*Public Draft*

# Fish Passage Improvement Project

at the

# RED BLUFF DIVERSION DAM

# EIS/EIR

ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

**CEQA Lead- Tehama-Colusa Canal Authority**

**NEPA Lead- U.S. Bureau of Reclamation**

Prepared for

**Tehama-Colusa Canal Authority**

Willows, California

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*Executive Summary*

# Draft Environmental Impact Statement/Environmental Impact Report Fish Passage Improvement Project at the Red Bluff Diversion Dam

Lead Agencies

**Tehama-Colusa Canal Authority and U.S. Bureau of Reclamation**

August 2002

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# Fish Passage Improvement Project at the Red Bluff Diversion Dam Executive Summary

## Introduction

The Tehama-Colusa Canal Authority (TCCA) Fish Passage Improvement Project at the Red Bluff Diversion Dam (RBDD) Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) addresses the environmental issues, alternatives, and impacts associated with improvement of anadromous fish passage, both upstream and downstream, at RBDD.

This DEIS/EIR was prepared by TCCA and the U.S Bureau of Reclamation (USBR) (see Section 5.1 for agency involvement and a list of the agency approvals required for the project to proceed). This document meets the legal requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and discloses relevant information to interested parties and invites such parties to play a role in both the decisionmaking process and the implementation of that decision. This DEIS/EIR also provides federal, state, and local decision makers with detailed information concerning the significant environmental, cultural, and other impacts associated with the alternative courses of action.

By preparing a single document that complies with both statutes, the involved agencies have avoided duplication of effort. The statutes are similar in that they require federal and state agencies to consider a range of alternatives to meet the project purpose, to evaluate the impacts of the alternatives, and to disclose the alternatives and impacts to the public prior to making a commitment of resources. The statutes differ in several ways, two of the more substantive being:

- CEQA requires state agencies to implement feasible mitigation, whereas NEPA requires only that federal agencies consider mitigation
- CEQA requires that proposed actions be compared to existing conditions, whereas NEPA requires only that they be compared to future conditions without the project

Prior to the completion of RBDD in the mid-1960s, anadromous fish had unimpeded passage through the current dam site. The dam created a barrier in the Sacramento River, impeding and delaying passage to spawning and rearing habitat above the dam. The dominant feature of RBDD is its gates. When the gates are lowered (gates-in) into the Sacramento River, the elevation of the water surface behind the dam rises, allowing gravity diversion into the Tehama-Colusa (TC) and Corning canals for delivery to irrigation districts. Raising the gates allows the river to flow virtually unimpeded but precludes gravity diversion into the canals. When the gates are lowered, RBDD presents a barrier for both upstream- and downstream-migrating fish because fish ladders, included in the

original dam design, have proven inefficient at certain flows to pass anadromous fish to upstream spawning grounds. Additionally, the tailrace and lake created by the dam provide habitat for species that prey on juvenile salmon, reducing their overall survival rates.

In 1993, the National Marine Fisheries Service (NMFS) issued a Biological Opinion for endangered winter-run chinook salmon, requiring that the gates be kept in the raised position (gates-out) for a greater portion of the year (September 15 through May 14) than had been required previously. This has significantly improved fish passage at RBDD, but has made the facility less effective as a water source for agriculture. The current gates-in schedule may be subject to further reduction, if it is found to be a reasonable and prudent action, to avoid jeopardy to species recently listed as endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA). Species of concern include winter-, spring-, and fall-/late-fall-run salmon; steelhead; sturgeon; and splittail. However, further reduction of the gates-in period would further reduce RBDD's ability to divert water for agriculture.

# Purpose and Need for the Action

NEPA regulations require that each environmental impact statement (EIS) briefly specify the purpose and need to which the agency is responding in proposing the various alternatives, including the preferred alternative. Similarly, CEQA requires that each environmental impact report (EIR) include a statement of the objectives sought by the proposed project. The objectives are intended to help the implementing agency develop a reasonable range of alternatives and aid decision makers in preparing findings or statements of overriding consideration, if necessary. For the purposes of this document, the NEPA-mandated purpose and need statement and the CEQA-mandated project objective are synonymous.

## Purpose and Need Statement

The purpose of the project is twofold:

- Substantially improve the long-term ability to reliably pass anadromous fish and other species of concern, both upstream and downstream, past RBDD.
- Substantially improve the long-term ability to reliably and cost-effectively move sufficient water into the TC Canal and Corning Canal systems to meet the needs of the water districts served by TCCA.

The need for this project is in response to the continued, well-documented fish passage and agricultural water diversion reliability problems associated with the operation of RBDD.

## Tehama-Colusa and Corning Canals

### Tehama-Colusa Canal

TC Canal construction began in 1964 and was completed in 1980. The canal is a 111-mile long, concrete-lined structure starting at RBDD and ending approximately 2 miles south of Dunnigan. The canal travels through Tehama, Glenn, and Colusa counties, and ends in Yolo County.

The canal was built as a result of signed contracts between USBR and water districts dating back as early as 1954. The water districts served by the canal include Orland-Artois, Glide, Kanawha, Holthouse, 4-M, Glenn Valley La Grande, Davis, Westside, Myers-Marsh, Cortina, Colusa County, and Dunnigan water districts. Glenn-Colusa Irrigation District also takes water from the TC Canal periodically.

### Corning Canal

The Corning Canal was authorized in 1950 as part of the Central Valley Project (CVP) and completed in 1959. It is a 21-mile-long, earth-lined canal starting at RBDD and ending about 4 miles south of the City of Corning.

The water districts served by the canal include Proberta, Thomes Creek, Corning, and Kirkwood water districts. The Corning Water District was formed in 1954, specifically to supplement the local groundwater supply with water from CVP.

The diverted water is used mainly for irrigating agriculture, with a very small percentage used for non-agriculture purposes. The principal crop types associated with the TC and Corning canals include almonds, olives, rice, corn, wheat, alfalfa, vine seeds, irrigated pasture, beans, sugar beets, tomatoes, and orchard fruits.

## Description of Alternatives

Alternatives were developed to provide a reasonable range of actions that satisfied statutory requirements and were feasible. Alternatives were selected based on public input, scientific information, and professional judgement.

### Preferred Alternative

The TCCA Board of Directors (TCCA Board) determined the Gates-out Alternative to be the Preferred Alternative (Resolution No. 01-06). The Gates-out Alternative was chosen during a board meeting held on December 5, 2001. This decision stemmed from the idea that "selection of a Preferred Alternative at this time simply allows the work on the solution to the fish passage and water delivery reliability problems at the Red Bluff Diversion Dam to continue…" Through this resolution, the TCCA Board reserves the right to change the selected Preferred Alternative in the future. Additionally, the selection of the Preferred Alternative in no way commits the TCCA Board or TCCA to any particular course of action, nor does it commit any expenditure of funds for any purpose.

Following this decision, the TCCA Board held a subsequent meeting on February 6, 2002. One of the topics of discussion included the TCCA Board's commitment to the Gates-out Alternative but their willingness to consider alternatives such as the "Flexible Gate" Alternative.

USBR has not yet chosen a Preferred Alternative. A list of the alternatives that are currently being evaluated, including the No Action Alternative, follows.

## No Action Alternative

CEQA requires that the Preferred Alternative be compared to an existing conditions base-line, whereas NEPA requires comparison with a No Action Alternative. The No Action Alternative represents ongoing activities and operations and corresponds to the "No Project" definition as outlined in the *CEQA Guidelines*, Section 15126, as "a condition that would be reasonably expected to occur if the project were not approved."

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Continue operating the Research Pumping Plant (RPP) and add a fourth pump
- Eliminate Stony Creek diversions because of lack of feasible options for constructing a fish screen on the Constant Head Orifice (CHO), which is used as an intake to the canal

## 1A: 4-month Improved Ladder Alternative

This alternative would continue the current operation of the dam with a 4-month gates-in period of May 15 through September 15. Improved agricultural water deliveries would be achieved through 1,700 cubic feet per second (cfs) of pumping capacity (320 cfs at RPP; 1,380 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of new ladders (right 800 cfs, left 831 cfs, for a total of 1,631 cfs).

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Install new 1,380-cfs pump station with fish screen at Mill Site; continue operating the RPP and add a fourth pump resulting in a combined pumping capacity of 1,700 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Modify the left and right bank fish ladders
- Implement Adaptive Management Program

## 1B: 4-month Bypass Alternative

This alternative would continue the current operation of the dam with a 4-month gates-in period of May 15 through September 15. Improved agricultural water deliveries would be achieved through 1,700 cfs of pumping capacity (320 cfs at RPP; 1,380 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of a new ladder at the right abutment (800 cfs). A 1,000-cfs bypass channel for fish passage would be constructed at the left abutment near the existing Discovery Center. This alternative requires an amendment to the U.S. Forest Service (USFS), Mendocino National Forest Land and Resource Management Plan.

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Install new 1,380-cfs pump station with fish screen at Mill Site; continue operating the RPP and add a fourth pump resulting in a combined pumping capacity of 1,700 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Install a new 1,000-cfs bypass around left abutment of dam

- Modify the right bank fish ladder
- Implement Adaptive Management Program
- Amend Mendocino National Forest Land and Resource Management Plan to allow construction of the bypass facility

## 2A: 2-month Improved Ladder Alternative

This alternative would reduce the current operation of the dam to a 2-month gates-in period of July 1 to August 31. Improved agricultural water deliveries would be achieved through 2,000 cfs of pumping capacity (320 cfs at RPP; 1,680 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of new ladders (right 800 cfs, left 831 cfs, total 1,631 cfs) and the reduced gates-in operation.

- RBDD Operations: Gates-in 2 months (July 1 through August 31)
- Install a new 1,680-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,000 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Modify the left and right bank fish ladders
- Implement Adaptive Management Program

## 2B: 2-month with Existing Ladders Alternative

This alternative would reduce the current operation of the dam to a 2-month gates-in period of July 1 to August 31. Improved agricultural water deliveries would be achieved through 2,000 cfs of pumping capacity (320 cfs at RPP; 1,680 cfs at Mill Site). Improvements to fish passage would be achieved through the reduced gates-in period. Existing ladders would continue to be operated at the right and left abutments (right 338 cfs, left 338 cfs, total 676 cfs).

- RBDD Operations: Gates-in 2 months (July 1 through August 31)
- Install a new 1,680-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,000 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Implement Adaptive Management Program

## 3: Gates-out Alternative

The Gates-out Alternative would eliminate the gates-in period. Improved agricultural water deliveries would be achieved through 2,500 cfs of pumping capacity (320 cfs at RPP; 2,180 cfs at Mill Site). Improvements to fish passage would be achieved through the reduction in gate operations. Existing ladders would no longer operate.

- RBDD Operations: Gates-in 0 months

- Install a new 2,180-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,500 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Implement Adaptive Management Program.

Table ES-1 summarizes the alternatives.

**TABLE ES-1**
Summary of Alternatives

| | Gates-in Operation | | Fish Passage Facilities | | | | Gates-out Water Supply | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Name | Duration | Timing | Right Bank (cfs) | Center (cfs) | Left Bank (cfs) | RPP (cfs) | Right Fish Ladder (cfs) | Mill Site (cfs) | Stony Creek (cfs) | Total (cfs) |
| Existing Conditions | 4 months | May 15 through Sept 15 | (E) 338 | (E) 100 | (E) 338 | 240 | 165 | | 600 | 1,005 |
| No Action | 4 months | May 15 through Sept 15 | (E) 338 | (E) 100 | (E) 338 | 320 | 165 | | | 485 |
| 4-month Improved Ladder | 4 months | May 15 through Sept 15 | (N) 800 | | (N) 831 | 320 | | 1,380 | | 1,700 |
| 4-month Bypass | 4 months | May 15 through Sept 15 | (N) 800 | | Bypass Channel 1,000; (E) 338 | 320 | | 1,380 | | 1,700 |
| 2-month Improved Ladder | 2 months | Jul 1 through Aug 31 | (N) 800 | | (N) 831 | 320 | | 1,680 | | 2,000 |
| 2-month with Existing Ladders | 2 months | July 1 through Aug 31 | (E) 338 | | (E) 338 | 320 | | 1,680 | | 2,000 |
| Gates-out | 0 months | | | | | 320 | | 2,180 | | 2,500 |

# Affected Environment and Environmental Consequences

## Fishery Resources

The fishery resources in the Sacramento River near RBDD consist of a diverse collection of species including native anadromous salmonids (NAS), other native anadromous fish (NAO), non-native anadromous fish (NNA), and resident native and non-native fish (RN and RNN). The Sacramento River is the largest river system in California and more than 90 percent of the Central Valley salmon spawning and rearing within this river system. The Sacramento River supports four runs (races) of chinook salmon (fall, late-fall, winter, and spring run) and steelhead. Other native anadromous species such as white sturgeon, green sturgeon, Pacific lamprey, and river lamprey also occupy or have the potential to occupy the Sacramento River at various stages of their life history and during seasonal intervals. Table ES-2 shows the life history timing for these species in the Sacramento River, near RBDD.

All of the impacts associated with the operation of all of the alternatives are beneficial to increased fish passage. Reduced gate operation alternatives would produce the largest measurable benefit to both NAS and NAO. Adult spring-run chinook salmon would receive the largest measurable benefit under the 2-month and Gates-out alternatives, with an approximate 79 to 91 percent improvement, while adult green sturgeon would realize an approximate 54 percent improvement in passage. Adult fall-run chinook salmon show an approximate 9 to 20 percent improvement, and adult lamprey show an approximate 17 to 20 percent improvement in passage under the 2-month and Gates-out alternatives. Juvenile NAS show little to no measurable benefit under any of the alternatives; however, juvenile green sturgeon show an approximate 21 to 38 percent improvement under the 2-month and Gates-out alternatives, and river lamprey shows an approximate 15 percent improvement under both the 2-month and Gates-out alternatives.

## Water Resources

**Surface-water Hydrology and Management.** RBDD is located approximately 60 river miles downstream from Shasta and Keswick dams. Shasta and Keswick dams are the ultimate barriers to anadromous fish migrations in the Sacramento River. The average monthly flow of the Sacramento River ranges from approximately 6,000 cfs to 20,000 cfs, with maximum flows reaching over 100,000 cfs.

The gates on RBDD are in place from mid-May to mid-September. When RBDD gates are in, the water level in the Sacramento River just above the dam rises approximately 12 feet, which results in the formation of Lake Red Bluff. When full, the lake contains approximately 3,900 acre-feet of water and extends approximately 6 miles upstream through the City of Red Bluff. RBDD affects river surface elevations upstream of the dam. During the gates-in period, the surface-water elevation at the dam is maintained at 252.5 feet. During the gates-out period (September 16 through May 14), surface-water elevations at RBDD range from approximately 238.5 feet (at 4,000 cfs) to 254 feet (at 100,000 cfs).

Neither construction nor operation of any of the alternatives would negatively affect the hydrology or water management in the project area.

**Water Quality.** The primary water quality concerns in the DEIS/EIR are Sacramento River water temperature, turbidity, and sediment deposition. According to the State Water Resources Control Board's Order 90-5, the temperature objective for the operation of CVP facilities for the upper Sacramento River from Keswick Dam to RBDD is less than or equal to 56 degrees Fahrenheit ($^{o}$F) (CALFED Bay-Delta Program, 1999). Additionally, the 1993 NMFS biological opinion designated 56$^{o}$F as the temperature to be maintained in the river from Keswick Dam to Bend Bridge, and requires a gates-out operation for a greater portion of the year. From 1998 to 2000, the water temperature exceeded the temperature objective established by Order 90-5 during the gates-in period, 85 percent of the time, with an average temperature of 56.7$^{o}$F. The average year-round temperature during the same period was 53.8$^{o}$F with roughly 38 percent of the data exceeding the 56$^{o}$F temperature standard.

None of the proposed alternatives would result in significant impacts to water quality. All potential impacts to water quality from the project would be caused by construction activities. Construction could potentially increase erosion in the project area, which could ultimately produce large amounts of sediment in the Sacramento River. Additionally,

construction equipment used onsite would require the use of hazardous materials (i.e., diesel fuels and cleaning solvents), which could result in spills that could affect nearby waterways. Mitigation would reduce these potential impacts to a less than significant level.

**Groundwater.** Groundwater quality is generally excellent in the region. In the most recent summary of groundwater conditions conducted in 1991, total dissolved solids (TDS) in the Red Bluff area was classified as less than 200 mg/L, which is below drinking water standards. No evidence of elevated levels of boron, nitrates, arsenic, or selenium has been found in the groundwater in the Red Bluff area. Any contaminated soil identified during construction would be disposed according to applicable standards. Mitigation would reduce these potential impacts to a less than significant level.

## Biological Resources

The land around the project area is predominantly agricultural or formerly agricultural. The few areas of native vegetation generally occur adjacent to or near the river corridor, in old river meanders, or in natural low-lying wet areas. The project site contains seven primary habitats:

- Riparian
- Freshwater marsh
- Mixed woodland
- Restored
- Annual grassland
- Disturbed
- Parkland

About 79 acres of the project site consists of disturbed areas. Disturbed habitat occurs on both sides of the Sacramento River and were created by former agricultural practices, restoration plantings (i.e., plowed fields), RBDD maintenance activities, pre-dam land uses, and activities at the Mill Site. Of the 79 acres, 51 acres are bare ground, 13 acres are dominated by star thistle, and 15 acres are dominated by blackberry bushes. Less than 1 acre is covered by a riprap pile composed of dam-building material.

Temporary and permanent impacts on riparian, freshwater marsh, disturbed, and parkland would occur under all of the alternatives. The largest of these impacts occurs under the 4-month Bypass Alternative. Under the 4-month Bypass Alternative, temporary and permanent impacts also occur on mixed woodland and restored habitat. Table ES-3 lists the acreage of each habitat type that would be affected by each alternative. Acreage is divided into temporary and permanent impacts for each alternative.

**Special-status Species.** Fifty-eight special-status wildlife species and 15 plant species were identified as having the potential to occur in or near the project area. Six species that are state- or federal-listed as threatened or endangered were identified as potentially occurring in the project area. These species include little willow flycatcher, western yellow-billed cuckoo, bald eagle, Swainson's hawk, peregrine falcon, and valley elderberry longhorn beetle (VELB).

**TABLE ES-2**
Life History Timing in the Sacramento River Near RBDD

| Name | Adult Immigration | Spawning | Incubation | Larval/Juvenile Rearing | Juvenile Emigration |
|---|---|---|---|---|---|
| Fall Chinook | July-Dec | Oct-Dec | Oct-Mar | Dec-Jun | Dec-Jul |
| Late-fall Chinook | Oct-Apr | Jan-Apr | Jan-Jun | Apr-Nov | Apr-Dec |
| Spring Chinook | Apr-Jul | Aug-Oct | Aug-Dec | Oct-Apr | Oct-May |
| Winter Chinook | Dec-Jul | Apr-Aug | Apr-Oct | Jul-Mar | Jul-Mar |
| Steelhead | Aug-Mar | Dec-Apr | Dec-Jun | Year-round (1 to 2 years) | Jan-Oct |
| White Sturgeon | Feb-May | Feb-Jun | Embryos planktonic drifting downstream | Larvae in river, juveniles in Delta | N/A |
| Green Sturgeon | Feb-Jun | Mar-Jul | Embryos planktonic drifting downstream | Larvae in river, juveniles in Delta | Jun-Aug |
| Pacific Lamprey | Feb-Jun | Spring-Summer | Brief followed by ammocoete larval stage | Up to 7 years | Sep-Apr |
| River Lamprey | Feb-Jun | Spring-Summer | Brief followed by ammocoete larval stage | Up to 5 years | Mar-Jun |

N/A = White sturgeon are not known to spawn upstream of RBDD.

In the vicinity of RBDD, the Sacramento River acts primarily as a transport corridor for adults immigrating upstream, juvenile fry rearing and dispersing, and smolts emigrating downstream.

All five anadromous salmonid fish species are either listed by California Endangered Species Act and/or the federal Endangered Species Act, or are listed as candidates under the federal ESA. Additionally, green sturgeon is a California Species of Special Concern Class1: Qualify as Threatened; river lamprey is a California Species of Special Concern Class 3: Watch List; and Pacific lamprey is a California Species of Special Concern Class 4: Population Status Apparently Secure (Moyle et al., 1995).

