components of other habitat types. Average pool depths were mostly in the one to two foot depth, however, deeper pools, up to the five to six foot depth range, were present. Boulder/cobble and bedrock were the dominant form of cover, although depth, terrestrial vegetation, and surface turbulence provided cover, as well. The dominant substrates were primarily bedrock and boulders.



Water temperatures in Stevenson Creek are generally cool and suitable for rainbow trout, although warm water temperatures occasionally occur in the summer months that can potentially affect trout growth (water temperatures at the bottom of the reach exceeded a daily mean of 19°C for three days in 2000, and six days in 2001). Monthly mean water temperatures recorded in Stevenson Creek between Shaver Lake and the SJR ranged from 10.5°C to 16.8°C in June through October of 2000, and 6.7°C to 16.9°C in May through October of 2001. Water temperatures did not exceed a daily average of 20°C or a daily maximum of 22°C during the monitoring periods of 2000 and 2001.

#### *North Fork Stevenson Creek – Angling Assessment*

North Fork Stevenson Creek is a popular fishing and recreation location. There are brown trout, rainbow trout, rainbow x and golden trout hybrids in North Fork Stevenson Creek. No fish are present upstream of the Tunnel 7 Outlet.

North Fork Stevenson Creek is a moderate to steep gradient stream that flows to Shaver Lake from the northwest. Natural streamflow is enhanced by releases made at Tunnel 7. Much of the reach downstream of the Tunnel 7 outlet was step pool and cascade or step run, but small components of riffles and other pool types also were present. Average pool depths in the reaches below the Tunnel 7 outlet were deeper, but all had average depths of three feet or less. There were a variety of cover types available upstream and downstream of the Tunnel 7 outlet. Boulder/cobble was the most common cover type available.

Water temperatures in North Fork Stevenson Creek are cool and suitable for brown, rainbow, and rainbow x golden trout. Monthly mean water temperatures recorded in North Fork Stevenson Creek ranged from 10.4°C to 16.4°C in June through October of 2000, and 7.7°C to 16.6°C in May through October of 2001. Water temperatures did not exceed a daily average of 18°C or a daily maximum of 22°C during the monitoring periods of 2000 and 2001.

#### 5.1.6 BIG CREEK MAINSTEM

The fish habitat information for the Big Creek mainstem is presented in Section 2.3.6 of the CAWG 1 report (SCE 2003b) and temperature information is discussed in Section 5.4.4 of the CAWG 5 report (SCE 2003c).

Brown trout are found in Big Creek between Dam 1 and Powerhouse 1. Brown and rainbow trout are found in Big Creek between Dam 4 and Powerhouse 2, and between Dam 5 and Powerhouse 8.

Angling assessment is not provided for any specific locations in the Big Creek mainstem due to the limited stream access and light fishing pressure. The Big Creek mainstem was not surveyed as part of the REC 8 Report.

### 5.1.7 BIG CREEK TRIBUTARIES

The fish habitat information for the Big Creek tributaries (including tributaries to Huntington Lake) is summarized from Section 2.3.7 of the CAWG 1 report (SCE 2003b) and temperature information is discussed in Section 5.4.4.7 of the CAWG 5 report (SCE 2003c). These tributaries include Pitman, Balsam, Ely, Rancheria, and Adit No. 8 Creeks.

Brown, rainbow, and brook trout are found in Pitman and Rancheria Creeks (kokanee are also seasonally present in Rancheria Creek during their fall spawning run). In Balsam Creek, rainbow trout are the only species found. Rainbow trout and rainbow x golden trout hybrids are found in Ely Creek. No fish were found in Adit No. 8 Creek.

Rancheria Creek/Portal Powerhouse Tailrace area is a popular Huntington Lake tributary fishing location. An angling assessment for the site is presented in the following section. Angling assessment is not provided for any other specific Big Creek tributaries due to limited stream access and light fishing pressure. The Big Creek tributaries were not surveyed as part of the REC 8 Report.

#### *Rancheria Creek/Portal Powerhouse Tailrace – Angling Assessment*

Rancheria Creek is a tributary of Big Creek located upstream of Huntington Lake.

Rancheria Creek near Portal Powerhouse Tailrace is a low to moderate gradient stream mostly composed of run habitat. Flow is dominated by discharges from the powerhouse and Howell-Bunger valve. Cover is composed primarily of boulder/cobble.

Water temperatures are cool and suitable for brown, brook, and rainbow trout. Monthly mean water temperatures recorded in the Rancheria Creek/Portal Power Tailrace area ranged from 4.9°C to 13.7°C in June through September of 2000, and 6.1°C to 16.8°C in May through October of 2001. Water temperatures did not exceed a daily average of 16°C or a daily maximum of 17°C during the monitoring periods of 2000 and 2001.

## 5.2 MAJOR RESERVOIRS

The fish population information for the study reservoirs is summarized from Table CAWG 7 ES-1 (Appendix C) of the CAWG 7 report (SCE 2003e). The fish habitat and temperature information for the study reservoirs is presented in Section 2.3.8 of the CAWG 1 report (SCE 2003b). The major reservoirs include Florence Lake, Mammoth Pool, Huntington Lake, and Shaver Lake. Information on Lake Edison is presented in Appendix A.

### 5.2.1 FLORENCE LAKE – ANGLING ASSESSMENT

Florence Lake is a popular fishing destination within the study area. Shore and boat fishing are both used in Florence Lake waters. Brown trout and rainbow trout are known to be present in Florence Lake (SCE 2003e).

The area around Florence Lake is dominated by bedrock and boulders. Sand and gravel deposition from the granite dominated mountains surrounding Florence Lake is found along the perimeter of the reservoir, especially towards the upstream end (SCE 2003b).

Water temperatures in Florence Lake are generally cool and suitable for trout. As stated in CAWG 5, the reservoir stratifies annually during the summer months and mixes in the fall (SCE 2003c). The average DO of the reservoir ranged from 6.6 to 8.2 mg/L in 2000, and from 7.1 to 9.9 mg/L in 2001.

Water level in the reservoir varies considerably throughout the year. The reservoir storage is normally high in summer through early fall to store runoff for generation through the Big Creek and Shaver Lake chains, for instream releases to the SFSJR and to provide recreation in the reservoir. Lake levels are reduced in the late fall through spring to provide room to store next year's runoff and to avoid the potential for freeze-thaw damage to the dam.

There are no major migration barriers between Florence Lake and the SFSJR at any lake elevations. There is, however, a partial migration barrier in the SFSJR immediately upstream of Florence Lake.

In the deepest region of the lake (Dam Site), the epilimnion (the warm upper waters) ranged in thickness from five to 16 meters, and the hypolimnion (the cool deeper waters) ranged in thickness from two to 21 meters, when stratified. The average temperature of the epilimnion (Dam Site) ranged from a low of 10.7°C in May 2001, to a high of 19.4°C in August 2001. The average temperature of the hypolimnion at the Dam Site ranged from a low of 6.6°C in May 2001, to a high of 15.2°C in August 2001. When mixed, the average temperature at the Dam Site ranged from a low of 11.3°C in October of 2000, to a high of 15.7°C in September of 2000. The lake was stratified in July and August of 2000, and May through September of 2001.

## 5.2.2 MAMMOTH POOL RESERVOIR – ANGLING ASSESSMENT

Mammoth Pool Reservoir is a popular fishing and recreation location within the study area. Shore and boat fishing methods are both used in the reservoir. Brown trout and rainbow trout are found here.

Much of the area around the reservoir is dominated by bedrock and boulders. Large bedrock dominated areas are particularly prevalent in the upper reaches of the reservoir (SCE 2003b).

There are no major migration barriers between Mammoth Pool Reservoir and the SJR upstream, or Jackass Creek. There are, however, migration barriers between the reservoir and both Chiquito Creek and Daulton Creek, at all reservoir elevations, and Mill Creek and Kaiser Creek, when the reservoir is below maximum capacity, due to steep bedrock sheets that drop into the reservoir.

As stated in the CAWG 5 Temperature Report, this reservoir stratifies annually during the summer months and mixes in the fall (SCE 2003c). At the deepest region of the lake (dam site), the epilimnion ranged in thickness from four to seven meters, and the hypolimnion ranged in thickness from 36 to 43 meters. The average temperature of the epilimnion (dam site) ranged from a low of 21.7°C in June 2001, to a high of 22.6°C in July 2001. The average temperature of the hypolimnion (dam site) ranged from a low of 15.0°C in June 2001, to a high of 17.4°C in July 2001. When mixed, the average temperature ranged from a low of 13.3°C in October of 2000, to a high of 21.1°C in August of 2000. Mixing within the lake during late summer results in warm water present to considerable depths. The reservoir was stratified in June and July of 2001. The average DO of the reservoir ranged from 6.6 to 7.3 mg/L in 2000, and from 6.4 to 9.3 mg/L in 2001.

### 5.2.3 HUNTINGTON LAKE – ANGLING ASSESSMENT

Huntington Lake is a popular fishing and recreation location within the study area. Both shore and boat fishing methods are used in Huntington Lake. Brown trout, rainbow trout, and kokanee salmon are among the species found here.

The area around the lake is dominated by sand, gravel, and boulders, and large forested areas dominated by coniferous trees (SCE 2003b).