**Impacts of Current Operations.** Current operation of RBDD includes a 4-month period when the gates are placed in the river, creating a velocity barrier and whitewater turbulence, which prevents or impedes fish passage. Fish ladders, located on the east and west sides and at the center of the dam, are operational during the gates-in period to provide passage. Under current operations, approximately 25 percent of adult fall-run chinook salmon, 15 percent of adult winter-run chinook salmon, 72 percent of adult spring-run chinook salmon, 17 percent of adult steelhead, 35 percent of adult green sturgeon, and 25 percent of adult lamprey are affected by operation of the dam. Of the juvenile species, approximately 39 percent of winter-run chinook salmon, 35 percent of late-fall-run chinook salmon, 36 percent of steelhead, nearly all of the larval/juvenile green sturgeon, 6 to 7 percent of downstream-migrating Pacific lamprey, and 30 percent of downstream-migrating river lamprey are subject to the operational effects of the dam and its associated diversion facilities.

Construction impacts could potentially be significant to all species and life stages of fish in the project area. Loss to adult and juvenile species could be caused by construction activities such as sheet pile installation and increased sediment and turbidity from in-river activities. Mitigation would reduce these impacts to a less than significant level.

**TABLE ES-3**
Acreage of Habitat Impacts for Project Alternatives

| | Alternatives | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1A: 4-month Improved Ladder | | 1B: 4-month Bypass | | 2A: 2-month Improved Ladder | | 2-month with Existing Ladders | | 3: Gates-out | |
| Vegetation Habitat | No Action | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact |
| Riparian | 0 | 2.18 | 5.56 | 2.60 | 6.30 | 2.18 | 5.56 | 2.05 | 4.76 | 2.05 | 4.76 |
| Freshwater marsh | 0 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 |
| Mixed woodland | 0 | 0 | 0 | 1.37 | 4.30 | 0 | 0 | 0 | 0 | 0 | 0 |
| Restored habitat | 0 | 0 | 0 | 4.96 | 4.80 | 0 | 0 | 0 | 0 | 0 | 0 |
| Annual grassland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Disturbed | 0 | 11.75 | 44.12 | 12.90 | 51.70 | 11.75 | 44.12 | 11.36 | 41.35 | 11.36 | 41.3 |
| Parkland | 0 | 0.19 | 4.86 | 4.19 | 12.32 | 0.19 | 4.86 | 0 | 0 | 0 | 0 |

All of the alternatives require the removal of elderberry shrubs and three osprey nests. The removal of the elderberry shrubs could negatively affect VELB. Additionally, removal of the osprey nests could negatively impact the birds that were occupying two of the nests during the project area survey. Mitigation would reduce these impacts to a less than significant level.

## Recreation

Potential project impacts on recreational opportunities, activities, and facilities of the project area were identified as a key concern of project stakeholders. Changes to recreation opportunities resulting from the proposed project alternatives were analyzed to determine the extent to which impacts may exist. While the project area is limited to RBDD and the Mill Site, the facilities examined in the physical recreational analysis are broader; extending north along the Sacramento River from RBDD to Ide Adobe State Historic Park.

According to a study by California State University, Chico, approximately 64,000 individuals recreated in and along the Sacramento River from RBDD to Ide Adobe State Historical Park during 1995. Most used one of three locations: River Park (also known as City Park), Ide Adobe State Historical Park, and the boat launch ramp area at the Red Bluff Recreation Area (Recreation Area) south of RBDD. More than half of the individuals counted in the survey recreated in the area during the summer months between May and September. This time frame also correlates to the current gates-in period of the dam, resulting in the creation of Lake Red Bluff.

Special holidays and well-attended activities result in increased recreation patronage during the summer, including the annual July 4 fireworks celebration at River Park and the Nitro National Drag Boat Festival on Memorial Day weekend.

Bypass construction would significantly impact the Sycamore Grove Campground and the outdoor recreational experience of campers. The campground would be bisected with a constructed channel structure, eliminating campsites and separating a portion of the Recreation Area. Additionally, the associated loss of riparian woodlands for educational/ interpretive uses is in conflict with the Lake Red Bluff Final EIS (FEIS). The Lake Red Bluff FEIS stresses the importance of recreational uses in concert with the restoration of riparian habitat and public education of the area's natural environment.

Reduced gate operations under the 2-month gates-in alternatives and Gates-out Alternative would limit Lake Red Bluff recreational activities to 2 months annually, or eliminate lake recreation all together. These activities, characterized as "lake-dependent" include boating, jet skiing, water skiing, and swimming and would cause the greatest impact. Additionally, the Nitro National drag boat races could not be held over the Memorial Day holiday weekend. These impacts are significant to local residents and users of the recreational facilities. No mitigation has been identified that would reduce this impact.

## Land Use

The predominant land use in the immediate area of the project is general industrial and recreation. A large portion of the land adjacent to Lake Red Bluff is the Recreation Area and is used for recreational and educational purposes. The project facilities lie entirely within the County of Tehama.

Generally, construction and operations of the proposed facilities would be consistent with existing land use and land use plans, with two exceptions: the bypass channel and changed gate operations.

Construction and operations of the 4-month Bypass Alternative would result in a conflict with the existing land use plan for the Recreation Area. The bypass channel would require removal of camping sites and would isolate the Discovery Center, drastically reducing its utility. Further, the existing Recreation Area has been developed through extensive volunteer efforts and has been the focus for many educational programs, which add to its unique character. Additionally, a number of boat ramps have been developed to take advantage of Lake Red Bluff. If gate operations were reduced to 2-month operations or gates-out operations year-round, these boat ramps would no longer be functional, causing impacts to current land use. No mitigation is available to offset these impacts.

## Geology

The project area is on the upper member of the Riverbank Formation, a Late Pleistocene-age stream/terrace deposit of fluvial/deltaic origin. This unit consists of moderately well-consolidated, interconnected, and discontinuous layers and lenses of channel and overbank deposits containing varying mixtures of gray, brown, reddish-brown, and red-orange-brown gravel, sand, silt, and clay. These deposits occur along channels, floodplains, and natural levees of major streams; are highly permeable; and vary in thickness from 5 to 15 feet (Regional Water Quality Control Board, 1990).

Groundwater in the immediate vicinity of Lake Red Bluff is greatly affected by the annual filling of the lake. This change in the surface elevation of the Sacramento River corresponds to a change in the groundwater hydraulic gradient as evidenced by groundwater elevation measurements recorded during the gates-in and gates-out periods.

Pactiv Corporation (Pactiv) land occupies an 8.3-acre site approximately 1,400 feet upstream of RBDD. The Pactiv landfill is used for the disposal of dried paper sludge generated at the onsite industrial wastewater treatment facility. Further upstream of this site, an active wastewater treatment plant currently discharges approximately 1.9 million gallons per day to the Sacramento River.

Under all of the alternatives, a large quantity of material would need to be excavated, up to approximately 800,000 cubic yards (CY). This includes excavation for the pumping station and forebay, as well as the right bank and left bank fish ladders, and bypass channel. Approximately 600,000 CY of this material would be stored onsite. Removal and storage of this material could cause soil erosion, movement of sediments, loss of topsoil, and associated water quality impacts. Mitigation would reduce these impacts to a less than significant level.

## Agricultural Resources

Agriculture is the largest industry in the Sacramento Valley. The region produces a wide variety of crops including rice, grain, tomatoes, field crops, fruits, and nuts. The value of Sacramento Valley crop production reached $1.7 billion in 1992, with rice, tomatoes, and orchard crops providing the highest revenues. The CVP's Tehama-Colusa service area is representative of areas within the region that are heavily dependent on CVP supplies. Districts within the Tehama-Colusa service area hold water service contracts with USBR, making them subject to water delivery curtailments up to 100 percent in dry years. All TCCA member districts rely on CVP service contracts for a portion of their supplies. Twenty-five such districts are located within the Sacramento Valley region. Approximately 10 percent of the applied water within the Sacramento Valley is provided through CVP service contracts.

The service area of the TC and Corning canals lies entirely in the area of origin of the Sacramento River watershed along the westerly side of the Sacramento River valley. Eighteen water districts contract with the federal government for water deliveries from the TC and Corning canals. These districts have contracts totaling 325,000 acre-feet of water each year and provide service to over 150,000 acres of land located in Tehama, Glenn, Colusa, and Yolo counties.

Agricultural districts served by TCCA would benefit from the increased reliability provided by the project.

## Power Resources

When California deregulated its energy market, it established the California Power Exchange to operate a power exchange system from which the state's investor-owned utilities (IOU) (Pacific Gas & Electric Company [PG&E], Southern California Edison, and San Diego Gas & Electric) had to buy their power on a day-ahead and day-of basis. The highest-price power supply bid that was needed for the next day set the price for the entire

market. The IOUs were also prevented from hedging into future markets. This eliminated bilateral, negotiated agreements from the marketplace.

As power suppliers gained an understanding of the market, the Pacific Northwest began to experience the second driest water year of record, and the supply of natural gas available to California decreased.

This led to a situation where wholesale market prices became volatile and provided opportunities for market manipulation. The California Independent System Operator had responsibility to provide the system with "spinning reserves," which it had to purchase on the spot market, driving wholesale power prices even higher.

In October 2001, the California Public Utilities Company ended direct access in the state, putting a close to California deregulation of electricity markets. The state, through large power purchases during volatile periods of deregulation is now in a position of being a major power purchaser and seller, and longer-term bilateral contracts dominate the market.

In December 2001, Federal Energy Regulatory Commission issued additional extensive orders clarifying the market mitigation framework that exists in California today; this is due to expire on September 30, 2002. Efforts are underway to redesign the California wholesale power market and to extend the present market mitigation framework until a new framework can be put in place.

In May 2002, documents surfaced indicating deliberate market manipulation by various power marketers, which in turn have led to calls for refunds, increased regulatory scrutiny, and perhaps litigation.

USBR's CVP supplies electricity to its individual components (called Project Use) and supplies the excess generation to a number of preference power customers through contractual arrangements with the Western Area Power Administration (Western). USBR's CVP and Washoe Project include 11 power plants with a maximum operating capability of about 2,044 megawatts and an estimated average annual generation of 4.6 million megawatt-hours (MWh). Western markets the remaining power, currently about 1,580 megawatts, to customers in northern and central California.

The first priority for CVP generation is Project Use, defined by USBR law and used to operate the CVP and Washoe Project facilities. It is anticipated that any new electrical load, such as would occur under a new pumping facility, would be supplied with Project Use Power. However, a formal determination regarding Project Use has not been made. If the project were served with CVP power, it would reduce the amount of electricity available for use by Western's preference customers.

Currently, RBDD and associated facilities use about 4,800 MWh per year. Electrical usage would be highest under the Gates-out Alternative, where annual use would increase to approximately 9,000 MWh per year. This increase in power consumption is considered less than significant, even if it resulted in a decrease in the amount of electricity available to preference power customers.

## Socioeconomics

In the 1970s and 1980s, both the City of Red Bluff's and County of Tehama's populations grew more rapidly than other areas of the state. In the 1990s, this trend reversed and the County grew at a rate similar to that of the state, and the City grew more slowly. In fact, the City of Red Bluff grew very slowly in the 1990s; population increased from 12,363 in 1990 to 13,147 in 2000.

In 2000, the civilian labor force in Tehama County was 25,760; about a quarter of those employees (5,580) lived in Red Bluff. In recent years, the unemployment rate has been higher in the County than in the state as a whole. For example, in 1990, the unemployment rate was 10.0 percent in the County versus 5.8 percent statewide; and in 2000, the rates were 6.9 percent and 4.9 percent, respectively.

Total employment grew much more rapidly during the 1990s in Tehama County (31 percent) than did the rest of the state (13 percent). The fastest growing sectors of the local economy are retail, trade, finance, insurance, and real estate. The local economy is highly dependent on agriculture, including forestry. The main cash crops in the County are dried plums, walnuts, dairy and beef cattle, almonds, corn, alfalfa, and olives. Farmland makes up approximately 47 percent of the total acreage in the County.

The Gates-out Alternative would create a number of potential economic impacts. The total of the various impacts of this alternative would result in a significant economic impact to the local community.

The combined impact from reduced recreation and tourism spending and the loss of the Nitro National drag boat races is estimated to be about $4.2 million per year. This is small relative to total annual sales in Tehama County of $1.7 billion, but it would be a more substantial impact to the City of Red Bluff. One measure of this impact would be the resulting loss of sales and use tax revenue of $89,000, which is about 1.9 percent of the City's total revenues from sales and use taxes.

The value of properties adjacent to the lake or with easy access to the lake would likely decline from the loss of the lake. While it is uncertain how large this impact would be, it is expected that, in general, the impact would be in the low end of national estimates of property values with lakeviews and proximity to a lake, resulting in potential decreases of of 4 to 18 percent.

Additionally, a noticeable impact to local residents would occur in a number of social aspects such as reduction in the quality of life and reduced community cohesion because of the Gates-out Alternative. No mitigation is available to offset these impacts.

## Cultural Resources

According to the Northeast Information Center of the California Historical Resources Information, three early archaeological inspections were conducted near RBDD. Two prehistoric-period cultural resources have been identified and recorded within a 0.5-mile radius of the proposed activity area. Three unrecorded cultural resources located within the proposed activity area were plotted on Information Center maps. All of these resources were noted for additional consideration.

Any area adjacent to a watercourse is sensitive and may have the potential to contain cultural resources. However, the Tehama County Genealogical and Historical Society noted that they were not aware of any historic resources at the proposed activity area.

Construction activities related to all of the alternatives include excavation and other grading and digging activities. It is possible that currently unidentified cultural resources could be discovered during these activities, and destruction of such resources could result in a significant impact. Mitigation would reduce these impacts to a less than significant level.

## Aesthetics and Visual Resources

The Sacramento River is considered an important aesthetic and visual resource for residents of the City of Red Bluff and Tehama County and visitors to the area. The river largely defines the eastern edge of the City, although there are some incorporated areas to the east of the river. Residents and visitors use the river for recreation, both on and adjacent to the river. When the gates are in, the formation of Lake Bluff represents a significant change to some viewers in the feeling of an abundance of water in Red Bluff.

Construction of the Mill Site pump station and conveyance facilities and Auxiliary Water System intake associated with improvements to the left bank fish ladder would be visible from the Sacramento River and the Recreation Area. Construction of all facilities would take roughly 3 years to complete. During the construction period, viewers would experience substantially degraded sites, although some construction activity could be screened from sight by cofferdams. Because of the lengthy duration of construction and the sensitive view area from the Sacramento River and the Recreation Area, impacts to visual resources are considered significant, although temporary.

The fish screen associated with the Mill Site pump station would effectively replace approximately 1,400 linear feet of the bluff on the west side of the Sacramento River, creating an industrial-looking facility in place of a natural feature. Given the size of the new structure and the sensitivity of the viewing location, this project element represents a substantial degradation in the visual quality of the site.

Construction of the bypass channel would be visible from the Sacramento River and from multiple locations within the Recreation Area. Construction of the bypass channel would take roughly 12 months to complete. During the construction period, viewers would experience substantially degraded views, including views of tree and other vegetation removal, channel trenching, temporary spoils piles, large construction equipment, concrete work, rock and gravel placement, and fence installation.

The bypass channel would represent a substantial change to the landscape as viewed from the Sacramento River and throughout the Recreation Area. The bypass channel represents a significant visual intrusion in the midst of a landscape that receives heavy recreational use. Because it crosses the Recreation Area, it effectively creates a visual barrier from one location to another. This visual barrier represents a substantial degradation of the existing visual character of the Recreation Area.

The largest impact to aesthetics would occur under the 2-month Gates-in and Gates-out alternatives. The ultimate effect of the reduced-gate and gates-out alternatives would be the negative aesthetic effect on scenic views, and substantially degraded visual character and

quality of the project vicinity as it relates to the Sacramento River in, and upstream from, the project area. This degradation would be particularly evident through the Lower River/Red Bluff Recreation Area, East Sand Slough, and the Middle River reaches. No mitigation is available to offset these impacts.

## Air Quality

Currently, Tehama County is not in attainment with the state standard for particulate matter less than 10 microns in diameter ($PM_{10}$) and ozone. During ground surface preparation for all of the alternatives, most of the $PM_{10}$ emissions would be composed of fugitive dust. Emission sources would include vehicles and construction equipment traveling over dirt surfaces, site clearing, grading, cut-and-fill operations, and wind-blown dust. Short-term impacts with regard to dust generated during construction would be considered potentially significant because of the current exceedances of the state $PM_{10}$ standards. Additionally, the impact on air quality would be temporary but significant for carbon monoxide and nitrogen oxide under all of the alternatives. Construction impacts are considered to be temporary, and when mitigation is applied, the impacts are considered to be less than significant.

## Traffic and Circulation

The roadways affected by the proposed project are maintained by the City of Red Bluff Public Works, Tehama County Public Works, and the California Department of Transportation.

Under the 4-month Improved Ladder and Bypass alternatives, Sale Lane would be significantly impacted by construction traffic. Additionally, under all of the alternatives, Altube Lane would be impacted by construction traffic. Many of the vehicles associated with construction would be heavy-duty trucks, including 20-yard earth-moving trucks, 10-yard concrete trucks, and commuter traffic. Sale Lane and Altube Lane are not designed to accommodate heavy truck traffic, and large construction vehicles could exceed the capacity and damage the surface of these roadways. Mitigation would reduce these impacts to a less than significant level.

## Noise

The project is located wholly within Tehama County. The County does not have set standards for construction noise. Installation of sheet piles associated with construction would result in a noticeable effect on nearby businesses and recreational areas, specifically on the area near the Discovery Center.

## Environmental Justice

Federal agencies are required to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities, as well as the equity of the distribution of the benefits and risks of their decisions.

No definable socioeconomic groups reside in the project area. Construction of the project facilities would offer temporary beneficial impacts to the City and County economies. Local

businesses will benefit from increased construction worker patronage, and local companies that become directly involved in portions of the construction effort would benefit from increased business activity.

The bypass channel would be constructed through an active park. The bypass would effectively cut off the Discovery Center and campground from the rest of the park, isolating them and reducing their value as recreational and educational amenities. Although this is not anticipated to have a disproportionate impact on any specific socioeconomic group, it would cause impacts to student groups that use the facility. Thus, impacts would be disproportionately borne by children.

# Other Impacts and Commitments

## Cumulative Impacts

Cumulative impacts are the impacts on the environment that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or entity undertakes such other actions. The proposed action in the DEIS/EIR may be interactively implemented with other concurrent projects. In addition, those other projects may affect the impacts of the proposed action. This cumulative impact analysis addresses impacts associated with the following related actions:

- Implementation of Central Valley Project Improvement Act (CVPIA)
- State Water Resources Control Board Water Rights Process and CALFED Bay-Delta Program
- Deregulation of Electric Industry in California
- Changes in Demand for Agricultural Products
- Changes to Fisheries Management
- Urbanization
- Changes in Demand for Recreational Opportunities
- Total Maximum Daily Load
- Trinity River Restoration Program (EIS/EIR)
- Sacramento County Municipal and Industrial Water Supply Contracts
- Sacramento River Conservation Area Program (Federal, State, and Local Agencies and Private Interest Groups)
- Stream Restoration and Other Salmonid Habitat Improvements in the Upper Sacramento River
- Integrated Storage Investigations Program, Specifically the North-of-the-Delta Offstream Storage Project

This DEIS/EIR tiers from the CALFED Programmatic EIS/EIR. Cumulate impacts of this project are consistent with impacts disclosed in that document.

## Environmental Commitments and Mitigations

Table ES-4 presents significant impacts and potential mitigation.

## References

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanake. 1995. Fish Species of Special Concern in California. Prepared for the State of California Department of Fish and Game, Final Report Contract No. 21281F. June.

California Regional Water Quality Control Board (RWQCB). 1990. Waste Discharge Requirements for Pactiv Company of California, Class III Landfill, Tehama, California. Order No. 91-064. September 12.

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| **Fishery Resources** | | | |
| ***Native Anadromous Salmonids, Other Native Anadromous Fish, Non-native Anadromous Fish, Resident Native and Non-native Fish*** | | | |
| 1A: 4-month Improved Ladder | Construction: Direct and indirect losses of adult and/or juvenile fish would occur during the installation of cofferdams.<br>Adult and juvenile fish may be stranded and lost during dewatering activities.<br>Direct losses and adverse indirect effects would occur from sediment disturbances and turbidity. | Construction: To avoid impacts to the majority of the focus species, sheet pile installation and in-stream heavy equipment activity should occur only during July and August.<br>Dewatered areas would be pumped down with a screened intake. Fish would be removed when water levels within the contained area are suitable for salvage. | Less than significant |
| 1B: 4-month Bypass | Construction: Identical to 4-month Improved Ladder Alternative. | Construction: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Construction: Identical to 4-month Improved Ladder Alternative. | Construction: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Construction: Identical to 4-month Improved Ladder Alternative. | Construction: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Construction: Identical to 4-month Improved Ladder Alternative. | Construction: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| **Water Resources** | | | |
| ***Surface-water Hydrology and Management – No negative impacts were identified.*** | | | |
| ***Surface Water Quality*** | | | |
| 1A: 4-month Improved Ladder | Erosion: Construction of the proposed facilities would require extensive grading and excavation. Impacts to surface waters could occur during grading and excavation necessary for construction of the proposed fish ladders, as well as the proposed pumping plant and associated conveyance facilities. | Erosion: To reduce the potential for sedimentation in the Sacramento River or Red Bank Creek to a less than significant level:<br>• Construction contractor shall obtain a General Construction Storm Water Permit, to comply with Clean Water Act Section 402(b) for construction of all facilities. As part of this permit, the contractor shall prepare a Stormwater Pollution Prevention Plan, which would include the following Best Management Practices:<br>– All ground-disturbing activities would be limited to the dry season (mid-May through mid-October) to the extent possible<br>– Vegetation would be left in place to the degree possible to reduce potential sedimentation<br>– All stockpiled material would be placed so that potential erosion is minimized<br>– Filter fabric, straw bales, and/or sediment basins would be used to reduce erosion and the potential for in-stream sedimentation | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | | – Seeding and re-vegetation would be initiated as soon as possible (timed properly to coincide with fall/winter precipitation) after construction completion | |
| 1A: 4-month Improved Ladder | Hazardous Materials: Construction efforts would include use of materials and equipment that require hazardous materials. Examples include diesel fuel and cleaning solvents. Although not intentional, it is possible that the use and handling of hazardous materials could result in spills that could impact nearby waterways. | Hazardous Materials: Implementation of construction Best Management Practices and development of a Spill Prevention Control and Countermeasures would minimize the risk of an uncontrolled spill and consequent contamination. The identification of staging areas for fueling and maintenance of heavy equipment would limit potential spills to designated areas where observation and cleanup could be readily accomplished.<br>Should an oil or fuel spill occur during construction or maintenance activities, all work would cease immediately, the Central Valley RWQCB, CDFG, and USBR would be notified immediately if the quantity of the spill were above state and/or federal reporting requirements; and cleanup procedures would begin immediately. | Less than significant |
| 1B: 4-month Bypass | Erosion and Hazardous Materials: Identical to 4-month Improved Ladder Alternative. | Erosion and Hazardous Materials: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Erosion and Hazardous Materials: Identical to 4-month Improved Ladder Alternative. | Erosion and Hazardous Materials: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Erosion and Hazardous Materials: Identical to 4-month Improved Ladder Alternative | Erosion and Hazardous Materials: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Erosion and Hazardous Materials: Identical to 4-month Improved Ladder Alternative. | Erosion and Hazardous Materials: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Groundwater Quality*** | | | |
| 1A: 4-month Improved Ladder | Contaminants: Soil contamination at the Pactiv site represents potential impacts to local groundwater resources if contaminated soil is allowed to come in contact with groundwater as a result of project construction activities. Additionally, leaching of soluble or mobile contaminants from soil to groundwater may occur over time if contaminated soil is stockpiled onsite for a long period of time or relocated to a disposal area onsite, through infiltration and other transport processes. | Contaminants: In the event that contaminated soil is encountered, the contractor shall follow and comply with all applicable federal, state, and local regulations. Soil should be removed immediately from the project area, and taken to an appropriate disposal area. If soil should be temporarily stockpiled in the project area, an impermeable liner should be used to prevent direct contact with non-contaminated areas.<br>The following mitigation measures would reduce the potential for contamination in groundwater in the proposed project area to a less than significant level:<br>• Construction contractor shall obtain a General Construction Storm Water Permit, to comply with Clean Water Act Section 402(b) for construction of all facilities. As part of this permit, the contractor shall prepare a Stormwater Pollution Prevention Plan, which would include the following Best Management Practices: | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | | – All ground-disturbing activities would be limited to the dry season (mid-May through mid-October) to the extent possible<br>– All stockpiled material would be placed so that potential erosion and contamination is minimized. Methods shall include, but not be limited to:<br>– Covering the stockpile with plastic sheeting or tarps<br>– Installing a berm around the stockpile to prevent runoff from leaving the area<br>– Planting temporary vegetation if stockpiled material would be kept onsite for a longer duration | |
| 1B: 4-month Bypass | Contaminants: Identical to 4-month Improved Ladder Alternative. | Contaminants: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Contaminants: Identical to 4-month Improved Ladder Alternative. | Contaminants: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Groundwater Quality: The reduced-gates alternative would result in a reduction in the amount of time Lake Red Bluff would be formed. This would ultimately change seasonal elevations of groundwater in the project area.<br>There is some potential that additional wells may exist in the vicinity of Lake Red Bluff that have not been identified during the development of this EIR. Wells that depend on the additional groundwater recharge and head provided by Lake Red Bluff could require alternate water supplies if the gates remain out during the dry season. However, because the gates are currently out most of the year, wells in the aquifer areas influenced by the filling of Lake Red Bluff are probably already designed to supply water regardless of gate position. | Groundwater Quality: If it is determined that wells in the project area are affected by the seasonal fluctuation of Lake Red Bluff, these wells could be relocated or extended to greater depths to meet continuous or seasonal water demands. | Less than significant |
| 2B: 2-month with Existing Ladders | Contaminants: Identical to 4-month Improved Ladder Alternative. | Contaminants: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Groundwater Quality: Identical to 2-month Improved Ladder Alternative. | Groundwater Quality: Mitigation identical to 2-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Contaminants: Identical to 4-month Improved Ladder Alternative. | Contaminants: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| 3: Gates-out | Groundwater Quality: Identical to 2-month Improved Ladder Alternative. | Groundwater Quality: Mitigation identical to 2-month Improved Ladder Alternative. | Less than significant |
| | **Biological Resources** | | |
| ***Wildlife Habitat*** | | | |
| 1A: 4-month Improved Ladder | Riparian Habitat: Up to 7.74 acres of riparian habitat would be impacted, including the permanent loss of 2.18 acres for the access bridge, the conveyance pipeline, left fish ladder, and the fish screen and forebay. An additional 5.56 acres of riparian habitat could be removed for construction activities for the forebay/conveyance and left fish ladder. | Riparian Habitat: To the extent possible, areas of riparian vegetation temporarily disturbed during construction would be planted with native riparian trees and shrubs following construction.<br>The permanent removal of riparian vegetation would be mitigated by creating riparian habitat at 3:1 ratio for the impacted acreage. TCCA and USBR would work with CDFG and USFWS to identify sites. | Less than significant |
| 1A: 4-month Improved Ladder | Freshwater Marsh Habitat: At least 0.05 acre of freshwater marsh habitat would be permanently lost with construction of the conveyance pipeline and access bridge. An additional 0.71 acre of freshwater marsh are within the 200-foot construction area and could be impacted, for a total of 0.76 acre. | Freshwater Marsh Habitat: To the extent possible, areas of freshwater marsh temporarily disturbed during construction would be planted with native riparian trees and shrubs following construction.<br>The permanent removal of freshwater marsh would be mitigated by creating freshwater marsh at a 3:1 ratio for the impacted acreage. TCCA and USBR would work with CDFG and USFWS to identify appropriate sites. | Less than significant |
| ***Special-status Species*** | | | |
| 1A: 4-month Improved Ladder | VELB: VELB are entirely dependent on the elderberry shrub. The six elderberry shrubs and/or groups of shrubs identified in the project area are within the 200-foot buffer area considered to be temporarily impacted in this analysis. Removal of the elderberry shrubs under this alternative has the potential to adversely affect the federal-listed VELB. | VELB: TCCA and USBR would attempt to avoid elderberry shrubs in locating staging areas, access roads, and other construction areas. Shrubs that can be avoided would be fenced and posted, and workers would be educated about VELB in accordance with the Conservation Guidelines. If elderberry shrubs cannot be avoided, they would be transplanted, and additional seedlings would be planted at a secure mitigation site in accordance with the Conservation Guidelines. | Less than significant |
| ***Other Special-status Species*** | | | |
| 1A: 4-month Improved Ladder | Osprey: The three osprey nest platforms on the south side of the Sacramento River would need to be removed during construction. | Osprey: Prior to the start of construction activities the two platforms supporting osprey nesting would be removed. TCCA and USBR would work with CDFG to identify nearby location(s) to erect two platforms to serve as replacement nesting sites. The relocated platforms would be installed concurrently with the removal of the existing platforms and be completed prior to the start of the nesting season. | Less than significant |
| | Bats: Three bat species were visually confirmed, and a fourth species was acoustically detected in the project vicinity. Numerous roost locations were documented in the two abandoned storage buildings at the Mill Site. Evidence was found that bats roost | Bats:<br>Exclusion and Building Removal: If the current project plans are modified and the buildings were to be demolished, impacts would be considered to be permanent and significant. Removal of the abandoned buildings would | |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | in some of the hydroelectric structures of RBDD in concrete weep holes and under metal overhangs. Several areas appeared to provide potential roosting and foraging habitat.<br><br>The two abandoned buildings used as bat roosts are within the 200-foot buffer area. There are no plans to remove these buildings. No significant impacts to bats would occur. If at the time of project construction a decision is made to permanently impact the roosting habitat by removing the buildings, bats would be significantly impacted, and appropriate mitigation for exclusion of bats from the habitat would be prescribed. For detailed mitigation measures refer to Appendix F.<br><br>To further ensure that there would be no significant impact, a 25-foot buffer area would be demarcated and flagged around the buildings. No construction activities would occur within this area. Construction materials would not be stored in the buildings occupied by bats, nor would workers enter the buildings. If these avoidance measures are not possible, TCCA would work with CDFG to coordinate an appropriate avoidance measure. | displace hundreds and possibly thousands of bats and be a significant loss of roosting habitat. The species currently identified are colonial, and displacement from the roosts may disrupt colony cohesion. Displaced bats may roost in exposed locations and be at increased risk of predation.<br><br>If the buildings are to be removed, prior mitigation in the form of exclusion would be performed. Exclusion consists of two phases: allowing emergence while temporarily blocking re-entry for 1 week, followed by permanently blocking the roost entrances. Surveys must be conducted to ensure that all bats have exited the roost before the entrances are permanently blocked to avoid direct mortality by entombment.<br><br>It is vital that exclusion only be performed in the winter (November through February) after any young of the year are mature. A qualified nuisance control professional should perform the exclusion. A qualified biologist should monitor the bats during the procedures to prevent any mortalities from bats becoming entangled in the netting, and to conduct surveys to ensure that bats are successfully excluded. With these mitigation measures, impacts to bats would be less than significant.<br><br>Provision of Alternate Roosting Habitat: To mitigate for the loss of roosting habitat, provision of alternate roosting habitat in the form of offsite installation of large bat houses is recommended. Large bat houses (bat condos) may be erected.<br><br>Bat condos are similar to raised wooden chicken coops with internal partitions to form roost crevices. The overall size should be 8 x 8 x 8 feet, and the width of the internal partitions should be approximately 0.75 to 1.0 inch for the free-tail bats and also 1.0 to 1.5 inches for the pallid bats. Bat condos should be oriented properly (usually southern or southeastern exposure), and the temperature regime and humidity inside the condo should replicate that found in the original roosts.<br><br>It is recommended that the existing exterior wall of the abandoned storage building located at the Mill Site with the plywood-backed louvers be reconstructed in a suitable offsite location to provide for myotis bat roosting habitat. Alternately, bat houses mounted on poles may be erected that simulate the existing roost (the gap under the loose board attached to a pole). Managers at the Recreation Area are currently experimenting with bat house style and placement and may provide a cooperative bat management opportunity. With these mitigation measures, impacts to bats would be less than significant. | |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| ***Wildlife Habitat*** | | | |
| 1B: 4-month Bypass | Riparian Habitat: Approximately 8.9 acres of riparian habitat would be permanently or temporarily removed. This includes the permanent loss of 2.6 acres of riparian habitat with land conversion resulting from installation of the bypass, access bride, conveyance pipeline, and the fish screen and forebay. Up to an additional 6.3 acres of riparian habitat could be removed to accommodate construction activities required for the bypass work area and the forebay/conveyance and right fish ladder work areas. These impacts would constitute a temporary impact. Following completion of construction, temporarily impacted areas of riparian habitat would be planted with native riparian tress and shrubs to restore the habitat. | Riparian Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 1B: 4-month Bypass | Freshwater Marsh Habitat: Identical to 4-month Improved Ladder Alternative. | Freshwater Marsh Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 1B: 4-month Bypass | Restored Habitat: Under this alternative, 9.76 acres of restored habitat would be impacted. Because the restored habitat was created as mitigation for removal of riparian habitat and/or oak woodland elsewhere, its removal would result in inadequate mitigation for the previous impact. Therefore, removal of restored habitat under this alternative is a significant impact. | Restored Habitat: To the extent possible, restored habitat disturbed during construction would be planted with similar trees and shrubs to restore the impacted habitat following construction.<br>The permanent removal of restored habitat would be mitigated by creating restored habitat at a 3:1 ratio for the impacted acreage. TCCA and USBR would work with CDFG and USFWS to identify appropriate locations for restored habitat. With this mitigation, the impacts to restored habitat would be less than significant. | Less than significant |
| ***Special-status Species*** | | | |
| 1B: 4-month Bypass | VELB: Identical to 4-month Improved Ladder Alternative. | VELB: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Other Special-status Species*** | | | |
| 1B: 4-month Bypass | Osprey and Bats: Identical to 4-month Improved Ladder Alternative. | Osprey and Bats: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| ***Wildlife Habitat*** | | | |
| 2A: 2-month Improved Ladder | Riparian Habitat: Up to 7.74 acres of riparian habitat would be impacted, including the permanent loss of 2.18 acres for the access bridge, the conveyance pipeline, left fish ladder, and the fish screen and forebay. An additional 5.56 acres of riparian habitat could be removed for construction activities for the forebay/conveyance and left fish ladder. | Riparian Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Freshwater Marsh Habitat: Identical to 4-month Improved Ladder Alternative. | Freshwater Marsh Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Special-status Species*** | | | |
| 2A: 2-month Improved Ladder | VELB: Identical to 4-month Improved Ladder Alternative. | VELB: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Other Special-status Species*** | | | |
| 2A: 2-month Improved Ladder | Osprey and Bats: Identical to 4-month Improved Ladder Alternative. | Osprey and Bats: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Wildlife Habitat*** | | | |
| 2B: 2-month with Existing Ladders | Riparian Habitat: Up to 6.81 acres of riparian habitat would be impacted, including the permanent loss of 2.05 acres of riparian habitat for installation of the access bridge, the conveyance pipeline, and the fish screen and forebay, all on the south side of the river. Up to an additional 4.76 acres of riparian habitat could be temporarily removed to accommodate construction activities. | Riparian Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Freshwater Marsh Habitat: Identical to 4-month Improved Ladder Alternative. | Freshwater Marsh Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Special-status Species*** | | | |
| 2B: 2-month with Existing Ladders | VELB: Identical to 4-month Improved Ladder Alternative | VELB: Mitigation identical to 4-month Improved Ladder Alternative. | |
| ***Other Special-status Species*** | | | |
| 2B: 2-month with Existing Ladders | Osprey and Bats: Identical to 4-month Improved Ladder Alternative. | Osprey and Bats: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Wildlife Habitat*** | | | |
| 3: Gates-out | Riparian Habitat: Identical to 2-month with Existing Ladders Alternative. | Riparian Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| 3: Gates-out | Freshwater Marsh Habitat: Identical to 4-month Improved Ladder Alternative. | Freshwater Marsh Habitat: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Special-status Species*** | | | |
| 3: Gates-out | VELB: Identical to 2-month with Existing Ladders Alternative. | VELB: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| ***Other Special-status Species*** | | | |
| 3: Gates-out | Osprey and Bats: Identical to 4-month Improved Ladder Alternative. | Osprey and Bats: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| | | **Recreation** | |
| 1B: 4-month Bypass | New Pump Station, Right Bank Fish Ladder, Conveyance Facility, and Bypass Channel: Temporary construction-related impacts associated with the 4-month Bypass Alternative include all impacts identified for the 4-month Improved Ladder Alternative and those noted below.<br>Temporary impacts from construction of the bypass channel include:<br>• Extensive excavation and earthmoving equipment within the Recreation Area.<br>• Limited access to the Discovery Center/Charter School.<br>• Limited access to the USFS/Sycamore Grove Campground.<br>• The relocation of Sale Lane and the USFS/Sycamore Grove Campground Road.<br>• Removal of approximately 10 camping spaces at the Sycamore Grove Campground.<br>• Construction-related traffic increase on Sale Lane.<br>• Construction of an access bridge over the bypass channel.<br>• Construction of security fencing around the bypass channel. | New Pump Station, Right Bank Fish Ladder, Conveyance Facility, and Bypass Channel: Mitigation options to address the temporary construction-related impacts include:<br>• Use the latest construction techniques to minimize impacts (i.e., noise blankets for pile-driving operations).<br>• Conduct an ongoing public information campaign targeted at area recreation users. This campaign would provide information on construction activities/impacts as well as information on temporary alternate recreation sites.<br>• Maintain temporary access for vehicles, pedestrians, and cyclists to all Recreation Area facilities throughout construction.<br>• Maintain the existing access to the Discovery Center with the construction of a bridge.<br>• Create a new alignment of Sale Lane to access the boat ramp south of RBDD.<br>• Design security fencing in conjunction with USFS to be minimally intrusive in size, location, color, and materials. Alternative security measures would be investigated, such as use of rock walls or other natural materials to address safety issues around the bypass channel.<br>• Develop 10 new campsites at an alternate location to offset those lost during construction. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| 1B: 4-month Bypass | Mill Site Pumping Station and Bypass Channel: The Recreation Area would be directly impacted by the alignment of the bypass channel bisecting a portion of the property. The construction and operations of the bypass channel would result in the following:<br>• Loss of restored riparian woodlands for recreation and educational/interpretative uses in the Recreation Area.<br>• Creation of a physical barrier between the Sacramento River Discovery Center/Charter School, Sycamore Grove Campground, and the remainder of the Recreation Area.<br>• Loss of 10 camping spaces at Sycamore Grove Campground.<br>• Construction of security fencing around the bypass channel impacting the experience of visitors to the Recreation Area.<br>• Limiting pedestrian and cycling access between the portions of the Recreation Area separated by the bypass channel to two crossings–one adjacent to a new bridge on Sale Lane crossing the channel and the second a footbridge east of the current Sycamore Grove campsites.<br>The associated loss of riparian woodlands for educational/interpretive uses is in conflict with the Lake Red Bluff FEIS. The Lake Red Bluff FEIS stresses the importance of recreational uses in concert with the restoration of riparian habitat and public education of the area's natural environment. | Mill Site Pumping Station and Bypass Channel: Mitigation options to address the permanent operations-related impacts include:<br>• Provide permanent access for vehicles, pedestrians, and cyclists to all Recreation Area facilities with an access bridge and pedestrian/cyclist bridge.<br>• Incorporate extensive natural landscaping into the final construction of the bypass channel to blend the new construction with the surrounding riparian area.<br>• Maintain the existing access to the Discovery Center with the construction of a bridge.<br>• Create a new alignment of Sale Lane to access the boat ramp south of RBDD.<br>• Design security fencing in conjunction with USFS to be minimally intrusive in size, location, color, and materials. Alternative security measures would be investigated, such as use of rock walls or other natural materials to address safety issues around the bypass channel.<br>• Develop 10 new campsites at an alternate location to offset those lost during construction.<br>• Use the bypass channel as an educational/interpretive element of the Recreation Area. This may include the development of fish-viewing locations along the bypass channel. | Significant |
| 2A: 2-month Improved Ladder | Adjusted Gates-in Period: Recreational activities that would experience limitations associated with the loss of Lake Red Bluff for 2 additional months include:<br>• Motor boating<br>• Jet skiing | Adjusted Gates-in Period: Mitigation options to address the permanent operations-related impacts include:<br>• Facilitate the development and implementation of a plan with the City of Red Bluff, Tehama County, local business organizations, appropriate permitting agencies, and local citizens groups to phase in the gate operations changes over a period of 5 years to: | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | • Swimming<br>• Water skiing<br>• Boat racing<br>While recreational motor boating and jet skiing are possible on the Sacramento River during the gates-out period, the available water area is considerably reduced for the 2 additional gates-out months. Therefore, less time is available for these activities. Swimming is possible, but unlikely in the cold Sacramento River water. Boat racing and water skiing are not feasible during the additional 2-month gates-out period. The activities are lake- dependent activities and would assume the greatest impact.<br>The Nitro National drag boat races could not be held over the Memorial Day holiday weekend. | – Allow the community to transition lake-dependent recreation activities to other opportunities.<br>– Identify specific activities and events through the facilitated planning process with local stakeholders.<br>• Facilitate the development of non-lake dependent recreational activities as part of the planning process mentioned above. This may include, but is not limited to:<br>– Cooperating on the implementation of recreational trail plans.<br>– Cooperating on the rehabilitation and expansion of existing area recreational parkland or facilities.<br>– Facilitating identification and acquisition of future recreational parkland.<br>• Facilitate the creation of other recreation-oriented events as part of the planning process mentioned above. This may include, but is not limited to:<br>– Facilitating the rescheduling of the Nitro National Drag Boat Festival.<br>– Facilitating the development of a land- or river-based festival event (river sports, and fishing) of similar size/impact as the Nitro National Drag Boat Festival. | |
| 2B: 2-month with Existing Ladders | Adjusted Gates-in Period: Identical to 2-month Improved Ladder Alternative. | Adjusted Gates-in Period: Mitigation identical to 2-month Improved Ladder Alternative. | Significant |
| 3: Gates-out | Gates-out Year-round: Recreational activities would experience limitations or elimination as a result of the loss of Lake Red Bluff, including:<br>**Limited:**<br>• Swimming<br>• Jet skiing<br>• Motor boating<br>**Eliminated:**<br>• Water skiing<br>• Boat racing<br>The Nitro National drag boat races, traditionally held on Lake Red Bluff over the Memorial Day holiday weekend, would not be viable at its current location. | Gates-out Year-round: Mitigation identical to 2-month Improved Ladder Alternative (Adjusted Gates-in Period). | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | The drag boat race would either move to another location or be replaced with another race in another location. Many stakeholders have expressed the importance of this high-profile event as a critical recreational opportunity in Red Bluff.<br><br>The activities listed are characterized as lake-dependent activities and would assume the greatest impact as a result of this alternative. | | |
| | | **Land Use** | |
| 1B: 4-month Bypass | Sycamore Grove Campground: Temporary and permanent construction-related impacts would also occur to the use of the Sycamore Grove Campground facilities located in the Recreation Area. Construction vehicles would need access to the campground area to construct the lower end of the channel. Approximately 10 camping facilities would be permanently removed as a result of construction of the bypass channel. A new road would need to be constructed to maintain access to the remaining camping facilities. | Sycamore Grove Campground: No mitigation is available. | Significant |
| 1B: 4-month Bypass | Discovery Center: Temporary impacts would occur as a result of construction to the use of the Discovery Center. Schools from the area make daily trips to the center during the spring months. If construction of the bypass channel were to occur during the springtime, access to the valley oak, western red bud, California native sycamore, and Fremont cottonwood plantings would be blocked. This would conflict with the riparian and oak lessons and hikes that occur with the daily trips. | Discovery Center: No mitigation is available. | Significant |
| 1B: 4-month Bypass | Recreation Area: Construction of the bypass channel does not comply with the current management direction in the Mendocino National Forest Land and Resource Management Plan. | Recreation Area: Amendment of Mendocino National Forest Land and Resource Management Plan under this alternative would reconcile management direction with the new situation, but would not avoid the impacts. | Significant |
| 2A: 2-month Improved Ladder | Boat Docks and Ramps: Permanent impacts would occur to the use of public and private boat docks and ramps located on Sacramento River. Public and private boat docks and ramps currently existing along the shoreline of the river would not properly function when the gates are in the up position; | Boat Docks and Ramps: No mitigation is available. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | therefore, they would be unusable for 2 additional months. | | |
| 2B: 2-month with Existing Ladders | Boat Docks and Ramps: Identical to 2-month Improved Ladder Alternative. | Boat Docks and Ramps: No mitigation is available. | Significant |
| 3: Gates-out | Boat Docks and Ramps: Permanent impacts would occur to the use of public and private boat docks and ramps located on Sacramento River. Public and private boat docks and ramps currently existing along the shoreline of the river would not properly function when the gates are in the up position. These boat docks and ramps would no longer access the lower elevations of the river in its natural, free-flowing state. | Boat Docks and Ramps: No mitigation is available. | Significant |
| | | **Geology** | |
| 1A: 4-month Improved Ladder | Excavation: Approximately 800,000 CY of material would need to be excavated. Approximately 600,000 CY of this material would be stored onsite. | Excavation: To minimize soil erosion, movement of sediments, loss of topsoil, and associated water quality impacts, an approved drainage, grading, and erosion control plan would be completed prior to construction. This plan would meet all local requirements and incorporate construction site Best Management Practices to stabilize areas cleared of vegetation and soil stockpiles. Best Management Practices may include preservation of existing vegetation, silt fences, and/or straw bales. Covering soil stockpiles with mulch or matting as well as continuous maintenance of erosion control measures would be necessary. Timely re-vegetation of disturbed sites would minimize post-construction erosion impacts. | Less than significant |
| 1B: 4-month Bypass | Excavation: Identical to 4-month Improved Ladder Alternative. | Excavation: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Excavation: Identical to 4-month Improved Ladder Alternative. | Excavation: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Excavation: Approximately 750,000 CY of material would need to be excavated to complete construction of this alternative. The primary excavation for this alternative is required to construct the Mil Site pump station and conveyance facilities. Approximately 580,000 CY of this material would remain onsite. | Excavation: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Excavation: Identical to 4-month Improved Ladder Alternative. | Excavation: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| **Agricultural Resources – *No negative impacts were identified.*** | | | |
| **Power Resources – *No significant impacts were identified.*** | | | |
| **Socioeconomic** | | | |
| 3: Gates-out | Fish Runs/Spending/Property Value/Quality of Life and Community Cohesion: Although there have been gradual reductions in the amount of time the lake has been available each year, the total loss of Lake Red Bluff would have much more dramatic effects on the local economy than those in recent history. The sum total of the various impacts of this alternative would result in a significant economic impact to the local community.<br><br>The potential for positive economic impact is uncertain and should be viewed as speculative at this stage of analysis.<br><br>The combined impact from reduced recreation and tourism spending and from the loss of the Nitro National drag boat races is estimated to be about $4.2 million per year. This is small relative to total annual sales in Tehama County of $1.7 billion, but it would be a more substantial impact to the City of Red Bluff. One measure of this impact is the resulting loss of sales and use tax revenue of $89,000, which is about 1.9 percent of the City's total revenues from sales and use taxes.<br><br>It is likely that the value of properties adjacent to the lake or with easy access to the lake would decline from the loss of the lake. While it is uncertain how large this impact would be, it is expected that, in general, the impact would be in the low end of national estimates of the value of lake views and proximity of 4 to 18 percent.<br><br>This alternative would also result in a noticeable impact to local residents in a number of social aspects such a reduction in the quality of life and reduced community cohesion. Even though these impacts are hard to quantify, they are nonetheless real impacts to the local community. | Fish Runs/Spending/Property Value/Quality of Life and Community Cohesion: No mitigation is available. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | | **Cultural Resources** | |
| 1A: 4-month Improved Ladder | Unidentified Cultural Resources: Construction activities include excavation and other grading and digging activities. It is possible that currently unidentified cultural resources could be discovered during these activities, and destruction of such resources could result in a significant impact. | Unidentified Cultural Resources: If during construction activities unusual amounts of non-native stone, bone, shell, or prehistoric or historic period artifacts are discovered, or if areas that contain dark-colored sediment that do not appear to have been created through natural processes are discovered, then work would cease in the immediate area of discovery, and a professionally qualified archeologist would be contacted immediately for an onsite inspection of the discovery. If any bone is uncovered that appears to be human, the Tehama County Coroner would be contacted. If the coroner determines the bone most likely represents a Native American interment, the coroner would contact the Native American Heritage Commission in Sacramento for identification of the most likely descendants. | Less than significant |
| 1B: 4-month Bypass | Unidentified Cultural Resources: Identical to 4-month Improved Ladder Alternative. | Unidentified Cultural Resources: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Unidentified Cultural Resources: Identical to 4-month Improved Ladder Alternative. | Unidentified Cultural Resources: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Unidentified Cultural Resources: Identical to 4-month Improved Ladder Alternative. | Unidentified Cultural Resources: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Unidentified Cultural Resources: Identical to 4-month Improved Ladder Alternative. | Unidentified Cultural Resources: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| | | **Aesthetics** | |
| 1A: 4-month Improved Ladder | Construction Views of Mill Site: Construction of all facilities would take roughly 3 years to complete. During the construction period, viewers would experience substantially degraded sites, although some construction activity may be screened from sight by cofferdams. | Construction Views of Mill Site: No mitigation is available. | Significant |
| 1A: 4-month Improved Ladder | Permanent Landscape Changes from Operations: Represents a substantial change to the landscape as viewed from the Sacramento River and the Recreation Area.<br>Given the size of the new structure and the sensitivity of the viewing location, operation of these facilities represents a substantial degradation of the visual quality of the site. | Permanent Landscape Changes from Operations: To help mitigate visual impacts, a committee would be formed following selection of a Preferred Alternative to develop measures intended to help the new facility blend with the surrounding environment. Potential measures include selection of a concrete color and a finish for the fish screen panels (if available). The committee to evaluate visual resources mitigation measures would be based on the existing Stakeholder Working Group. | Significant |
| 1B: 4-month Bypass | Construction Views of Mill Site: Identical to 4-month Improved Ladder Alternative. | Construction Views of Mill Site: No mitigation is available. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| 1B: 4-month Bypass | Construction View of Bypass Channel: Construction of the bypass channel would take roughly 12 months to complete. During the construction period, viewers would experience substantially degraded views, including views of tree and other vegetation removal, channel trenching, temporary spoils piles, large construction equipment, concrete work, rock and gravel placement, and fence installation.<br>Because of the sensitivity of the construction area and the number of recreational viewers in the immediate vicinity of construction, construction of the bypass pipeline would substantially degrade the visual character and quality of the site and its surroundings. | Construction Views of Bypass Channel: No mitigation is available. | Significant |
| 1B: 4-month Bypass | Permanent Landscape Changes from Operations: Identical to 4-month Improved Ladder Alternative. | Permanent Landscape Changes from Operations: Mitigation identical to 4-month Improved Ladder Alternative. | Significant |
| 1B: 4-month Bypass | Permanent Landscape Changes from Bypass Channel: The bypass channel would represent a substantial change to the landscape as viewed from the Sacramento River and throughout the Recreation Area.<br>Regardless of the location from which the bypass channel is viewed, it represents a significant visual intrusion in the midst of a landscape that receives heavy recreational use. Because it crosses the Recreation Area, it effectively creates a visual barrier from one location of the Recreation Area to another. This visual barrier represents a substantial degradation of the existing visual character of the Recreation Area. | Permanent Landscape Changes from Bypass Channel: To help mitigate visual impacts, a committee would be formed following selection of a Preferred Alternative to develop measures intended to help the bypass channel blend with the surrounding environment. Potential measures include selection of fencing material and landscaping around the channel. The committee to evaluate visual resources mitigation measures would be based on the existing Stakeholder Working Group. | Significant |
| 2A: 2-month Improved Ladder | Construction Views of Mill Site: Identical to 4-month Improved Ladder Alternative. | Construction Views of Mill Site: No mitigation is available. | Significant |
| 2A: 2-month Improved Ladder | Permanent Landscape Changes from Operations: Identical to 4-month Improved Ladder Alternative. | Permanent Landscape Changes from Operations: Mitigation identical to 4-month Improved Ladder Alternative. | Significant |
| 2A: 2-month Improved Ladder | Permanent Landscape Changes from Reduction of Gates-in Period: Under the 2-month Improved Ladder Alternative, the RBDD gates would remain in the up position for an additional 2 months, reducing the gates-in period from 4 months each year to 2 months each year. | Permanent Landscape Changes from Reduction of Gates-in Period: No mitigation is available. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | Because the quality of some of the views within the Middle River reach are considered moderate under the gates-out condition and moderately high under the gates-in condition, an increase in the gates-out condition may be considered to be a substantial degradation of the visual quality of the Middle River reach. | | |
| 2B: 2-month with Existing Ladders | Construction Views of Mill Site: Identical to 4-month Improved Ladder Alternative. | Construction Views of Mill Site: No mitigation is available. | Significant |
| 2B: 2-month with Existing Ladders | Permanent Landscape Changes from Operations: Identical to 4-month Improved Ladder Alternative. | Permanent Landscape Changes from Operations: Mitigation is identical to 4-month Improved Ladder Alternative. | Significant |
| 2B: 2-month with Existing Ladders | Permanent Landscape Changes from Reduction in Gates-in Time Period: Visual quality impacts are identical to 2-month Improved Ladder. | Permanent Landscape Changes from Reduction in Gates-in Time Period: No mitigation is available. | Significant |
| 3: Gates-out | Construction Views of Mill Site: Identical to 4-month Improved Ladder Alternative. | Construction Views of Mill Site: No mitigation is available. | Significant |
| 3: Gates-out | Permanent Landscape Changes from Operations: Identical to 4-month Improved Ladder Alternative. | Permanent Landscape Changes from Operations: Mitigation is identical to 4-month Improved Ladder Alternative. | Significant |
| 3: Gates-out | Permanent Landscape Changes from Elimination of Gates-in Period: The impacts to visual resources resulting from the Gates-out Alternative would be the same as those described for the 2-month Improved Ladder Alternative.<br><br>Because the change from the gates-in to gates-out appearance would be permanent, the ultimate effect of the Gates-out Alternative would be to have negative aesthetic effects on scenic views and to substantially degrade the existing visual character and quality of the project vicinity.<br><br>This degradation would be particularly evident through the Lower River/Red Bluff Recreation Area, East Sand Slough, and the Middle River reach. Therefore, the impact of eliminating the annual gates-in period would be considered significant. | Permanent Landscape Changes from Elimination of Gates-in Period: To help mitigate visual impacts, a committee would be formed following selection of a Preferred Alternative to develop measures intended to help improve the appearance of those areas through the Sacramento River reaches that are particularly impacted by the loss of Lake Red Bluff. Potential measures include natural vegetation or landscaping through the east bank of the river adjacent to the Recreation Area and the East Sand Slough, and the creation of shallow lagoons or ponds adjacent to the Recreation Area and the City Park. The committee to evaluate visual resources mitigation measures would be based on the existing Stakeholder Working Group. | Significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| **Air Quality** | | | |
| 1A: 4-month Improved Ladder | Fugitive Dust Emissions: During ground surface preparation, most of the $PM_{10}$ emissions would be composed of fugitive dust. Short-term impacts with regard to dust generated during construction would be considered potentially significant because of the current exceedance of the state $PM_{10}$ standards. | Fugitive Dust Emissions: A dust control program would be implemented with the following components:<br>• Equipment and manual watering would be conducted on all stockpiles, dirt/gravel roads, and exposed or disturbed soil surfaces, as necessary, to reduce airborne dust.<br>• The contractor or builder would designate a person to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. This person would respond to citizen complaints.<br>• Dust-producing activities would be suspended when high winds create construction-induced visible dust plumes moving beyond the site in spite of dust control.<br>• All trucks hauling soil and other loose material would be covered, or would be required to have at least 2 feet of freeboard.<br>• All unpaved access roads and staging areas at construction sites would have soil stabilizers applied as necessary.<br>• Streets in and adjacent to construction area would be kept swept and free of visible soil and debris.<br>• Traffic speeds on all unpaved roads would be limited to 15 miles per hour. | Less than significant |
| 1A: 4-month Improved Ladder | Construction Exhaust Emissions: Total daily emission levels of 777.82 lb/day of CO and 238.84 lb/day $No_x$ would exceed their respective significance thresholds of 550 lb/day and 219 lb/day set in the National Ambient Air Quality Standards. | Construction Exhaust Emissions: An equipment control program would be implemented with the following components:<br>• Properly maintain equipment.<br>• Limit idling time when equipment is not in operation. | Less than significant |
| 1B: 4-month Bypass | Fugitive Dust Emissions: Identical to 4-month Improved Ladder Alternative. | Fugitive Dust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 1B: 4-month Bypass | Construction Exhaust Emissions: Total daily emission levels of 1,147.57 lb/day of CO and 352.45 lb/day $No_x$ would exceed their respective significance thresholds of 550 lb/day and 219 lb/day set in the National Ambient Air Quality Standards. | Construction Exhaust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2A: 2-month Improved Ladder | Fugitive Dust Emissions: Identical to 4-month Improved Ladder Alternative. | Fugitive Dust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| 2A: 2-month Improved Ladder | Construction Exhaust Emissions: Total daily emission levels of 963.73 lb/day of CO and 295.96 lb/day $No_x$ would exceed their respective. significance thresholds of 550 lb/day and 219 lb/day set in the National Ambient Air Quality Standards. | Construction Exhaust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Fugitive Dust Emissions: Identical to 4-month Improved Ladder Alternative. | Fugitive Dust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Construction Exhaust Emissions: Total daily emission levels of 876.11 lb/day of CO and 269.04 lb/day $No_x$ would exceed their respective significance thresholds of 550 lb/day, and 219 lb/day set in the National Ambient Air Quality Standards. | Construction Exhaust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Fugitive Dust Emissions: Identical to 4-month Improved Ladder Alternative. | Fugitive Dust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Construction Exhaust Emissions: Total daily emission levels of 1,491.09 lb/day of CO and 457.99 lb/day $No_x$ would exceed their respective significance thresholds of 550 lb/day and 219 lb/day set in the National Ambient Air Quality Standards. | Construction Exhaust Emissions: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| | **Traffic and Circulation** | | |
| 1A: 4-month Improved Ladder | Left and Right Banks: Large construction vehicles could exceed the capacity of Sale Lane and Altube Avenue. Neither roadway is designed to accommodate heavy truck traffic, and daily commuting by heavy trucks could impact the road surface. | Left and Right Banks: To reduce construction-related impacts on traffic and roadways, the construction contractor would be required to develop a traffic control plan with the Tehama County Public Works, City of Red Bluff Public Works, and California Department of Transportation, which would be subject to review by California Department of Transportation and the Public Works Director. This plan would ensure that construction traffic is routed in a way that maintains acceptable levels of service on all affected roadways and intersections that are currently measured and used by project-related vehicles.<br>The traffic control plan would address the structural capacity of roads and bridges along routes that could be traveled by construction-related vehicles. The traffic control plan would ensure that the structural integrity of those roads and bridges would not be damaged by construction-related vehicle trips. | Less than significant |
| 1B: 4-month Bypass | Bypass and Right Bank: Construction-related traffic impacts from construction of the proposed bypass channel are anticipated to be significant on Antelope Boulevard between Sale Lane and Belle Mill Road, | Bypass and Right Bank: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |

**TABLE ES-4**
Summary of Significant Adverse Environmental Impacts and Proposed Mitigation

| DEIS/EIR Action Alternative | Description of Significant Impact | Mitigation | Level of Significance after Mitigation |
|---|---|---|---|
| | although the roadway currently has a measured level of service D in the affected area. In addition, large construction vehicles could exceed the capacity of Sale Lane and Altube Avenue. Neither roadway is designed to accommodate heavy truck traffic, and daily commuting by heavy trucks could impact the road surface. | | |
| 2A: 2-month Improved Ladder | Left and Right Banks: Large construction vehicles could exceed the capacity of Sale Lane and Altube Avenue. Neither roadway is designed to accommodate heavy truck traffic, and daily commuting by heavy trucks could impact the road surface. | Left and Right Banks: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 2B: 2-month with Existing Ladders | Right Bank: Large construction vehicles could exceed the capacity of Altube Avenue. This roadway is not designed to accommodate heavy truck traffic, and daily commuting by heavy trucks could impact the road surface. | Right Bank: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| 3: Gates-out | Right Bank: Large construction vehicles could exceed the capacity of Altube Avenue. This roadway is not designed to accommodate heavy truck traffic, and daily commuting by heavy trucks could impact the road surface. | Right Bank: Mitigation identical to 4-month Improved Ladder Alternative. | Less than significant |
| **Noise — *No significant impacts were identified*** | | | |
| **Environmental Justice — *No significant impacts were identified.*** | | | |

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# 1.0 Introduction and Purpose and Need

## 1.1 Introduction

The Tehama-Colusa Canal Authority (TCCA) Fish Passage Improvement Project at the Red Bluff Diversion Dam (RBDD) Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) addresses the environmental issues, alternatives, and impacts associated with improvement of anadromous fish passage, both upstream and downstream, at RBDD.

This DEIS/EIR was prepared by TCCA and the U.S Bureau of Reclamation (USBR) (see Section 5.1 for agency involvement and a list of the agency approvals required for the project to succeed). This DEIS/EIR meets the legal requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). This document discloses relevant information to all interested parties and invites such parties to play a role in both the decision-making process and the implementation of that decision. This DEIS/EIR also provides federal, state, and local decision makers with detailed information concerning the significant environmental, cultural, and other impacts associated with the alternative courses of action.