There are no major migration barriers between Huntington Lake and Rancheria Creek, Big Creek, Line Creek, Coon Creek, and Home Camp Creek at all lake elevations. However, when the reservoir is drawn down, stream flows from Big Creek, Line Creek, Coon Creek, and Home Camp Creek are potentially insufficient for upstream fish migration. These stream flows are not controlled by SCE.

Water temperature in Huntington Lake is capable of supporting both warmwater and coldwater fisheries. As stated in the CAWG 5 report, the reservoir stratifies annually during the summer months and mixes in the fall (SCE 2003c). At the deepest region of the lake (dam site), the epilimnion ranged in thickness from four to 16 meters, and the hypolimnion ranged in thickness from 10 to 35 meters. The average temperature of the epilimnion (dam site) ranged from a low of 11.3°C in May 2001, to a high of 19.2°C in August 2001. The average temperature of the hypolimnion (dam site) ranged from a low of 6.5°C in May 2001, to a high of 13.1°C in August 2001. When mixed, the average temperature ranged from a low of 12.5°C in October of 2000, to a high of 15.1°C in September of 2001. The lake was stratified in August of 2000, and May through August of 2001. The average DO of the reservoir ranged from 7.6 to 11.0 mg/L in 2000, and from 6.4 to 9.4 mg/L in 2001.

### 5.2.4 SHAVER LAKE – ANGLING ASSESSMENT

Shaver Lake is a popular fishing and recreation location within the study area. Both shore and boat fishing methods are used in Shaver Lake. Rainbow trout, kokanee salmon, largemouth bass, smallmouth bass, bluegill, crappie and carp are among the species found here.

The area around Shaver Lake is dominated by bedrock, boulders, and sand, and large forested areas dominated by coniferous trees (SCE 2003b).

Water temperature in the Shaver Lake is capable of supporting both warmwater and coldwater fisheries. As stated in CAWG 5, the reservoir stratifies annually during the summer months and mixes in the fall (SCE 2003c). At the deepest region of the lake (dam site), the epilimnion ranged in thickness from one to six meters, and the hypolimnion ranged in thickness from 33 to 38 meters. The average temperature of the epilimnion (dam site) ranged from a low of 16.1°C in May 2001, to a high of 21.1°C in July 2001. The average temperature of the hypolimnion (dam site) ranged from a low of 7.6°C in May 2001, to a high of 13.6°C in July 2001. When mixed, the average temperature ranged from a low of 14.9°C in August of 2000, to a high of 18.5°C in September of 2001. The lake was stratified in May through July of 2001. The average DO of the reservoir ranged from 7.1 to 7.5 mg/L in 2000, and from 5.6 to 9.2 mg/L in 2001.

### **5.3 FOREBAYS**

The fish population information for the study forebays is summarized from Table CAWG 7 ES-1 (Appendix C) of the CAWG 7 report (SCE 2003e). The fish habitat and temperature information for the study forebays is presented in Section 2.3.8 of the CAWG 1 report (SCE 2003b). The study forebays include the Bear and Mono Diversion Pools, Dam 6, Dam 4, and Dam 5 Forebays, and Balsam Forebay. Information on Portal Forebay is presented in Appendix B.

#### **5.3.1 BEAR DIVERSION POOL – ANGLING ASSESSMENT**

Bear Diversion Pool is a popular fishing and recreation location within the study area. Most fishing in Bear Diversion Pool is from shore. Brown trout and rainbow trout are present in Bear Diversion Pool.

Much of the area around Bear Diversion Pool is dominated by bedrock and boulders (SCE 2003b).

Upstream migration for fish into Bear Creek from the Forebay would be difficult at any reservoir elevation due to a large, steep bedrock sheet immediately upstream of the forebay.

Water temperatures in the Bear Diversion Pool are cool and suitable for trout. The average monthly temperature ranged from a high of 14.2°C in August to a low of 6.8°C in October of 2000, and from a high of 18.2°C in August to a low of 12.7°C in October of 2001.

#### **5.3.2 MONO DIVERSION POOL – ANGLING ASSESSMENT**

The Mono Creek Diversion Pool is a popular fishing location within the study area. Most fishing is from shore. Brown trout and hatchery stocked rainbow trout are found here.

Much of the area around Mono Diversion Pool is dominated by boulder, gravel, and sand (SCE 2003b).

Water temperatures in the Mono Diversion Pool are cool and suitable for trout. There are no migration barriers for fish between Mono Diversion Forebay and Mono Creek immediately upstream. Vermilion Valley Dam, which is approximately 1.3 miles upstream of the forebay, is a complete barrier to fish migration. The average monthly temperature of the Mono Diversion Pool ranged from a high of 13.6°C in June to a low of 10.7°C in October and August of 2000, and from a high of 15.9°C in September to a low of 10.8°C in July of 2001.