Prior to the completion of RBDD, anadromous fish had unimpeded passage through the current dam site. Construction of the dam created a barrier in the Sacramento River, impeding and delaying passage to spawning and rearing habitat above the dam. Constructed in the mid-1960s, the dominant feature of RBDD is its gates. When the gates are lowered into the Sacramento River, the elevation of the water surface behind the dam rises, allowing gravity diversion into the Tehama-Colusa (TC) and Corning canals for delivery to irrigation districts. Raising the gates allows the river to flow virtually unimpeded but precludes gravity diversion into the canals. When the gates are lowered, RBDD presents a barrier for both upstream- and downstream-migrating fish because fish ladders, included in the original dam design, have proven to be inefficient at certain flows to pass anadromous fish to upstream spawning grounds. Additionally, the tailrace and lake created by the dam provide habitat for species that prey on juvenile salmon, reducing their overall survival rates.

***Prior to the completion of RBDD, anadromous fish had unimpeded passage through the current dam site.***

A Biological Opinion for endangered winter-run chinook salmon, issued in 1993 by the National Marine Fisheries Service (NMFS), requires that the gates be kept in the raised (non-diverting) position (gates-out) for a greater portion of the year (September 15 to May 14) than had been required previously. This has significantly improved fish passage at RBDD, but has made the facility less effective as a water source for agriculture. The current schedule for gates in the lowered (diverting) position (gates-in) may be subject to further reduction, if it is found to be a reasonable and prudent action, to avoid jeopardy to species recently listed as endangered under the Federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA). Species of concern include winter-, spring-, and fall-/late-fall-run salmon; steelhead; sturgeon; and splittail. However, further reduction of the gates-in period would further reduce RBDD's ability to divert water for agriculture.

## 1.2 Purpose and Need for the Action

NEPA regulations require that each environmental impact statement (EIS) briefly specify the purpose and need to which the agency is responding in proposing the various alternatives, including the Preferred Alternative. Similarly, CEQA requires that each environmental impact report (EIR) include a statement of the objectives sought by the proposed project. The objectives are intended to help the implementing agency develop a reasonable range of alternatives and aid decision makers in preparing findings or statements of overriding consideration, if necessary. For the purposes of this document, the NEPA-mandated purpose and need statement and the CEQA-mandated project objective are synonymous.

### 1.2.1 Purpose and Need Statement

The purpose of the project is twofold:

- Substantially improve the long-term ability to reliably pass anadromous fish and other species of concern, both upstream and downstream, past RBDD.
- Substantially improve the long-term ability to reliably and cost-effectively move sufficient water into the TC Canal and Corning Canal systems to meet the needs of the water districts served by TCCA.

The need for this project is in response to the continued well-documented fish passage and agricultural water diversion reliability problems associated with the operation of RBDD.

### 1.2.2 Similarities and Differences between NEPA and CEQA

*By preparing a single document that complies with both NEPA and CEQA statutes, the involved agencies have been able to avoid unnecessary duplication of effort.*

This document is designed to comply with both NEPA and CEQA. Both NEPA and CEQA are laws that require governmental agencies to evaluate the environmental impacts of their proposed decisions before making formal commitments to carry them out, and that such evaluation be done in detail, and with public involvement. NEPA is a federal law and applies to federal agencies, whereas CEQA is a California law and applies to state and local agencies. For this project, NEPA requires preparation of an EIS, and CEQA requires preparation of an EIR. By preparing a single document that complies with both statutes, the involved agencies have been able to avoid unnecessary duplication of effort.

Despite the similarities between the two laws, important differences remain. NEPA is a procedural law requiring agencies to evaluate a range of reasonable alternatives, disclose potential impacts, and identify feasible mitigation. Reasonable alternatives must be rigorously and objectively evaluated under NEPA (as opposed to CEQA's requirement that they be discussed in "meaningful detail"). Under NEPA, the evaluation of potential impacts must include socioeconomic impacts, whereas under CEQA, such analysis is not required. Although mitigation is identified in NEPA documents, it is not required to be implemented. In contrast, CEQA requires agencies to implement feasible mitigation measures or feasible alternatives as a means of reducing the severity of significant environmental effects identified in EIRs.

The CEQA requirement to determine a "significance threshold" for expected impacts presents an important or critical feature of the document. Impacts to be covered include those to endangered, threatened, and rare species and their habitat (*CEQA Guidelines*, Section 15065, subd. [a]). Thus, when an EIR shows that a project has the potential to harm a species officially listed under either ESA or CESA, the "lead agency" (TCCA for this project) has a mandatory legal obligation to treat that impact as significant and to mitigate if feasible. Thresholds of significance for other issue areas/resources are developed using applicable regulations where they exist, or best professional judgment.

CEQA requires that this DEIS/EIR propose mitigation measures for each significant effect of the project, subject to the approval of an agency governed by California law, even where the mitigation measure cannot be adopted by the lead agency. For the purposes of this document, it is assumed that TCCA can implement all of the proposed mitigation. However, in the event that implementation of specific mitigation is beyond the jurisdiction of TCCA, it would become the purview of another "responsible agency."

### 1.2.3 Legislative and Management History

The following information provides a historical view of the overall purpose of RBDD as a part of the Central Valley Project (CVP). Details are chronologically provided describing the legislation impacting these projects.

**1937** - Central Valley Project Authorization; August 26, 1937
(Public Law 392; 70th Congress; 50 Stat 844, 850)

This document serves as the original authorization enabling the creation of the CVP. This Act required the Department of the Interior - USBR to submit a detailed feasibility plan for the CVP to President Truman. This Act authorized "…the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.'' The CVP was specifically authorized in Section 2 of this document. Section 2 refers to the CVP purpose stating:

> *…to be for the purposes of improving navigation, regulating the flow of the San Joaquin and Sacramento River, controlling floods, providing for the storage and for the delivery of the stored waters thereof, for the reclamation of arid and semiarid lands and lands of Indian Reservations, and other beneficial uses, and for the generation and sale of electric energy as a means of financially aiding and assisting such undertakings and in order to permit the full utilization of the works constructed to accomplish the aforesaid purposes.*

**1940** - Central Valley Project Re-authorization; October 17, 1940
(Public Law 868; 76th Congress; 54 Stat 1198, 1199)

This document re-authorized the CVP and reiterated the CVP purpose as stated in the 1937 legislation.

**1949** - Central Valley Basin; A Comprehensive Report on the Development of the Water and Related Resources of the Central Valley Basin for Irrigation, Power Production, and Other Beneficial Uses in California, and Comments by the State of California and Federal Agencies; 1949
(Senate Document 113; 81st Congress, 1st Session)

This document identified additional CVP projects needed beyond those already funded and under construction. This includes the early scope of the Red Bluff-Dunnigan Canal. RBDD is not specifically mentioned in this document. However, it appears the Red Bluff-Dunnigan Canal later evolved into the TC Canal including RBDD.

This document alludes to the purpose of the canal by stating, "The Bureau of Reclamation is investigating the economic

possibilities of delivering an irrigation supply to lands in the northern Sacramento Valley lying above the major existing irrigation developments…The Red Bluff-Dunnigan Canal would serve lands along the westerly side of the Sacramento Valley, between Red Bank Creek in Tehama County and the town of Dunnigan in Yolo County.''

Recreation is not specifically identified in the discussions of the Red Bluff-Dunnigan Canal. However, recreation is prominent in the overall "Introduction and Summary'' of all projects included in this document. The "Introduction and Summary'' states:

> *California's future is largely dependent upon the coordinated development of all of the natural resources of the area, to that end the agriculture, industry, mining, lumbering, recreation, and other activities will contribute fully as possible to the prosperity of the region and the Nation. A prime essential of such a program is the orderly development of a system of multiple-purpose reservoirs and related works. These would conserve water for domestic, industrial, and irrigation uses; safeguard urban and rural areas from floods; produce hydroelectric energy; improve navigation; and provide opportunities for recreational activities. Resulting agricultural and industrial expansion would spread large benefits throughout California and add materially to the prosperity and wealth of the Nation.*

To advance the Red Bluff-Dunnigan Canal and other projects noted in this document, USBR was required to submit a feasibility plan, approved by the President, to the Secretary of the Congress. One element of this plan was a study by the National Parks Service to, "…determine the recreational potentialities of the comprehensive plan and to determine what steps should be taken to save, insofar as possible, historical or archeological values which might be lost through the construction of such features…''

The document concluded, "The comprehensive plan described in this report for irrigation, power, flood control, and other purposes in the Central Valley Basin is economically sound.''

**1950** - An Act to authorize Sacramento Valley Irrigation Canals, Central Valley Project, California; September 26, 1950
(Public Law 839; 81st Congress, 2nd Session; 64 Stat 1036, 1037)

This document authorizes the Sacramento Valley Irrigation Canals, Central Valley Project. The Sacramento Valley Irrigation Canal's purpose is stated as the same purpose of the 1937 and 1940 CVP authorization:

> *…to be for the purposes of improving navigation, regulating the flow of the San Joaquin and Sacramento River, controlling floods, providing for the storage and for the delivery of the stored waters*

*thereof, for the reclamation of arid and semiarid lands and lands of Indian Reservations, and other beneficial uses, and for the generation and sale of electric energy as a means of financially aiding and assisting such undertakings and in order to permit the full utilization of the works constructed to accomplish the aforesaid purposes.*

This document specifically authorizes the Tehama-Colusa Conduit irrigation canal and all necessary pumping plants/ works. The Tehama-Colusa Conduit is described as, "…beginning at the Sacramento River near Red Bluff, California and extending southerly through Tehama, Glenn, and Colusa Counties so as to permit the most effective irrigation of the irrigable lands lying in the vicinity of said canal and supply water for industrial, domestic, and other beneficial uses.''

**1951 -** Report of the Regional Director of the Sacramento Canals Unit, Sacramento River Division Central Valley Project, California; 1951 (House Document 73; 83rd Congress, 1st Session)

This document is the report (feasibility study/plan of development) submitted to, and approved by President Truman on January 19, 1953. This report was required by previous legislation and was submitted to the Secretary of the Congress following the President's approval.

This report proposes the construction feasibility of:

- Corning Canal and Pumping Plant
- Chico Canal and Pumping Plant
- TC Canal and Redbank Diversion Dam (a.k.a. RBDD), distribution, and drainage systems

The "summary sheet'' of this report specifically refers to the purpose and need of the overall project as:

*Principally irrigation, with power incidental thereto.*

*To stabilize agricultural economy, increase supply of dairy and livestock products, protect and expand specialized orchard industry, provide an alternate water supply for inadequate groundwater resources, generate hydroelectric energy for project use, and commercial sales.*

Recreation is not specifically identified in the report's purpose and need statement. A brief statement regarding recreation and the construction of the Redbank Dam states, "Redbank Dam will stabilize about 5 miles of the Sacramento River into an elongated lake adjacent to the City of Red Bluff.'' "It is anticipated that the

lake would provide increased opportunities for boating, camping, and fishing.''

As a part of this report, National Parks Service investigated the recreational potential of the Redbank Reservoir. The National Parks Service document begins by stating, "The primary purpose of this reservoir will be diversion for irrigation; a secondary purpose will be for power production.''

The report also details the potential types of recreation that may be developed adjacent to the dam/reservoir:

> *…development of the lake would provide increased opportunities, mainly for picnicking, boating, fishing, and camping, as the lake will probably be too cold for swimming. To utilize these opportunities, roads, trails, parking areas, camping and picnic areas, water supply development, sanitary facilities, landscaping, beaches, boat docks, and additional swimming pool facilities will be needed.*

The report was approved by President Truman on January 19, 1953, with the request that it be submitted to Congress for its consideration.

## 1.3 Project Setting and Location/Project Facilities

RBDD is located in north-central California on the Sacramento River about 2 miles southeast of the City of Red Bluff (City) (see Figure 1.3-1). The dam and the lake formed by the dam, Lake Red Bluff, are owned and operated by USBR. The lake is about 3 miles long and contains 3,900 acre-feet of water at normal water surface elevation.

***RBDD is located in north-central California on the Sacramento River about 2 miles southeast of the City of Red Bluff.***

The dam and lake are part of the Sacramento Canals Unit of CVP. The unit was designed to provide irrigation water in the Sacramento Valley, mainly in Tehama, Glenn, and Colusa counties. Also, a part of the unit are the TC and Corning canals, which deliver the irrigation water to areas in those counties.

The dam is a concrete structure 52 feet high and 740 feet long. It consists of 11 gates, each 18 feet high and 60 feet long. The gates are raised and lowered to control the level of Lake Red Bluff and enable diversions to the TC Canal. The headworks of the dam, which is a structure through which water from the lake is diverted into TC Canal, is located on the right abutment of the dam.

The dam gate closest to the right abutment is operated as a sluice gate to remove sediment accumulation near the headworks. The first section of the TC Canal, downstream from the headworks, is enlarged to act as a sediment basin. Sediment deposited in the basin is removed by dredging. The diversion capacity of the first sections of the TC and

Corning canals is 3,030 cubic feet per second (cfs). A drum screen structure downstream from the headworks prevents fish passing through the headworks from entering the canals. A bypass system then returns those fish to the river.

A fish ladder is located on each abutment of the dam. The steps of the fish ladders drop the water surfaces in the ladders in 1-foot increments as flows pass downstream. Auxiliary flow is added to the ladders near their downstream ends to create a higher flow velocity in the ladders where they enter the river below the dam. This higher velocity is intended to attract upstream migrating fish to the entrance of the fish ladder.

*In general, the proposed alternatives focus on the operation of RBDD and construction of structures to allow substantial RBDD operational changes.*

In general, the proposed alternatives focus on the operation of RBDD and construction of structures to allow substantial RBDD operational changes. When the gates are lowered, RBDD presents a barrier for both upstream- and downstream-migrating fish because fish ladders, included in the original dam design, have proven to be inefficient at certain flows to pass anadromous fish to upstream spawning grounds. The direct and indirect impacts of the alternatives occur within the Sacramento River and the San Joaquin River basins.

*The direct and indirect impacts of the alternatives occur within the Sacramento River and the San Joaquin River basins.*

## 1.4 Proposed Project

Currently, all alternatives are receiving an equal level of consideration. However, the TCCA Board of Directors (TCCA Board) identified the Gates-out Alternative and its Preferred Alternative. The TCCA Board has since clarified its preference to be the maximum pumping facility, regardless of gate operations, recognizing that its chief concern was water supply reliability. This stated preference does not preclude either co-lead agency from selecting a different alternative. USBR has not identified a Preferred Alternative. Following consideration of public comments, the co-lead agencies will jointly identify a specific project to carry forward.

## 1.5 Public Involvement and Scoping

*The Public Involvement Program was aimed at educating and including the public in the decision-making process.*

### 1.5.1 Public Involvement: 1992 to 1994

Following the completion of the Appraisal Study in 1992, USBR commenced the Fish Passage Improvement Program including a detailed Public Involvement Program. The Public Involvement Program was aimed at educating and including the public in the decision-making process. The initial plan identified perceived public involvement needs and actions to meet those needs. This plan was to be implemented over a 6-year period. However, because of a number of concerns, the program was placed on hold in late 1994.

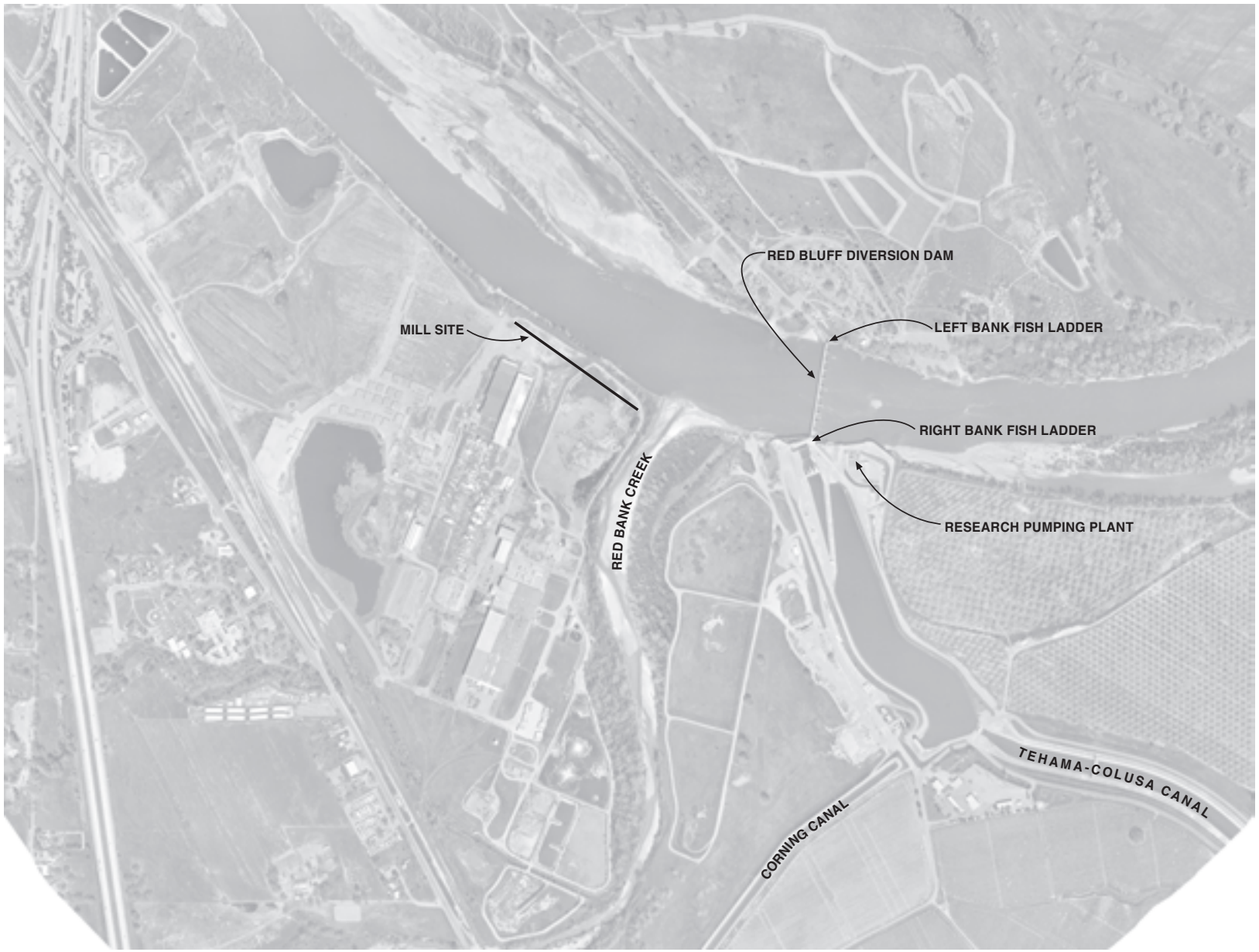


**FIGURE 1.3-1**
**SITE LOCATION MAP**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_030 (8/15/02)

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The following activities were implemented under the initial plan between 1992 and 1994:

- Conducted a public open house to provide information on the project (September 1992)
- Conducted three public workshops to obtain input and opinions on the program (October 1992)
- Conducted two focus groups including representatives of various interest groups to develop a strategy for the fish passage effort (December 1992)
- Conducted six informal public meetings to educate the public regarding project issues (June to November 1994)
- Formed an Advisory Committee of various interest groups to provide input to the decision makers
- Created a database containing 463 addresses
- Developed a project newsletter
- Created seven fact sheets
- Developed and distributed a Congressional Aide project briefing paper

*Scoping is an ongoing process of working with the public and regulatory agencies to identify and refine significant issues.*

### 1.5.2 Public Involvement: 1994 to Present

Since 1994, several interim technical studies have been completed in cooperation with the regulatory/fisheries agencies. These studies examined specific issues at RBDD. In 1999, the NEPA and CEQA environmental processes began. This is a coordinated effort with USBR and TCCA as co-lead sponsors. The project is referred to as the "Fish Passage Improvement Project at the Red Bluff Diversion Dam."

The first step in the environmental process for the Fish Passage Improvement Project at the Red Bluff Diversion Dam was the scoping process. Scoping is an ongoing process of working with the public and regulatory agencies to identify and refine significant issues. The scoping process provides a basis for those important issues to be analyzed throughout the environmental process.

The scoping process began with the publication of the Prescoping Report in January 2000, and formally ended in September 2000, with the publication of the September 2000 Scoping Report. During the scoping period, a public meeting was held on August 8, 2000, to solicit issues, concerns, and ideas from the public and interested agencies.

Approximately 50 individual oral and written comments were received during the scoping period. Twenty-four oral comments were received at the public scoping meeting.