### 5.3.3 DAM 6 FOREBAY – ANGLING ASSESSMENT

Dam 6 Forebay is a seldom used fishing location within the study area. Most fishing is from shore. Brown and rainbow trout are found here.

Much of the area around the forebay is dominated by bedrock and boulders. Finer materials are located along the bottom thalweg. Boulders and cobbles dominate the region at the mouth of the forebay, at the confluence of the San Joaquin River with the forebay (SCE 2003b).

Water temperatures in the Dam 6 Forebay are generally cool and suitable for trout. As stated in CAWG 5, the forebay stratifies during the summer months and mixes in the fall (SCE 2003c). The epilimnion was four meters thick in August and September 2001, and the hypolimnion ranged in thickness from 13 to 21 meters. The average temperature of the epilimnion ranged from a low of 17.3°C in August, to a high of 19.5°C in September of 2001. The average temperature of the hypolimnion ranged from a low of 14.6°C in August, to a high of 17.2°C in September of 2001. The average DO of the reservoir ranged from 7.4 to 10.9 mg/L in 2001.

### 5.3.4 DAM 4 FOREBAY – ANGLING ASSESSMENT

Dam 4 Forebay is a seldom used fishing location within the study area. Most use of Dam 4 Forebay is by residents of the town of Big Creek. Brown and rainbow trout are found here. Much of the area around the forebay is dominated by bedrock, boulders, and sand (SCE 2003b).

Upstream fish migration to Big Creek from the forebay is not impeded, even during periods of reservoir drawdown. However, there are a number of barriers in the lower reach of Pitman Creek, near Dam 4 Forebay, including a barrier at the confluence with Big Creek.

The forebay is a small waterbody, with a well-mixed thermal structure (SCE 2003c). Due to the small size and nature of the forebay, and the large volumes of water that pass through it from Powerhouse 1 during the summer months, thermal stratification is not likely to occur. The average monthly temperature of the Dam 4 Forebay ranged from a high of 14.0°C in September to a low of 11.6°C in July of 2000, and from a high of 14.6°C in October to a low of 10.4°C in June of 2001.

### 5.3.5 DAM 5 FOREBAY – ANGLING ASSESSMENT

Dam 5 Forebay is a seldom used fishing location within the study area. The forebay lies within a gated area. Automobile access to the forebay is limited for recreationists. Brown and rainbow trout are found here.

Much of the area around the forebay is dominated by bedrock and boulders (SCE 2003b).

This forebay is a small waterbody, with a well-mixed thermal structure (SCE 2003c). Due to the small size and volume of water that moves through the forebay during generation from Powerhouses 2 and 2A, thermal stratification is not likely to occur in the forebay. The average monthly temperature of the Dam 5 Forebay ranged from a high of 15.8°C in October to a low of 11.4°C in June of 2000, and from a high of 15.9°C in September and October to a low of 7.0°C in May of 2001.

### 5.3.6 BALSAM FOREBAY – ANGLING ASSESSMENT

Balsam Forebay is a popular fishing and recreation location within the study area. Most fishing in the forebay is from shore. Brown trout, rainbow trout, kokanee salmon, and smallmouth bass were among the fish species found here.

The area around Balsam Forebay is dominated by sand, fines, and boulders (SCE 2003b).

Water temperatures in the Balsam Forebay are capable of supporting warmwater and coldwater fisheries. As stated in CAWG 5, the reservoir was minimally stratified during two of the summer months (SCE 2003c). Due to the small size and nature of the forebay and the movement of water through the forebay from Huntington Lake and back and forth to Shaver Lake, thermal stratification is not often likely to occur or persist in the forebay. The average temperature of the epilimnion ranged from a low of 8.3°C in May, to a high of 20.8°C in July of 2001. The average temperature of the hypolimnion ranged from a low of 6.4°C in May, to a high of 19.0°C in July of 2001. The average DO of the reservoir ranged from 7.2 to 10.2 mg/L in 2001.

## 6.0 LITERATURE CITED

Southern California Edison Company (SCE). 2001. Vermilion Valley Hydroelectric Project (FERC Project No. 2086) Final Application for New License for Minor Project-Existing Dam. Volume 2 of 4: Exhibit E. Southern California Edison, Big Creek, California.

\_\_\_\_\_. 2003a. Portal Hydroelectric Power Project (FERC Project No. 2174) Application for New License for Major Project-Existing Dam. Volume 2 of 6: Exhibit E. March 2003. Southern California Edison, Big Creek, California.

\_\_\_\_\_. 2003b. CAWG 1 Characterize Stream/Reservoir Habitat.

\_\_\_\_\_. 2003c. CAWG 5 Water Temperature Monitoring Report.

\_\_\_\_\_. 2003d. REC 8 Angling Opportunities and Experience Assessment.