*Approximately 50 individual oral and written comments were received during the scoping period. Twenty-four oral comments were received at the public scoping meeting.*

A general summary of the main topics of concern noted at the public scoping meeting follows:

- **Bypass Alternative**
  - Why was it eliminated as an alternative?
  - If the bypass alternative is implemented, will whitewater facilities be in the construction plans?
  - Many cost advantages are attached to the bypass alternative.
  - Tehama County will experience economic benefits from the bypass alternative.
- **Impact to Lake Red Bluff**
  - The loss of Lake Red Bluff will have severe economic impacts.
  - Loss of Lake Red Bluff will affect the aesthetics of that area.
  - Termination of Lake Red Bluff will have negative impacts on recreation.
  - Boat races will suffer.
- **Predator Control**
  - High populations of pike minnow are the most serious threats to fish.
  - Seals are also a threat.
  - What about the fish derby?
- **Ladders**
  - Do the existing fish ladders function properly?
- **Electricity/Pumping**
  - Too much pumping will raise electric rates tremendously.
  - Recent electricity alerts have already established electricity as a concern.
  - What will the effect be on agricultural costs?
- **General**
  - The Fish Passage Improvement Project needs more alternatives.
  - What are the issues regarding southern California water concerns?
  - What does "gates-in" entail?
  - Why is the project taking so long to take off?
  - How many salmon have passed through RBDD?

  - Has an off-stream storage site been considered as an alternative?
  - General support for agriculture was witnessed.

- **Support for Gates-out**
  - Fisheries were in support of the longest gates-out periods.
  - Some support for an alternative that would remove the entire dam surfaced.

## Public and Agency Concerns Identified during Scoping

Table 1.5-1 provides a summary of public and agency concerns identified during scoping.

**TABLE 1.5-1**
Summary of Public and Agency Concerns

| Agency | Concern |
|---|---|
| U.S. Forest Service, Mendocino National Forest | Letter, no date.<br>Recreational development of the Red Bluff site (Recreation Area) plays a key role in the U.S. Fish and Wildlife Service's (USFWS) plan for a Sacramento River National Wildlife Refuge. The Red Bluff Recreation Area Plan (Plan) emphasizes interpretation of natural systems through displays, facilities, and programs.<br>The bypass channel as presently envisioned (CH2M HILL 2001: 1-G-15) lies entirely within the Red Bluff Recreation Area. The only sizeable portion of the recreation area above the 100-year floodplain, and thus available for facility construction, is located within the area between the proposed bypass channel and the river. If the bypass channel were built according to the present design, the site's existing and proposed interpretive facilities would be cut off from the riparian and upland habitat they are intended to interpret by a 90-foot-wide moat surrounded by an 8-foot-tall fence (CH2M HILL 2001: 90-C-1, 90-C-2).<br>Alternative 1B (Bypass Channel) would not comply with the Land and Resource Management Plan. It would significantly alter the character of the Lake Red Bluff Recreation Area from desired condition set forth in the Plan. Consequently, implementation of Alternative 1B would require a Plan amendment. |
| U.S. Fish and Wildlife Service | Planning Aid Memorandum dated October 19, 2001.<br>Alternative 1(c) (gates-in 4 months, old ladders, develop water supply from Stony Creek) does not appear to meet the intent of the presently established "Project Need, Purposes, and Goal" (needs and purpose) listed in the CH2M HILL February 2001 document. It appears unlikely to substantially improve the reliability of water deliveries because of the many uncertainties associated with the water supply on Stony Creek. It does not improve fish passage over the No Action Alternative, especially for focus species (spring-run chinook and green sturgeon).<br>The USFWS listed the alternatives in order of preference:<br>1. Alternative 3<br>2. Alternative 2B<br>3. Alternative 2A<br>4. Alternative 1A<br>5. Alternative 1B<br>Main points of discussion: |

**TABLE 1.5-1**
of Public and Agency Concerns

| Agency | Concern |
|---|---|
| | • New ladder designs are not known to produce substantial improvements in fish passage efficiency and reliability over the existing ladders.<br>• Many uncertainties attached to the bypass channel.<br>• Benefits of improved ladders is not as substantial in comparison to reduced gate operations.<br>• Gates-out provides a situation closest to the original ecosystem form and function.<br>• Overall ecosystem benefits will be greater with the gates-out alternative than with the reduced gates alternative. |
| California Department of Fish and Game | Letter dated October 23, 2001.<br>California Department of Fish and Game (CDFG) concurs with the Planning Aid Memorandum prepared by USFWS. |
| National Marine Fisheries Service | Letter dated October 26, 2001.<br>NMFS fully concurs with the statements and determinations put forth by USFWS. |
| California Department of Water Resources | Letter dated January 8, 2002.<br>• The alternative that best fits the consideration of improved reliability of both fish passage and water supply at the RBDD is either reduced gates or gates-out.<br>• A reduced gates or gates-out operation would lead to an increase in riparian vegetation in the existing Lake Red Bluff footprint. This vegetation would include both native and invasive introduced species, based on the species present in the Lake Red Bluff area today. From an aesthetic and wildlife standpoint, this increased growth would have both beneficial and detrimental effects.<br>• Approximately 234 acres are within the fluctuation zone of Lake Red Bluff. That would be the area subject to increased growth with a reduced gates or gates-out alternative. The additional vegetation in the floodplain could have significant effects on water surface elevations in the Red Bluff area during high water events.<br>• Additional riparian growth resulting from the project will reduce the flood-carrying capacity of the Sacramento River in already reduced natural floodplains and bypass channels. This potential impact could increase water surface elevations.<br>• A reduced gate operation alternative would mean that only a very small percentage, or even no winter-run salmon, could be directly counted, and run-size estimates would be less accurate. If either the reduced gate or gates-out alternative is selected, additional effort should be made to increase the accuracy of the winter- and spring-run chinook population estimates above Red Bluff. |
| Chamber of Commerce | Letter dated January 3, 2002.<br>• The Chamber of Commerce will actively oppose any alternative chosen that eliminates the seasonal impoundment of the Sacramento River behind the gates of RBDD.<br>• To eliminate the opportunity of using the river in its lake-like condition each summer would be a sad and irreparable dis-service to, as well as devaluation of, the economic base of the community. |

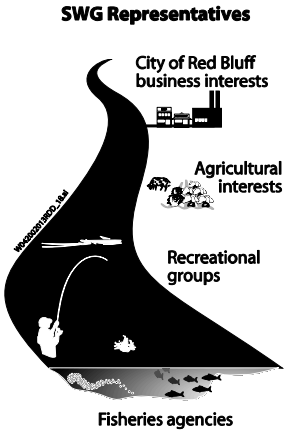
### Project Team Structure

TCCA and USBR recognized the need to coordinate with many other organizations, project stakeholders, and government agencies to develop a supported solution meeting the project's purpose and need. To allow for efficient input from these varying interests, the following project team structure was created:

- **TCCA and USBR** - Co-lead agencies sponsoring this project and decision makers, working with the project consultants.
- **Technical Assistance Group (TAG)** - TAG/technical review group meets monthly and includes various public agencies. The group discusses technical issues related to the environmental review.
- **Stakeholder Working Group (SWG)** - Forum for representatives from the agricultural, recreation, business, and general public to raise issues and learn about the project. The group meets monthly and serves as a conduit for information to the larger community. This group originated as a small focus group of interested individuals assisting with preparations for the March 13, 2001 public meeting.
- **Interest Groups, the Public, and Other Public Agencies** - Information channeled through the TAG and SWG members. Provide input through direct communication, letters, project web site, public meetings, and public hearings.

TCCA and USBR created SWG to provide a forum for representatives of various interest groups and organizations to understand and discuss the project issues. This group provides the project team with insight to the views of the public and other special interests. Some of the representatives in the group include:

- The City of Red Bluff
- Fisheries agencies
- Local business interests
- Agricultural interests
- Recreational groups




SWG members also act as liaisons to their respective interest groups regarding the status and issues of the project. Members serve as a direct connection between the project team and the public. Keeping the public involved through SWG, open public forums, and project updates is key to the success of the project. SWG has helped the project identify critical issues regarding the importance of recreation and the aesthetics of Lake Red Bluff and the consideration for power consumption of the proposed pump stations.

The following is a comprehensive list of the public involvement opportunities held for the Fish Passage Improvement Project at the Red

Bluff Diversion Dam following the August 8, 2000 public scoping meeting.

- **Public Meeting:** Red Bluff Community Center, 1500 South Jackson, Red Bluff, CA 96080
  - March 13, 2001
- **Focus Group Meetings:** USBR Office, 22500 Altube Avenue, Red Bluff, CA 96080
  - December 18, 2000
  - January 24, 2001
- **Stakeholder Working Group Meetings:** Red Bluff Community Center, 1500 South Jackson, Red Bluff, CA 96080
  - August 7, 2001
  - October 26, 2001
  - November 13, 2001
  - December 11, 2001
  - January 8, 2002
  - February 12, 2002
  - March 12, 2002
  - April 9, 2002
  - May 14, 2002
- **Project Newsletters:** Three informational newsletters were submitted to the project mailing list (577 addresses) at key milestones (newsletters will coincide with the release of the draft and final environmental documents)
  - September 2000
  - December 2000
  - Summer 2002
- **Project Web Site:** The project web site at **www.tccafishpassage.org** provides detailed and current information on the project.

*During the public comment period, a public hearing will be held so that the lead agencies can receive the public's oral and written comments.*

### Future Actions

This environmental process includes a public comment period, during which the public is asked to supply the lead agencies with comments on this DEIS/EIR. During the public comment period, a public hearing will be held so that the lead agencies can receive the public's oral and written comments.

Once the public comment period closes, the lead agencies will consider and respond to the comments and produce a Final EIS/EIR (FEIS/EIR). No less than 30 days after the availability of the FEIS/EIR, the lead NEPA agencies will produce a Record of Decision (ROD). The lead CEQA agency will certify the Final EIR no less than 10 days after

providing responsible state and other commenting agencies a written response to their comments.

## 1.6 Required Permits and Approvals

The following approvals are anticipated to be required for each of the proposed alternatives:

- **Federal Clean Water Act Section 404 Permit** – U.S. Army Corps of Engineers (USACE)
- **Federal Rivers and Harbors Act Section 10 Permit** – USACE
- **Federal Endangered Species Act Section 7 Consultation** – USFWS and NMFS
- **Federal Fish and Wildlife Coordination Act Report** – USFWS
- **National Flood Insurance Program Letter of Map Revision** – Federal Emergency Management Agency
- **Easement for Bypass Facility** – U.S. Forest Service (USFS)
- **California Fish and Game Streambed Alteration Agreement** – CDFG
- **California Endangered Species Act Consultation** – CDFG
- **Federal Clean Water Act Section 401 Water Quality Certification** – California Regional Water Quality Control Board (RWQCB)
- **Federal Clean Water Act Section 402 General Construction Activity Stormwater Permit** – California RWQCB
- **Petition to Change Point of Diversion** – State Water Resources Control Board (SWRCB)
- **State Lands Commission Public Agency Lease/Encroachment Permit** – State Lands Commission
- **Encroachment Permit** – State Reclamation Board
- **National Historic Preservation Act Section 106 Authorization** – California Department of Parks and Recreation, Office of Historic Preservation
- **Clean Air Act Permit** – Tehama County Air Pollution Control District

## 1.7 Preparers of the DEIS/EIR

This DEIS/EIR has been prepared at the direction of the co-lead agencies, TCCA, and USBR. Additionally, this project has actively solicited input and review from cooperating agencies, notably USFWS, NMFS, USFS, CDFG, and DWR. Additionally, throughout the process, input has been considered and solicited from affected parties and agencies, including local governments, trade organizations, interest groups, and individuals. Please see Section 5.2 for a more comprehensive list of individuals involved in the project.

## 1.8 Areas of Controversy

The following issues associated with the proposed Fish Passage Improvement Project at the Red Bluff Diversion Dam are anticipated to be controversial:

- Reduction in gates-in operations would reduce the amount of time Lake Red Bluff would be available for recreational and aesthetic benefits.
- Operation of a proposed pump station, regardless of the alternative selected, would increase the amount of electricity consumed by CPV (Project Use), thus decreasing the amount of net electricity available for sale to power customers.
- Potential benefits to fish resources accrued under the various alternatives may result in impacts to human-related resources such as recreational opportunities and aesthetics. The balance of benefits to impacts is likely to be controversial.

Other issues, notably project funding, may also be considered controversial; however, these issues are not considered to affect the environment and are therefore not included here.

# 2.0 Description of Alternatives

This chapter describes the alternatives that were developed to restore fish passage at RBDD and improve the long-term ability to reliably provide water supplies into the TCCA systems (as described in the Purpose and Need Statement). This chapter also describes the no-action baseline. The full range of alternatives considered for the project is described in Section 2.1, including the screening criteria used to establish the five primary alternatives and related actions. Additional detail on the screening criteria is presented in the Alternatives Analysis Report included as Appendix A.

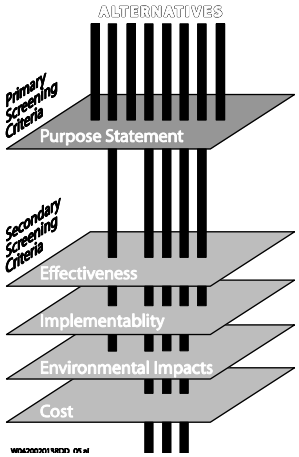
The alternatives were formulated from public input, scientific information, and professional judgement in a manner consistent with NEPA and CEQA. Anticipated impacts associated with each alternative are analyzed in Chapter 3.

*The alternatives were formulated from public input, scientific information, and professional judgement, in a manner consistent with NEPA and CEQA.*

## 2.1 Alternatives

Many alternatives were identified as reasonable for addressing the purpose statement for the project, which was considered the primary screening criterion. These alternatives were then considered against secondary screening criteria, which reduced the number of alternatives to the five described in this section. Following are the secondary screening criteria:

- Effectiveness
- Implementability
- Environmental Impacts
- Cost




In addition, a No Action Alternative was also fully analyzed. The No Action Alternative, or future without the proposed action, is the measure against which the environmental impacts and other aspects of the action alternatives were compared. Unless otherwise noted, the operations, policies, requirements, and other assumptions incorporated into the No Action Alternative are adopted into the other alternatives.

*The No Action Alternative, or future without the proposed action, is the measure against which the environmental impacts and other aspects of the action alternatives were compared.*

### 2.1.1 Existing Conditions

#### Current RBDD Operations (Gates-in May 15 through September 15)

In a cooperative effort to alleviate fish passage problems at RBDD, voluntary gate removal during the non-irrigation season began during the 1986 water year. In 1988, USBR and CDFG, NMFS, and USFWS entered into a 4-year Cooperative Agreement to implement actions to

benefit winter-run chinook salmon in the Sacramento River (NMFS, 1993). At that time it was agreed that RBDD gates would be raised from December 1 to April 1 to facilitate adult winter-run migration. Subsequently, gate operations were modified in 1992 in consultation with NMFS as part of the reasonable and prudent alternative contained in a jeopardy opinion of the operation of RBDD. At that time, USBR proposed that gates at RBDD be raised from November 1 through April 30 of each subsequent year with provisions for intermittent closures during March and April for recharging the TC and Corning canals.

The 1993 Biological Opinion for the Operation of the Central Valley Project and the State Water Project (NMFS, 1993) included the following operations: the RBDD gates would be raised through April 1, 1993; be raised beginning November 1, 1993, and remain raised through April 30, 1994. On September 15 of each year commencing in 1994 through at least May 14 of each subsequent year, the gates at RBDD should remain in the raised position.

The dam gates are currently raised on September 15. Thus, this DEIS/EIR refers to the gates-in period as occurring through September 15. Thus, this DEIS/EIR refers to the gates-in period as occurring "through September 15," and the gates-out period as beginning "September 16." From a practical standpoint, gate operations often occur across days, thus the dates used in this DEIS/EIR are approximations.

Since implementation of the Reasonable and Prudent Conservation Measures for the protection of winter-run chinook salmon (NMFS, 1993), operations at RBDD have resulted in reductions in losses of fishery resources. The current gates-out operation at RBDD (September 16 through May 14) has greatly reduced the period of time when adults are delayed and juveniles are adversely affected by RBDD operations. The effects of predation on juveniles was essentially eliminated with reduced gate operations. The current operations at RBDD also provide fall-run salmon spawning habitat immediately upstream of RBDD, which is lost when Lake Red Bluff is inundated (USFWS, 1998).

***RBDD is a part of CVP and is owned and operated by USBR to deliver water to the 17 water districts served by TCCA.***

### Existing Facilities at Red Bluff Diversion Dam

The existing facilities at RBDD and the TC Canal and Corning Canal are briefly described in the following paragraphs. Readers interested in a more detailed history and description of these facilities are referred to the Appraisal Report (USBR, 1992) and the Supplemental Report (USFWS,1998). Figure 2.1-1 presents an overview of the existing RBDD facilities.

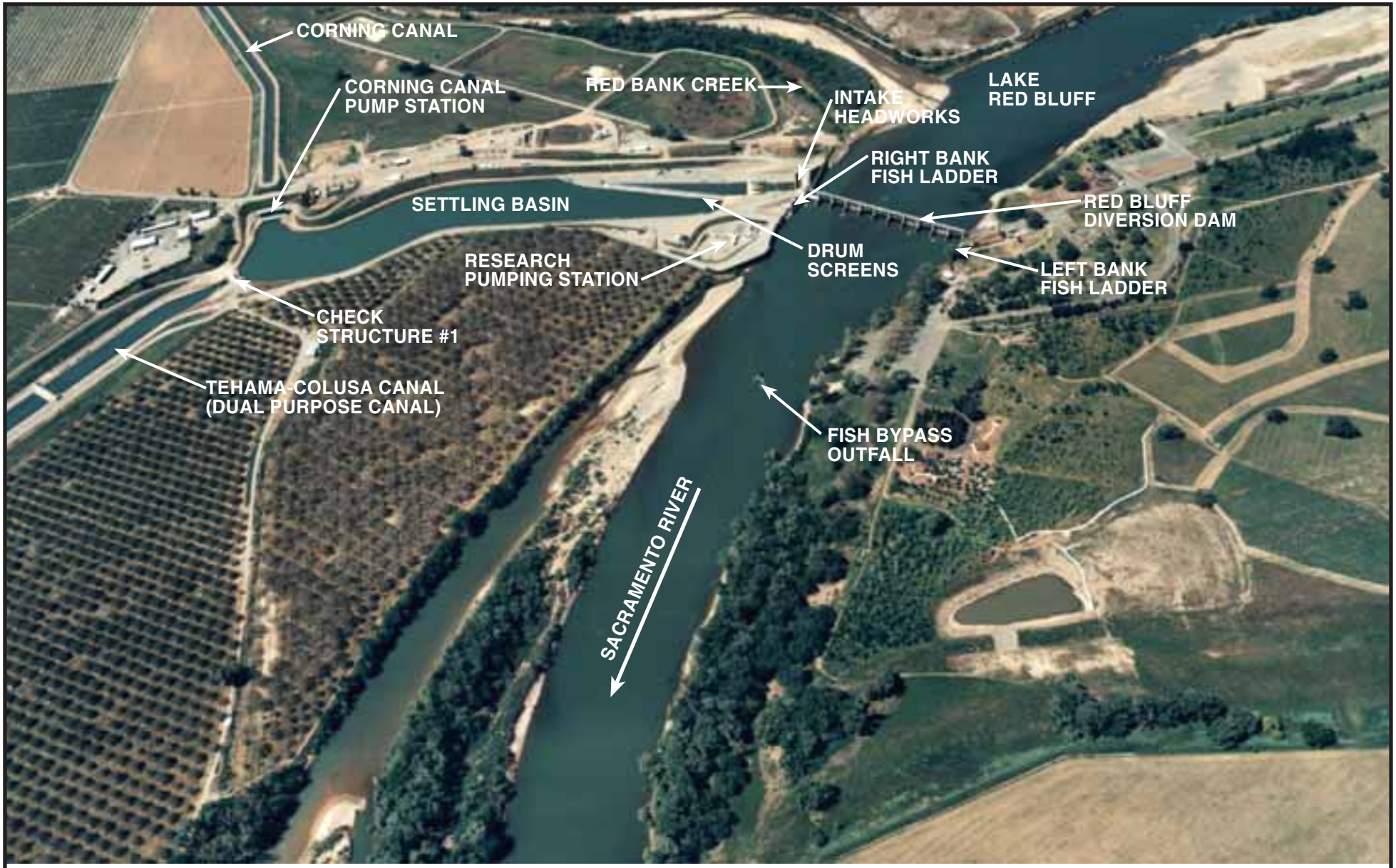



**FIGURE 2.1-1**
**EXISTING FACILITIES AT THE RED BLUFF DIVERSION DAM**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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**Red Bluff Diversion Dam.** RBDD is a part of CVP and is owned and operated by USBR to deliver water to the 17 water districts served by TCCA. Located just downstream of the City of Red Bluff, California, RBDD was constructed by USBR in August 1964. The dam has 11 spillway bays, with Bay 11 adjacent to the right abutment of the dam being designed as a sluiceway. The 11 spillway bays are 60 feet wide and are separated by 8-foot-wide piers.