\_\_\_\_\_. 2003e. CAWG 7 Characterize Fish Populations.



**APPENDIX A**  
**FISH HABITAT INFORMATION FOR VERMILION VALLEY**  
**HYDROELECTRIC PROJECT**  
**(FERC PROJECT NO. 2086)**

## LAKE EDISON

### *Angling Assessment*

Lake Edison is a popular fishing location within the SFSJR watershed and adjacent to the study area. Shore and boat fishing methods are both used in Lake Edison. Brown trout, brook trout, and rainbow trout are present in Lake Edison (SCE 2001).

The area around Lake Edison is dominated by bedrock and boulders. Sand and gravel deposition from the granite dominated mountains surrounding Lake Edison is found along the perimeter of the reservoir.

Water temperatures in Lake Edison are generally cool and suitable for trout. The reservoir stratifies annually in the summer months and mixes in the fall. The average Dissolved Oxygen (DO) of the reservoir ranged from 7.0 to 7.5 mg/L in 2000, and from 7.2 to 7.7 mg/L in 2001.

**APPENDIX B**  
**FISH HABITAT INFORMATION FOR PORTAL HYDROELECTRIC**  
**POWER PROJECT**  
**(FERC PROJECT NO. 2174)**

PORTAL FOREBAY*Angling Assessment*

Portal Forebay is a popular fishing location within the study area. Most fishing in Portal Forebay is from shore, although many anglers use float tubes as well. Brown, brook, and rainbow trout are present here (SCE 2003a).

Much of the area around the forebay is dominated by sands, fines, and gravel (SCE 2003a). Finer materials are located along the bottom thalweg, and along the perimeter of the reservoir.

Water temperatures in the Portal Forebay are cool and suitable for trout. Average monthly water temperature ranged from 12.3°C to 14.8°C in 2000. In 2001, the average monthly water temperature ranged from 11.7°C to 16.6°C.

**APPENDIX C**  
**REFERENCED TABLES**

**Table REC-8-1. Angling Survey Locations Survey Locations for 4/27/02 to 5/24/02**

	Location	Active	Kiosk
Florence Lake	Florence Lake Boat Ramp/Ferry Dock	x <sup>2</sup>	x <sup>5</sup>
	Immediate shoreline area from boat ramp to ferry dock	x <sup>2</sup>	
	Jackass Meadow Campground		x <sup>5</sup>
Edison Lake	Boat Ramp - Lake Edison Boat Launch	x <sup>2</sup>	x <sup>5</sup>
	Shoreline area from Vista Point Overlook extending to Vermilion Valley campground	x <sup>2</sup>	
	Vermilion Valley Resort/ferry dock	x <sup>2</sup>	x <sup>5</sup>
Mono Creek	Mono Creek from Vermilion Valley Dam to Mono Diversion (kiosk at gage)	x <sup>2</sup>	x <sup>5</sup>
Mono Creek Forebay	Mono Creek Forebay	x <sup>2</sup>	
South Fork San Joaquin River	SFSJR from Florence Dam to Hooper Gage (Jackass Meadow Area)	x <sup>2</sup>	
	SFSJR upstream and downstream of Mono Hot Springs	x <sup>2</sup>	x <sup>5</sup>
Portal Forebay	Portal Forebay	x <sup>2</sup>	
	Portal Forebay Campground		x <sup>5</sup>
Huntington Lake	Boat Ramp - Huntington Lake, East (USFS Public)	x <sup>1</sup>	x <sup>4</sup>
	Boat Ramp - Huntington Lake, West (HL Resort Private)	x <sup>1</sup>	x <sup>4</sup>
	Roving boat surveys (shore anglers and on water anglers)	x <sup>1</sup>	
Portal Tailrace/Rancheria Creek	Rancheria Creek from Portal Power Plant Tailrace to confluence with Huntington Lake	x <sup>1</sup>	
	Eastwood Visitor Center		x <sup>4</sup>
Shaver Lake	Sierra Marina Boat Ramp	x <sup>1</sup>	x <sup>4</sup>
	Boat Ramp - Camp Edison Boat Launch	x <sup>1</sup>	x <sup>4</sup>
	Day Use Area off Hwy 168 (Shaver Lake Point)		x <sup>4</sup>
	Roving boat surveys (shore anglers and on water anglers)	x <sup>1</sup>	
Mammoth Pool	Boat Ramp - Mammoth Boat Launch	x <sup>3</sup>	x <sup>4</sup>
	Windy Point Picnic Area	x <sup>3</sup>	x <sup>4</sup>
Balsam Forebay	Picnic Area		x <sup>4</sup>
Bear Forebay	Diversion Forebay parking area off Kaiser Pass Rd.		x <sup>5</sup>
Others	High Sierra Ranger Station		x <sup>5</sup>
	Mono Hot Springs Campground		x <sup>5</sup>

x1 - Active surveying began April 27

x2 - Active surveying began May 18

x3 - Active surveying began June 20

x4 - Kiosks installed during the week of April 22-26

x5 - Kiosks installed on May 16

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location.**

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		South Fork San Joaquin River							
Order		5	5	5	5	5	5	5	5
Reach		Upstream of Florence Lake	Florence Lake to Bear Creek		Bear Creek to Mono Crossing		Mono Crossing to Rattlesnake Creek	Rattlesnake Creek to SJR	
Rosgen Level I Channel Type		B	B	C	G	C	B	B	G
Species	Estimate of								
Brown Trout	Density (#/km)	206	522	303	306	226	220	350	385
	Density (#/ha)	225	713	312	261	137	123	174	262
	Biomass (kg/ha)	N/A	35.1	11.1	8.6	9.3	8.3	4.7	10.2
	Condition Factor		1.37	1.45	1.38	1.35	1.32	1.24	1.27
Rainbow Trout	Density (#/km)		174	21	32	632	700	984	837
	Density (#/ha)		238	22	27	382	391	490	571
	Biomass (kg/ha)		13.0	2.0	0.4	6.7	23.9	5.8	9.3
	Condition Factor		1.31	1.84	1.44	1.60	1.31	1.38	1.43
Brook Trout	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Rainbow x Golden Trout Hybrid	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Sacramento Sucker	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Hardhead	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Sacramento Pikeminnow	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Prickly Sculpin	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		South Fork San Joaquin River Basin							
		Tombstone Creek			South Slide Creek		North Slide Creek		
Stream		1	1	1	1	1	1	1	1
Order									
Reach		Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion	
Rosgen Level I Channel Type		Aa+	Aa+	C/E	Aa+	Aa+	Aa+	Aa+	
Species	Estimate of								
Brown Trout	Density (#/km)	No Fish	416	No Fish	No Fish	No Fish	No Fish	No Fish	No Fish
	Density (#/ha)		2,960						
	Biomass (kg/ha)		188.4						
	Condition Factor		1.37						
Rainbow Trout	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Brook Trout	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Rainbow x Golden Trout Hybrid	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Sacramento Sucker	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Hardhead	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Sacramento Pikeminnow	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Prickly Sculpin	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing



**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		South Fork San Joaquin River Basin					
Stream		Hooper Creek		Crater Creek			
Order		3	3	1	1	1	1
Reach		Above Diversion	Below Diversion	Above Diversion	Below Diversion	Below Diversion	Diversion Channel
Rosgen Level I Channel Type		Aa+	Aa+	Aa+	Aa+	C	Aa+
Species	Estimate of						
Brown Trout	Density (#/km)					No Fish	
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Rainbow Trout	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Brook Trout	Density (#/km)			547	276		1,193
	Density (#/ha)			1,495	1,919		3,872
	Biomass (kg/ha)			21.2	29.8		81.4
	Condition Factor			1.46	1.05		1.33
Rainbow x Golden Trout Hybrid	Density (#/km)	663	962				
	Density (#/ha)	2,029	4,229				
	Biomass (kg/ha)	71.3	124.9				
	Condition Factor	1.23	1.31				
Sacramento Sucker	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
Hardhead	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Sacramento Pikeminnow	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
Prickly Sculpin	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		South Fork San Joaquin River Basin					
		Bear Creek		Chinquapin Creek		Camp 62 Creek	
Stream							
Order		4	4	1	1	2	2
Reach		Above Diversion	Below Diversion	Above Diversion	Below Diversion	Above Diversion	Below Diversion
Rosgen Level I Channel Type		B	A	Aa+	Aa+	Aa+	Aa+
Species	Estimate of						
Brown Trout	Density (#/km)	470	1,406				
	Density (#/ha)	514	3,211				
	Biomass (kg/ha)	18.6	131.3				
	Condition Factor	1.20	1.23				
Rainbow Trout	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Brook Trout	Density (#/km)			665	2,034	945	1,162
	Density (#/ha)			5,452	13,094	5,928	6,780
	Biomass (kg/ha)			122.3	215.8	152.3	124.4
	Condition Factor			1.35	1.01	1.21	1.21
Rainbow x Golden Trout Hybrid	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Sacramento Sucker	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
Hardhead	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Sacramento Pikeminnow	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
Prickly Sculpin	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		Bolsillo Creek			Adit No. 2 <sup>1</sup>		East Fork Camp 61 <sup>1</sup>	West Fork Camp 61 <sup>1</sup>	Camp 61 Creek <sup>1</sup>
Order		1	1	1	1	1	1	1	
Reach		Above Diversion	Below Diversion	Below Diversion	Upper Site	Lower Site	Above Portal Forebay	Above Portal Forebay	Below Portal Forebay <sup>2</sup>
Rosgen Level I Channel Type		B	Aa+	B	Aa+	Aa+	Aa+	Aa+	B
Species	Estimate of								
Brown Trout	Density (#/km)				No Fish	601	49		940
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor				1.07		1.00		1.07
Rainbow Trout	Density (#/km)						81	65	
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						0.90	1.00	
Brook Trout	Density (#/km)	2,187	143	1,509			1,299	2,040	
	Density (#/ha)	20,503	1,087	12,378					
	Biomass (kg/ha)	431.9	22.6	216.5					
	Condition Factor	1.11	1.22	1.24			0.97	1.02	
Rainbow x Golden Trout Hybrid	Density (#/km)						16		
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						1.11		
Sacramento Sucker	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Hardhead	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor								
Sacramento Pikeminnow	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								
Prickly Sculpin	Density (#/km)								
	Density (#/ha)								
	Biomass (kg/ha)								