Each spillway bay has a 60-foot-wide by 18-foot-high fixed wheel gate. The gates were first lowered on August 18, 1966. Gate 11 has been modified to allow for 4 feet of top spill to sluice floating debris through Bay 11. Under current operations, the gates-in period is between May 15 and September 15. Riverflow is allowed to pass under each of the gates in a specific flow-related pattern to enhance attraction flow to the fish ladders. Although this specific gate operation pattern was developed by the fisheries resource agencies, the strategy has had limited success because of the shortcomings of the existing fish ladder flow in attracting adult fish.

**Fish Ladders–Right and Left Bank.** Pool-and-weir fish ladders on both the right and left abutments were included in the original design and construction of RBDD. These fish ladders are oriented slightly differently but basically provide 85 cfs of fish ladder flow and 253 cfs of additional attraction flow. This gives a total flow capacity of 338 cfs for each fish ladder. Fish-counting facilities are also included in the right and left bank fish ladders. When the gates are lowered and Lake Red Bluff is formed, the fish ladders become operational.

A temporary fish ladder is installed and removed each year in spillway Bay 6. This fish ladder has a capacity of 100 cfs. It was initially installed in 1984, and it has been reported that it passes from 6 percent to 50 percent of the run, depending on the year and riverflow conditions.

*Each fish ladder has a flow capacity of 338 cfs.*

As discussed above, the spillway gates are operated by USBR in strict accordance with a spill pattern developed in conjunction with the fisheries resource agencies. This pattern is not completely effective in guiding adult fish to the ladder entrances.

**Right Bank Fish Ladder Pumps.** The right bank fish ladder pump station is a temporary pumping facility that has the capacity to pump 165 cfs into the area just upstream of the drum screens. Fabricated metal fish screens are added to the area just downstream from the right bank fish ladder entrance any time that the fish ladder is out of service.

**Canal Intake Headworks.** The headworks are located on the right abutment of RBDD and comprise six top-seal radial gates, each 11.5 feet wide and 10 feet high.

Originally, RBDD was designed with five gates, but a sixth gate was added during construction of the drum screens in 1989 to 1990. At the normal operating differential of 2 feet, the headworks can deliver 3,100 cfs to the area upstream from the drum screens. Using 270 cfs for the right bank fish ladder attraction water and 240 cfs for the drum screen bypass system (60 cfs at each bypass), a remaining flow of 2,570 cfs would pass through the drum screens. This amount aligns with the peak design flow required for irrigation (2,500 cfs).

The invert of the headworks is 8 feet higher than the crest of the dam. Without the gates in place, the riverflow would need to be more than 24,000 cfs to reach the level of the headworks invert and 88,000 cfs to reach the normal operating level of Lake Red Bluff.

**Drum Screens and Fish Bypass Outfall.** Another major change was made at RBDD in April 1990 when rotary drum screens were installed to replace fish louvers. The fish louvers were not sufficiently effective in keeping fish out of the TC and Corning canals. The drum screens effectively exclude all salmon from the canal systems.

The original design capacity was 3,000 cfs. At the normal operating water elevation, using the current approach velocity of 0.40 foot per second (fps), the rated capacity of the drum screens is 2,400 cfs. To meet the design peak irrigation delivery amount of 2,500 cfs, the approach velocity would be 0.42 fps. After consulting with the fisheries resource agencies, it was determined that the drum screens should never be operated unless the approach velocity is at or below 0.40 fps. The resource agencies also recommended replacing the wire mesh on the drum screens with a mesh that meets current criteria as required by the normal replacement schedule.

The drum screens have four 48-inch-diameter bypass pipes, each with a design capacity of 60 cfs. These four pipes later merge into two 60-inch-diameter bypass pipes that convey the total bypass flow of 240 cfs to the outfall located in the middle of the river, approximately 1,100 feet downstream of RBDD.

**Research Pumping Plant.** In 1993, USBR installed a Research Pumping Plant (RPP) just downstream from RBDD. One purpose of RPP was to determine the feasibility of pumping Sacramento River water directly into the canals using screw or helical pumps. The advantage of this pumping system is that it would pump both water and fish. The fish are removed from the irrigation water stream through vertical fish screens downstream from the pump discharge and are returned through a piped bypass system to the river.

The RPP is located just downstream of the right bank fish ladder entrance and includes an intake structure with trashracks and four 48-inch-diameter intake pipes leading to four pump bays. Two Archimedes screw pumps and one helical pump were installed initially in three of the pump bays; the fourth bay is empty. Each pump lifts water to a flat plate "vee" screen. Of the 90-cfs pump discharge, 10 cfs is used for fish bypass flow. The remaining 80 cfs per pump is discharged into the settling basin behind the drum screens.

This system is being evaluated as a possible remedy to further remove fish passage impediments because it does not rely on RBDD to operate, and it can deliver water into the TC Canal year-round except during high river conditions when the fish bypass system does not work. A full-scale pumping plant would eliminate dependence on RBDD and thus allow gates-out and a free-flowing river year-round. The RPP is a 240-cfs capacity pumping plant complete with fish screen, pumps, and fish bypass facilities. The "experimental" or RPP has been operating since 1995. The survival rate of juveniles passing through the system is considered excellent. The combined direct and delayed mortality rates have been consistently lower than 5 percent. However, the water users are concerned about the long-term reliability and operation and maintenance (O&M) cost of the RPP technology if applied to a full-scale pumping operation. NMFS' approval will be required prior to a decision to use RPP as a source for permanent diversion.

***TC Canal is owned by USBR but operated and maintained by TCCA.***

The RPP testing was completed in 2001, and it appears that the technology has been accepted by the resource agencies for protecting fish. The total existing effective capacity of RPP is 240 cfs. With the fourth pump installed, the effective capacity would increase to 320 cfs.

The fish bypass from RPP passes through a juvenile evaluation facility and then continues on to attach to the drum screen bypass pipes. At high-river tailwater levels the bypass is not functional because there is no hydraulic differential. In addition to meeting the research objectives, the RPP has been used in recent years to partially meet irrigation demand when RBDD gates are opened.

**Tehama-Colusa Canal.** The TC Canal serves 14 of the 17 water districts served by the two canal systems and has delivery capacity to provide water to the Glenn-Colusa Irrigation District canal. The dual-purpose and single-purpose spawning channels initially built at or adjacent to the TC Canal are no longer in use for fish spawning. Water still passes through the dual-purpose channel to feed the TC Canal system. The TC Canal is approximately 111 miles long and extends from

Red Bluff in Tehama County (County) to below Dunnigan in Yolo County. The capacity of TC Canal is 2,530 cfs at the start and reduces capacity to 1,700 cfs at its terminus. The TC Canal is owned by USBR but is operated and maintained by TCCA under a long-term contract with USBR.

The Corning Canal serves 3 of the 17 water districts served by the two canal systems. The Corning Canal Pumping Plant lifts water from the settling basin downstream of the drum screens 55 feet up into the Corning Canal. The Corning Canal is 21 miles long (USFWS, 1998) and has a design capacity of 500 cfs at the head end and 88 cfs at its terminus. The Corning Canal Pumping Plant has six pumps that are used to meet the varying irrigation demands of the Corning, Proberta, and Thomes Creek water districts. The Corning Canal and Corning Canal Pumping Plant are owned by USBR but are operated and maintained by TCCA under a long-term contract with USBR.

*The Corning Canal and Corning Canal Pumping Plant are owned by USBR but are operated and maintained by TCCA.*

**Stony Creek Diversions.** TCCA must annually supplement its water supply during the times that gravity diversion at RBDD is not available. During these times, TCCA obtains water, when it is available, from Black Butte Reservoir via a diversion from Stony Creek. Diversions from Stony Creek are currently permitted for 45-day periods between April 1 and May 15 and between September 15 and October 29. The Stony Creek Diversion depends on the USACE's operation of Black Butte Reservoir. It is operated primarily for flood control purposes and not irrigation; these two needs are not always compatible. Furthermore, the volume of water in Black Butte Reservoir is decreasing because the reservoir is silting in. Because of the relatively small size of the reservoir, it is kept at its minimum capacity until late in the rainy season. Because of this, the reservoir could be at its minimum level when diversions are needed due to a change in the season from a wet to a dry year. This arrangement does not provide TCCA and the 17 water districts it serves with sufficient water diversion reliability and flexibility because significant demand for irrigation water also occurs during spring and fall, when RBDD gates are out.

As an interim measure, CVP water stored in Black Butte Reservoir is released to Stony Creek for subsequent rediversion to the TC Canal to partially offset the loss of gravity flow diversion at RBDD when the gates at RBDD are out. In recent years, special water releases, when available, from Black Butte Reservoir into Stony Creek have been diverted into the TC Canal by reversing the flow through the Constant Head Orifice (CHO) on the canal at the Stony Creek canal siphon. The CHO was originally installed to enhance fish and wildlife by the release of TC Canal water into Stony Creek, but it has never been used for that purpose. Regular use of these diversions is planned to be discontinued as soon as a permanent solution is implemented at RBDD. Diversions from the TC Canal to Stony Creek are not currently planned as part of

*Diversion from the TC Canal to Stony Creek was considered as part of the permanent solution but was rejected because of unreliable water supplies.*

the permanent solution. This was considered, but rejected because of unreliable water supplies.

### 2.1.2 Selection of the Preferred Alternative

The TCCA Board of Directors (TCCA Board) determined the Gates-out Alternative to be the Preferred Alternative (Resolution No. 01-06). The Gates-out Alternative was chosen during a board meeting held on December 5, 2001. This decision stemmed from the idea that "selection of a Preferred Alternative at this time simply allows the work on the solution to the fish passage and water delivery reliability problems at the Red Bluff Diversion Dam to continue…" Through this resolution, the TCCA Board reserves the right to change the selected Preferred Alternative in the future. Additionally, the selection of the Preferred Alternative in no way commits the TCCA Board or TCCA to any particular course of action, nor does it commit any expenditure of funds for any purpose.

*The TCCA Board reserves the right to change the selected Preferred Alternative in the future. The selection of the Preferred Alternative in no way commits the TCCA Board or TCCA to any particular course of action.*

Following this decision, the TCCA Board held a subsequent meeting on February 6, 2002. One of the topics of discussion included the TCCA Board's commitment to the Gates-out Alternative but their willingness to consider alternatives such as the "Flexible Gate" Alternative.

USBR has not yet chosen a Preferred Alternative. A list of the alternatives that are currently being evaluated, including the No Action Alternative, follows.

### 2.1.3 No Action Alternative

CEQA requires that the Preferred Alternative be compared to an **existing conditions** baseline, whereas NEPA requires comparison with a No Action Alternative. The No Action Alternative represents ongoing activities and operations and corresponds to the "No Project" definition as outlined in the *CEQA Guidelines*, Section 15126, as "a condition that would be reasonably expected to occur if the project were not approved."

*The No Action Alternative represents ongoing activities and operations.*

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Continue operating RPP and add a fourth pump
- Eliminate Stony Creek diversions (because of lack of feasible options for constructing a fish screen on the CHO)

### 2.1.4 1A: 4-month Improved Ladder Alternative

The 4-month Improved Ladder Alternative would continue the current operation of the dam with a 4-month gates-in period of May 15 through September 15. Improved agricultural water deliveries would be achieved through 1,700 cfs of pumping capacity (320 cfs at RPP;

1,380 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of new ladders (right 800 cfs, left 831 cfs, for a total of 1,631 cfs).

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Install a new 1,380-cfs pump station with fish screen on the right bank at Mill Site; continue operating the RPP and add a fourth pump resulting in a combined pumping capacity of 1,700 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Modify the left and right bank fish ladders
- Implement Adaptive Management Program as described in Section 2.4

### 2.1.5 1B: 4-month Bypass Alternative

The 4-month Bypass Alternative would continue the current operation of the dam with a 4-month gates-in period of May 15 through September 15. Improved agricultural water deliveries would be achieved through 1,700 cfs of pumping capacity (320 cfs at RPP; 1,380 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of a new ladder at the right abutment (800 cfs). A 1,000-cfs bypass channel for fish passage would be constructed at the left abutment near the existing Sacramento River Discovery Center. This alternative requires an amendment to USFS, Mendocino National Forest Land and Resource Management Plan.

- RBDD Operations: Gates-in 4 months (May 15 through September 15)
- Install a new 1,380-cfs pump station with fish screen at Mill Site; continue operating the RPP and add a fourth pump resulting in a combined pumping capacity of 1,700 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Install a new 1,000-cfs bypass around left abutment of dam
- Modify the right bank fish ladder
- Implement Adaptive Management Program as described in Section 2.4
- Amend Mendocino National Forest Land and Resource Management Plan to allow construction of the bypass facility

### 2.1.6 2A: 2-month Improved Ladder Alternative

The 2-month Improved Ladder Alternative would reduce the current operation of the dam to a 2-month gates-in period of July 1 through August 31. Improved agricultural water deliveries would be achieved through 2,000 cfs of pumping capacity (320 cfs at RPP; 1,680 cfs at Mill Site). Improvements to fish passage would be achieved with construction and operation of new ladders (right 800 cfs, left 831 cfs, total 1,631 cfs) and the reduced gates-in operation.

- RBDD Operations: Gates-in 2 months (July 1 through August 31)
- Install a new 1,680-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,000 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Modify the left and right bank fish ladders
- Implement Adaptive Management Program as described in Section 2.4

### 2.1.7 2B: 2-month with Existing Ladders Alternative

The 2-month with Existing Ladders Alternative would reduce the current operation of the dam to a 2-month gates-in period from July 1 through August 31. Improved agricultural water deliveries would be achieved through 2,000 cfs of pumping capacity (320 cfs at RPP; 1,680 cfs at Mill Site). Improvements to fish passage would be achieved through the reduction in gate operations. Existing ladders would continue to be operated at the right and left abutments (right 338 cfs, left 338 cfs, total 676 cfs).

- RBDD Operations: Gates-in 2 months (July 1 through August 31)
- Install a new 1,680-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,000 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Implement Adaptive Management Program as described in Section 2.4

### 2.1.8 3: Gates-out Alternative

The Gates-out Alternative would eliminate the gates-in period, leaving the gates in the raised position year-round. Improved agricultural water deliveries would be achieved through 2,500 cfs of pumping capacity (320 cfs at RPP; 2,180 cfs at Mill Site). Improvements to fish passage

would be achieved through the reduction in gate operations. Existing ladders would no longer operate.

- RBDD Operations: Gates-in zero (0) months
- Install a new 2,180-cfs pump station with fish screen at Mill Site; continue operating RPP and add a fourth pump resulting in a combined pumping capacity of 2,500 cfs
- Install a conveyance facility across Red Bank Creek to convey water from the pump station to the TC Canal
- Implement Adaptive Management Program as described in Section 2.4

Table 2.2-1 presents a summary of each alternative and its associated proposed timing, facilities, and flow.

# 2.2 Proposed Facilities

## 2.2.1 Mill Site Pump Station

The preferred pump station option is a conventional vertical propeller pump station at the Mill Site used in conjunction with the existing RPP to meet the full peak water delivery needs. The Mill Site is located upstream from RBDD and Red Bank Creek. The general layout of the Mill Site facilities is shown on Figure 2.3-1.

***Under all of the alternatives, the Mill Site Pump Station facilities would include a fish screen along the river.***

Each pump station site configuration consists of trashracks and fish screens, a forebay or intake piping, pump station, and conveyance facilities. A fish bypass system may be needed, depending on the length of the fish screens and the type of pumping system. The length of the fish screen, the size of the forebay, and the pumping and conveyance capacities are dependent upon the alternative. Many potential combinations of intake and pumping facility options are associated with each alternative.

For the vertical propeller pump option, the discharge piping would be routed to a new discharge outlet structure at the sedimentation basin. It is assumed that the drum screens would be removed under the Gates-out Alternative. The option to retain drum screens and current intake facilities may be considered in final design of the proposed project. When the gates are in, water would be diverted by gravity through the fish screens into the new forebay and would then bypass the pump station into the conveyance system for delivery to the sedimentation basin.

**TABLE 2.2-1**
Summary of Final Alternatives

| | Gates-in Operation | | Fish Passage Facilities | | | Gates-out Water Supply | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Duration** | **Timing** | **Right Bank (cfs)** | **Center (cfs)** | **Left Bank (cfs)** | **Research Pumping Plant (cfs)** | **Right Fish Ladder (cfs)** | **Mill Site (cfs)** | **Stony Creek (cfs)** | **Total (cfs)** |
| Existing Conditions | 4 months | May 15 through Sept 15 | Existing 338 | Existing 100 | Existing 338 | 240 | 165 | | 600 | 1,005 |
| No Action | 4 months | May 15 through Sept 15 | Existing 338 | Existing 100 | Existing 338 | 320 | 165 | | 600 | 485 |
| 1A: 4-month Improved Ladder Alternative | 4 months | May 15 through Sept 15 | New 800 | | New 831 | 320 | | 1,380 | | 1,700 |
| 1B: 4-month Bypass Alternative | 4 months | May 15 through Sept 15 | New 800 | | Bypass channel 1,000; existing 338 | 320 | | 1,380 | | 1,700 |
| 2A: 2-month Improved Ladder Alternative | 2 months | July 1 through Aug 31 | New 800 | | New 831 | 320 | | 1,680 | | 2,000 |
| 2B: 2-month with Existing Ladders Alternative | 2 months | July 1 through Aug 31 | Existing 338 | | Existing 338 | 320 | | 1,680 | | 2,000 |
| 3: Gates-out Alternative | 0 months | | | | | 320 | | 2,180 | | 2,500 |

Under all of the alternatives, the Mill Site Pump Station facilities would include a fish screen along the river. The screens would be designed to provide a 0.33-fps approach velocity as required by CDFG. The length of the screen depends on the alternative selected and the characteristics of the river (i.e., depth, channel geometry, flow volume, and velocity under various operating conditions) at the screen location, which would be determined during preliminary design. For a 2,500-cfs pump station, the length of the screen would be approximately 1,100 feet. The screens would be installed in approximately 60 bays. For a 2,180-cfs pump station, the length of screen would be approximately 1,000 feet, and the screens would be installed in approximately 54 bays. Blowout panel(s) would be provided as an emergency hydraulic relief system in the event of differential heads between the river and the forebay. The top of bulkheads would be set at the 25-year flood elevation to limit the amount of debris in the forebay for most extreme flood events. A cofferdam would be constructed around the screens and the site dewatered to allow construction of the screens in the dry.

Water would flow through the fish screens into the pump station forebay and into the vertical propeller pump station. Approximately seven pumps would be required for the 4-month Alternative, eight pumps for the 2-month Alternative, and ten pumps for the Gates-out Alternative (2,180-cfs vertical propeller, 320-cfs RPP). The location of the pump station relative to the fish screens would be determined during preliminary design. Considerations for the location would include the cost of excavating the forebay versus piping, as well as the hydraulic flow characteristics entering the pump station.

***The objective of the fish screen design is to provide safe fish passage for juvenile fish (primarily salmon and steelhead) past TCCA water diversion facilities.***

The pumps would lift the water to the pump station outlet box. The water would flow by gravity from the outlet box through a siphon under Red Bank Creek. The water would discharge downstream of the fish drum screens in the sedimentation basin. The site plan area requirements and sizes of conveyance facilities are based on the pumping capacity requirement for the Gates-out Alternative. The required offsite pumping capacity would be smaller for the 2-month and 4-month alternatives.

The land where the pump station and conveyance facilities would be constructed is adjacent to land owned by the federal government for RBDD and is currently available for purchase. Power supply is nearby, and access is in place. Direct access to the pump station site from the existing RBDD site would likely require a bridge across Red Bank Creek.


**NOTE:** CAPACITY AND SIZE OF FISH SCREEN DEPENDENT ON ALTERNATIVE SELECTED. LARGEST SIZE (2180cfs) SHOWN.

**FIGURE 2.3-1**
**GENERAL LAYOUT OF MILL SITE FACILITIES**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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### Fish Screen Design Criteria

The objective of the fish screen design is to provide safe fish passage for juvenile fish (primarily salmon and steelhead) past TCCA water diversion facilities. This would be accomplished through the use of positive barrier on-river fish screens.