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		South Fork San Joaquin River Basin						
		Cold Creek <sup>3</sup>	Mono Creek			Boggy Meadow Creek <sup>3</sup>	Warm Creek <sup>3</sup>	
Stream								
Order		4	4	4	4	2	2	2
Reach			Above Lake Edison	Below Lake Edison	Below Diversion		Upper	Lower
Rosgen Level I Channel Type		B	C	B	B	C/G	G	G
Species	Estimate of							
Brown Trout	Density (#/km)	632	2,462	1,259	64	848		
	Density (#/ha)				113			
	Biomass (kg/ha)				3.3			
	Condition Factor	1.01	1.07	1.17	1.10	1.08		
Rainbow Trout	Density (#/km)	74	393	259	11	141		
	Density (#/ha)				19			
	Biomass (kg/ha)				0.9			
	Condition Factor	1.05	1.09	1.20	0.91	1.02		
Brook Trout	Density (#/km)	11	243			576		
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A	1.07			1.05		
Rainbow x Golden Trout Hybrid	Density (#/km)	11					440	374
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A					1.06	1.08
Sacramento Sucker	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Hardhead	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Sacramento Pikeminnow	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Prickly Sculpin	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		San Joaquin River Basin					
		Mammoth Reach		Rock Creek		Stevenson Reach	
Stream		6	6	3	3	6	6
Order		Upper Site Lower Site		Above Diversion Below Diversion		Upper Site Lower Site	
Reach							
Rosgen Level I Channel Type		B	B	Aa+	Aa+	G	G
Species	Estimate of						
Brown Trout	Density (#/km)	125	52	930	481	7	7
	Density (#/ha)	83	46	2,407	1,155	5	6
	Biomass (kg/ha)	2.0	4.7	91.5	42.4	0.1	0.0
	Condition Factor	1.09	1.18	1.31	1.30	1.22	1.16
Rainbow Trout	Density (#/km)	91	384	241	432	100	
	Density (#/ha)	61	340	623	1,037	76	
	Biomass (kg/ha)	2.1	12.5	29.5	29.0	0.3	
	Condition Factor	1.69	2.25	1.19	1.46	1.36	
Brook Trout	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Rainbow x Golden Trout Hybrid	Density (#/km)						
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Sacramento Sucker	Density (#/km)	498	1,197			514	15
	Density (#/ha)	331	1,061			389	12
	Biomass (kg/ha)	29.3	35.7			3.6	2.5
Hardhead	Density (#/km)						295
	Density (#/ha)						233
	Biomass (kg/ha)						2.2
	Condition Factor						0.97
Sacramento Pikeminnow	Density (#/km)						597
	Density (#/ha)						471
	Biomass (kg/ha)						4.6
Prickly Sculpin	Density (#/km)					43	
	Density (#/ha)					32	
	Biomass (kg/ha)					0.2	

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		Big Creek Basin						
Stream		Big Creek						
Order		4	4	4	4	5	5	5
Reach		Dam 1 to Powerhouse 1				Dam 4 to Powerhouse 2	Dam 5 to Powerhouse 8	
Rosgen Level I Channel Type		B	G	A	Aa+	A	A	Aa+
Species	Estimate of							
Brown Trout	Density (#/km)	320	648	1,214	497	363	602	160
	Density (#/ha)	462	1,852	3,572	1,579	811	946	331
	Biomass (kg/ha)	16.0	50.9	N/A	117.6	N/A	N/A	N/A
	Condition Factor	0.92	1.17		1.42			
Rainbow Trout	Density (#/km)					363	930	769
	Density (#/ha)					811	1,463	1,594
	Biomass (kg/ha)					N/A	N/A	N/A
	Condition Factor							
Brook Trout	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Rainbow x Golden Trout Hybrid	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Sacramento Sucker	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Hardhead	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Sacramento Pikeminnow	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Prickly Sculpin	Density (#/km)		14					
	Density (#/ha)		41					
	Biomass (kg/ha)		0.5					

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		Big Creek Basin						
		Pitman Creek			Balsam Creek		Ely Creek	
Stream								
Order		3	4	4	3	3	1	2
Reach		Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion
Rosgen Level I Channel Type		B	B	Aa+	Aa+	Aa+	Aa+	Aa+
Species	Estimate of							
Brown Trout	Density (#/km)	338	22					
	Density (#/ha)	780	50					
	Biomass (kg/ha)	45.4	3.2					
	Condition Factor	1.12	1.23					
Rainbow Trout	Density (#/km)	1,066	613	1,647	1,335	12	190	266
	Density (#/ha)	2,458	1,426	5,496	8,101	33	1,605	1,635
	Biomass (kg/ha)	57.3	38.2	77.5	171.6	2.3	133.9	76.7
	Condition Factor	1.20	1.71	1.45	1.56	2.07	1.25	1.38
Brook Trout	Density (#/km)	82	22					
	Density (#/ha)	189	50					
	Biomass (kg/ha)	1.5	1.0					
	Condition Factor	1.00	1.06					
Rainbow x Golden Trout Hybrid	Density (#/km)							102
	Density (#/ha)							629
	Biomass (kg/ha)							31.4
	Condition Factor							1.40
Sacramento Sucker	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Hardhead	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Sacramento Pikeminnow	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Prickly Sculpin	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		Big Creek			
Stream		Adit No 8	Rancheria Creek <sup>1</sup>		
Order		1	3	3	3
Reach		Below Diversion	Above Energy Dissipater	Below Energy Dissipater	Below Energy Dissipater
Rosgen Level I Channel Type		Aa+	B	B	A
Species	Estimate of				
Brown Trout	Density (#/km)	No Fish	132	110	22
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.71	1.40	1.11
Rainbow Trout	Density (#/km)		963	679	580
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.39	1.39	1.18
Brook Trout	Density (#/km)		569	154	33
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.40	1.12	1.06
Rainbow x Golden Trout Hybrid	Density (#/km)				
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor				
Sacramento Sucker	Density (#/km)		307	88	33
	Density (#/ha)				
	Biomass (kg/ha)				
Hardhead	Density (#/km)				
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor				
Sacramento Pikeminnow	Density (#/km)				
	Density (#/ha)				
	Biomass (kg/ha)				
Prickly Sculpin	Density (#/km)				
	Density (#/ha)				
	Biomass (kg/ha)				

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing



**Table CAWG 7 ES-1. Summary of Fish Abundance by Stream and Location (cont).**

Drainage Sub-Basin		Stevenson and North Fork Stevenson Reach						
Stream		North Fork Stevenson Creek				Stevenson Creek		
Order		2	2	2	2	3	3	3
Reach		Upstream of Tunnel 7 Outlet	Downstream of Tunnel 7 Outlet			Downstream of Shaver Lake Dam		
Rosgen Level I Channel Type		Aa+	Aa+	G	C	B	Aa+	A
Species	Estimate of							
Brown Trout	Density (#/km)	No Fish		305	430			
	Density (#/ha)			703	2,170			
	Biomass (kg/ha)			43.7	33.2			
	Condition Factor			1.23	1.39			
Rainbow Trout	Density (#/km)			210	314	751	966	128
	Density (#/ha)			485	1,588	2,829	3,161	309
	Biomass (kg/ha)			13.5	29.8	52.3	74.9	N/A
	Condition Factor			1.27	1.27	1.04	1.34	
Brook Trout	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Rainbow x Golden Trout Hybrid	Density (#/km)	583		11				
	Density (#/ha)	487		24				
	Biomass (kg/ha)	9.0		1.3				
	Condition Factor	0.98		1.35				
Sacramento Sucker	Density (#/km)			11	42			
	Density (#/ha)			24	212			
	Biomass (kg/ha)			13.5	65.9			
Hardhead	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor							
Sacramento Pikeminnow	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							
Prickly Sculpin	Density (#/km)							
	Density (#/ha)							
	Biomass (kg/ha)							

<sup>1</sup> Data collected in 2002 for Portal Hydroelectric Power Project Relicensing

<sup>2</sup> In 2001, brook trout were also captured with a density estimate of 1,299 fish/km

<sup>3</sup> Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing

**APPENDIX D**  
**STUDY AREA (MAPS)**

## **Placeholder for Study Area Maps**

### **Non-Internet Public Information**

These Maps have been removed in accordance with the Commission regulations at 18 CFR Section 388.112.

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