The required approach velocity of 0.33 fps would be used for on-river applications to meet CDFG criteria. The lengths and depths of the screens for each option were derived from preliminary hydrographic field surveys at each of the proposed pump station sites.

### Fish Bypass System

A minimum of three internal fish bypasses would be required for the Mill Site vertical pump station option at the maximum 2,180-cfs pumping capacity, assuming the normal riverflow of 8,000 cfs during the irrigation season. A pumped bypass system would use the fish-friendly screw or helical pumps that have been tested at RPP over the past several years.

*The fish bypass piping system would be sized to achieve a minimum velocity of 4 fps and designed to limit the exposure along the fish screen to 120 seconds.*

The fish bypass piping system would be sized to achieve a minimum velocity of 4 fps to convey fish back to the river from the fish bypass pump station and minimize sediment deposition in the pipeline. At the minimum bypass entrance velocity of 2 fps, the required flow for each bypass pipeline at normal river elevations is about 36 cfs. The fish bypass would outlet just below the downstream end of the fish screen in the river channel. Alternatively, the fish could be conveyed in a separate pipeline from the fish bypass pumps to the existing drum screen bypass system pipeline. This would require a piped bypass system paralleling the discharge conveyance system to the sedimentation basin, about ½ mile long. The pipeline would be constructed across the sedimentation basins and connect to the existing fish bypass pipe from the drum screen bypass.

Fish bypasses would be designed to limit the exposure along the fish screen to 120 seconds, which is the current exposure time criterion, assuming a variance would be granted by NMFS. Separate pipelines from the entrance of each fish bypass would convey water and fish to a screw/ helical pump station located on the east side of the forebay. An exception to the current "no pumped fish bypass" criterion would be required from NMFS, or an exception to the maximum exposure time would be required to eliminate the need for the fish bypass system.

The fish bypass pump station would be similar to the existing RPP located downstream of the irrigation gates. One 30- to 50-cfs pump would be required for the 4-month Alternative, two for the 2-month Alternative, and three for the Gates-out Alternative. A pipe from the pump station would convey the water and fish back to the river

upstream of the current gravity-flow intake gates as shown on Figure 2.3-1.

### Conveyance Facilities across Red Bank Creek

The conveyance system across Red Bank Creek would consist of pipes or culverts or a combination of both. The most advantageous combination would be considered in the preliminary design. The conveyance system would be sized for a maximum velocity of 8 fps at peak flow. The discharge structure at the sedimentation basin could be located anywhere along the westerly side of the sedimentation basin. The best apparent location and the specific design would be determined during the preliminary design.

A vehicle access bridge would most likely be constructed across Red Bank Creek to provide access for maintenance vehicles between the Mill Site and the existing TCCA facilities.

## 2.2.2 Fish Ladders

Alternatives including new ladders would include changes to the current RBDD fish ladders. These upgrades would entail entrance reconfiguration to improve entrance conditions, and increased attraction flow to better guide the upstream migrating fish to the ladders.

### Right Bank Fish Ladder

The objective of this design is to modify the existing right bank fish ladder to provide improved adult fish passage. This would be accomplished by increasing the Auxiliary Water System (AWS) flow from 265 cfs to 715 cfs. The fish ladder flow would remain at 85 cfs, although new Ice Harbor-type weirs would be installed. The total maximum fish ladder flow would be 800 cfs, including the AWS flow. The fish ladder entrance bay would be reconfigured to enhance fish attraction and to accommodate the increased total flow. This main entrance would be 12 feet by 12 feet with a top-down slide gate to ensure proper entrance conditions at all design tailrace levels. A low-flow entrance (6 feet by 6 feet) would also be included to provide a jet parallel to the dam axis just downstream of the spillway Bay 11 end sill. The low-flow entrance would also have a top-down slide gate for closure or adjustment.

*Fish ladder upgrades would entail entrance reconfiguration to improve entrance conditions, and increased attraction flow to better guide the upstream migrating fish to the ladders.*

The lowest weir (weir number 1) of the existing fish ladder would be abandoned to provide for a larger entrance bay. The entrance bay invert would be at Elevation 232, which would provide 7 feet of water depth in the entrance bay at design low tailwater flows. The entrance bay would have a large floor diffuser and a smaller wall diffuser. The new fish ladder Pools 2 through 5 would have floor diffusers only.

At the design total flow of 800 cfs and the design maximum tailwater, the transit velocity in the entrance bay just before the high-flow fish

ladder entrance is 3.6 fps, which is just below the design maximum transit velocity criterion of 4.0 fps.

The new AWS system would be operated with a constant-flow input to the wall diffuser at all design tailwater flows. Flow to the floor diffusers and the opening of the entrance gates would be controlled to provide a constant 1-foot differential from the entrance bay to the tailwater surface elevation. AWS energy dissipation would be designed to minimize air and hydraulic hot spots on all diffusers.

The existing AWS intake would be abandoned, and a new AWS intake would be constructed in the abandoned louver structure portion of the TC Canal. The AWS intake at the canal would need to be rebuilt to ensure proper flow conditions for the new AWS intake and the existing drum screens. The new AWS intake would have a trashrack with 1-inch bar spacing, an automated trashrack cleaner, and a gross approach flow velocity of 1.0 fps.

#### Left Bank Fish Ladder

After modeling and evaluating various fish ladder flow rates ranging from 1,000 to 3,000 cfs, USBR (1997a) recommended enlarging the left bank fish ladder to a total flow of 1,000 cfs. To simplify the modifications to the left bank fish ladder in the context of the overall configurations for alternatives including improved ladders, an 831-cfs ladder is proposed. This size would allow for diffuser placement similar to that proposed for the right bank fish ladder and substantially simplify the required modifications to the existing ladder.

The objective of this design is to modify the existing left bank fish ladder to provide improved adult fish passage. This would be accomplished by increasing the AWS flow from 265 cfs to 746 cfs. The fish ladder flow would remain at 85 cfs, although new Ice Harbor-type weirs would be installed. The fish ladder entrance bay would be reconfigured to enhance fish attraction and to accommodate the increased total flow. The existing AWS intake would be modified to include 1-inch bar spacing trashracks, an automated trashrack cleaner, and a gross approach velocity of 1.0 fps. The existing AWS intake would serve as a single 96-cfs wall diffuser in the entrance bay. A new AWS intake would be constructed on the left bank just upstream of the existing fish ladder exit. This intake would be similar to the one proposed for the right bank fish ladder and would be sized for the 650-cfs floor diffuser flow. The general layout of the left bank fish ladder is shown on Figure 2.3-2.

### 2.2.3 Research Pumping Plant

The proposed vertical propeller pump station at the Mill Site would be used in combination with the existing RPP to provide irrigation capacity. The existing RPP consists of a four-bay structure that has two

Archimedes screw pumps and one Wemco hidrostal screw pump providing a total 240-cfs effective irrigation flow. The preliminary design would include adding an 80-cfs Wemco hidrostal screw pump in the spare pump bay to provide an additional 80-cfs effective irrigation flow capacity increasing the effective total capacity to 320 cfs from the pump station. Fish screens and a mechanical screen cleaning system would be designed for installation in the Bay 4 conveyance channel. USBR may install the fourth pump and also the fish screens prior to construction of improvements under this project.

### 2.2.4 Dam Bypass

Over the years, there has been consistent interest in various "bypass alternatives" that could be used to improve fish passage while allowing the dam to function. These bypass alternatives typically include proposals to construct a channel through historical river meanders or sloughs along the eastern bank of the river channel. The basic concept is that a bypass channel approximating natural river conditions would be more efficient for passing fish than fish ladders. Additionally, some bypass proponents assert that the channels would be adequate to allow for a return to an 8-month or 12-month gates-in operation at RBDD. The greatest interest in bypass alternatives has been from citizens of Red Bluff, many of whom are concerned about the fate of Lake Red Bluff, which is formed during the gates-in period.

*The greatest interest in bypass alternatives has been from citizens of Red Bluff.*

Bypass alternatives have been formally reviewed in at least three public documents: a 1992 Appraisal Report by USBR, a 1995 Bypass Evaluation Report by USBR, and a 2000 Prescoping Report by CH2M HILL. All three documents have resulted in recommendations that the bypass alternatives not be considered further. However, the general public has disputed all three recommendations.

The bypass channel concept that is being evaluated for this project has been configured to reduce costs, limit flood impacts and liability, and minimize adverse water quality changes to the Sacramento River near RBDD. Specifically, the objective has been to establish physical characteristics that allow for fish passage. The basic approach for the bypass channel has been to focus on non-salmonids, particularly sturgeon, which have more restrictive requirements than salmonids.

In order for the bypass channel to meet all of the concerns consistently expressed by the fishery agencies and engineers, the bypass channel must:

- **Be passable by all species of concern.**

Velocities in the channel should be considerably lower than in standard fish ladders. Literature review suggests that maximum velocities of

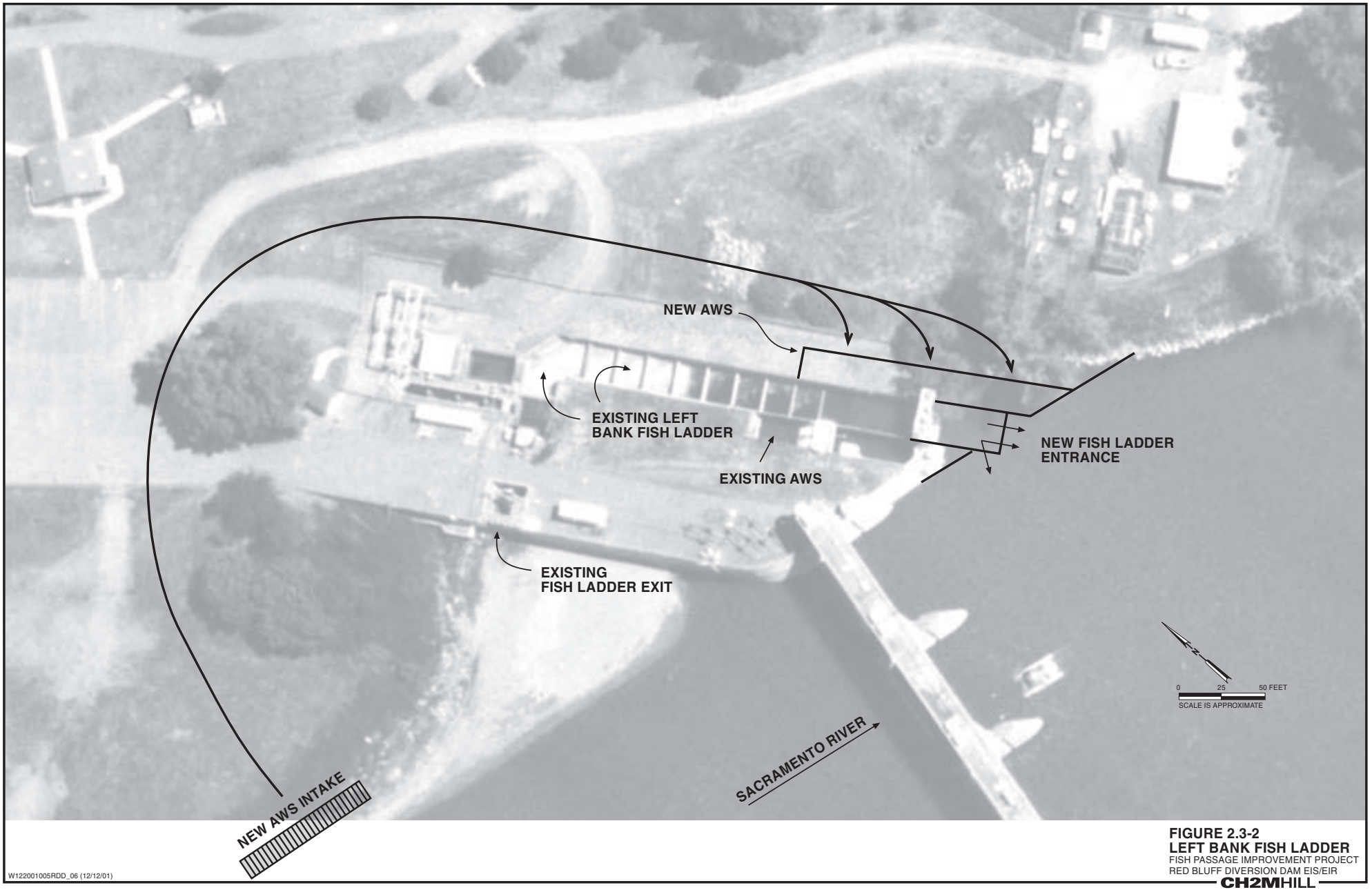


**FIGURE 2.3-2**
**LEFT BANK FISH LADDER**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR
CH2MHILL

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3.0 fps in the majority of the channel would be appropriate to pass non-salmonid species, with maximum velocities of 6.0 fps through very short reaches or slots.

The design includes concrete weirs about 2.5 feet high, placed at 150-foot intervals along the bypass channel. The weirs should be arch-shaped (in the horizontal direction) to provide more flow in the center of the channel and add complexity to the flow regime. The design also includes two full depth slots in each weir, approximately 5 feet wide, to provide fish passage without requiring the fish to swim over the weirs.

- **Avoid creation of slack waters and predator holding habitat either above or below the dam.**

The bypass channel is configured to minimize the distance between the bypass entrance and exit and the dam itself. This configuration is intended to eliminate any additional slack water created by the bypass facility. Further, the location of the downstream end of the channel is intended to supplement attraction water to the left bank fish ladder, theoretically improving the performance of the ladder.

- **Avoid areas or conditions of potential stranding.**

Like other fish passage facilities, the bypass channel will be designed with flow depths to provide adequate fish passage and the requisite pool volume for energy dissipation. The channel configuration will also ensure complete drainage without pools where fish could be stranded.

The design includes a small, V-shaped concrete subchannel on each side to provide drainage of the facility. The bottom of the main channel would be sloped to drain toward each V-shaped subchannel from the center of the bypass channel. The arched weirs are assumed to be configured convex relative to the direction of the flow based on the premise that this will reduce stranding and further enhance drainage. Additionally, it is assumed that the rock covering the bottom of the channel would be grouted to prevent juvenile fish from hiding in the voids between the rocks and becoming stranded.

- **Provide enough attraction flow for the fish to readily find the bypass.**

The bypass channel should re-enter the river as close as possible to the downstream side of RBDD to enhance the ability of migrating fish to find the channel.

- **Avoid new facilities that recreate or move existing barriers.**

To minimize cost, the bypass channel was located so as to minimize interference with the Discovery Center, the existing road, the USFS campground, and the existing fish ladder and its proposed improvements.

- **Be structurally stable at all flows (i.e., it must not trigger a shift in the river's channel).**

When the RBDD gates are in, only minor fluctuations in the water surface elevation behind the dam are expected. Therefore, flow control can be achieved with a simple weir concept. Another element of flow control is the ability to close off the bypass channel. A control structure will be constructed at the levee near the upstream entrance to the bypass channel to incorporate the weir and a set of large gates for closing the channel to reduce flood damage and maintenance.

- **Be able to accommodate the flow fluctuations that can be expected during the periods of use.**

The flow control structure should be designed to close off the bypass channel from the Sacramento River when there is potential for flooding. The existing levee is high enough to protect against a 100-year flood in the river. However, it may still be possible for overland flow from other adjacent waterways to enter the bypass channel downstream of the levee. Rock slope protection will be used to provide bank stability and protection from erosion.

- **Be free of constant or intensive maintenance efforts.**

Current designs of the bypass channel include three features intended to keep maintenance efforts at a reasonable level. The channel includes gates at the upstream end that will minimize the amount of debris in the channel during periods of non-use, particularly during winter flood events. The channel would also be contoured to allow drainage via subchannels along both sides of the floor of the channel. The floor of the channel would be grouted to avoid stranding juvenile fish during dewatering of the channel. The channel would be armored with rock to minimize scour and sloughing of the banks.

- **Be economically viable.**

At 1,000 cfs, the channel would carry approximately the same amount of flow as an improved fish ladder, while at the same time, the capacity would be small enough to keep the size and the cost of the facility at a

reasonable level. Final cost estimates will be available pending technical review of the design.

- **Be safe (i.e., not create a dangerous, attractive public nuisance).**

Most fish passage facilities, including this bypass channel, have inherent safety risks associated with high velocities, orifices and notches, submerged or exposed obstacles, and other elements of the facility. Accordingly, boating and other potential public uses of the bypass channel would carry serious safety and liability issues. Public use of this facility is viewed as incompatible with the fisheries use. The perimeter

of the bypass channel should be securely fenced, and the flow control structure at the upstream end should be designed to prevent boats from entering from the Sacramento River.

The proposed layout of the bypass channel is presented on Figures 2.3-3 and 2.3-4.

# 2.3 Construction Methods

The following descriptions of construction methods are intended to provide a general overview of the types of construction methods anticipated to be used during construction of the facilities described in the previous section. It is important to note that individual construction contractors may use different construction methods depending on construction timing, funding, developments in technology, or future permit conditions.

## 2.3.1 General Construction Methods

The primary features of construction would be excavation, construction of concrete structures, and fill and re-grading operations. In basic terms, this would require large pieces of equipment for digging, moving soil, and pouring concrete. Additionally, because a large portion of the construction activity would occur near the Sacramento River, long series of sheet pile would likely be required to establish dry areas for forming concrete structures. Sheet pile are installed using a pile driver, vibratory hammer, or other similar piece of equipment.

*The primary features of construction would be excavation, construction of concrete structures, and fill and re-grading operations.*

Overall, approximately 800,000 cubic yards (CY) of material would need to be excavated to facilitate the construction of the Fish Passage Improvement Project. At this time, it is anticipated that the majority of this soil, or approximately 600,000 CY of material, would be stored onsite (specific locations to be determined - possibly in the existing drainage/sedimentation basins onsite). Approximately 2,000 linear feet (LF) of sheetpile would be required to construct various cofferdams in several locations. The Fish Passage Improvement Project would require a myriad of construction equipment including cranes, front end loaders, pile drivers, backhoes, excavators, scrapers, bulldozers, dump trucks, and other construction equipment and tools.

### Mill Site Pump Station and Conveyance Facilities

Construction of the Mill Site Pump Station would require excavation of a large forebay. Approximately 750,000 CY of material would be excavated under the Gates-out Alternative. It is anticipated that a large portion of that material (approximately 580,000 CY) would be disposed of onsite. The remainder of excavated material would likely be hauled offsite to a disposal facility. A complete pile-driving set-up would be required, as well as a construction barge and extensive earthmoving

equipment. Divers would most likely be used to cut sheetpiling under water. A large cofferdam would be required adjacent to the river, approximately 1,400 LF under the Gates-out Alternative. The cofferdam would be dewatered prior to construction.

#### Right Bank Fish Ladder

Construction of the right bank fish ladder would require approximately 8,000 CY of excavation and would require an approximately 300-LF cofferdam.

#### Left Bank Fish Ladder

Construction of the left bank fish ladder would require the excavation of approximately 16,000 CY and an approximately 200-LF cofferdam.

#### Research Pumping Plant

The fourth bay in the RPP structure currently exists; therefore, no excavation would be required. A new pump would be installed in an existing bay.

*The schedule depends primarily on funding, but other factors are also important, such as timely reviews and facility option and alternative selection, as well as acquisition of required permits and rights-of-way.*

### 2.3.2 Construction Schedule

The project schedule is shown on Figure 2.3-5. The schedule depends primarily on funding, but other factors are also important, such as timely reviews and facility option and alternative selection, as well as acquisition of required permits and rights-of-way. The schedule has been updated from the schedule shown in the Prescoping Report, which was based on the assumption that the funding for the preliminary design would be available on or before January 1, 2000, as well as other unknowns. However, funds were not available until March 10, 2000, and reviews, approvals, and public processes are taking longer than initially anticipated. The construction schedule Phase IV assumes the most complex combination of facilities, which is the 4-month Improved Ladder Alternative. This is the most complex schedule because of the sequencing required to maintain operation of two of the current fish ladders while one of the fish ladders is being upgraded. If the Gates-out Alternative or 2-month Existing Ladders Alternative were selected (no fish ladder upgrades) and all of the pumping capacity were to be developed at an offsite pump station, then the schedule would be simplified or could be reduced.

## 2.4 Adaptive Management

Because of the inherent uncertainty involved in complex systems such as fisheries, all of the alternatives considered would include an Adaptive Management Program. Adaptive management acknowledges that there is a need to constantly monitor such systems and adapt actions that are taken to restore ecological health and improve water

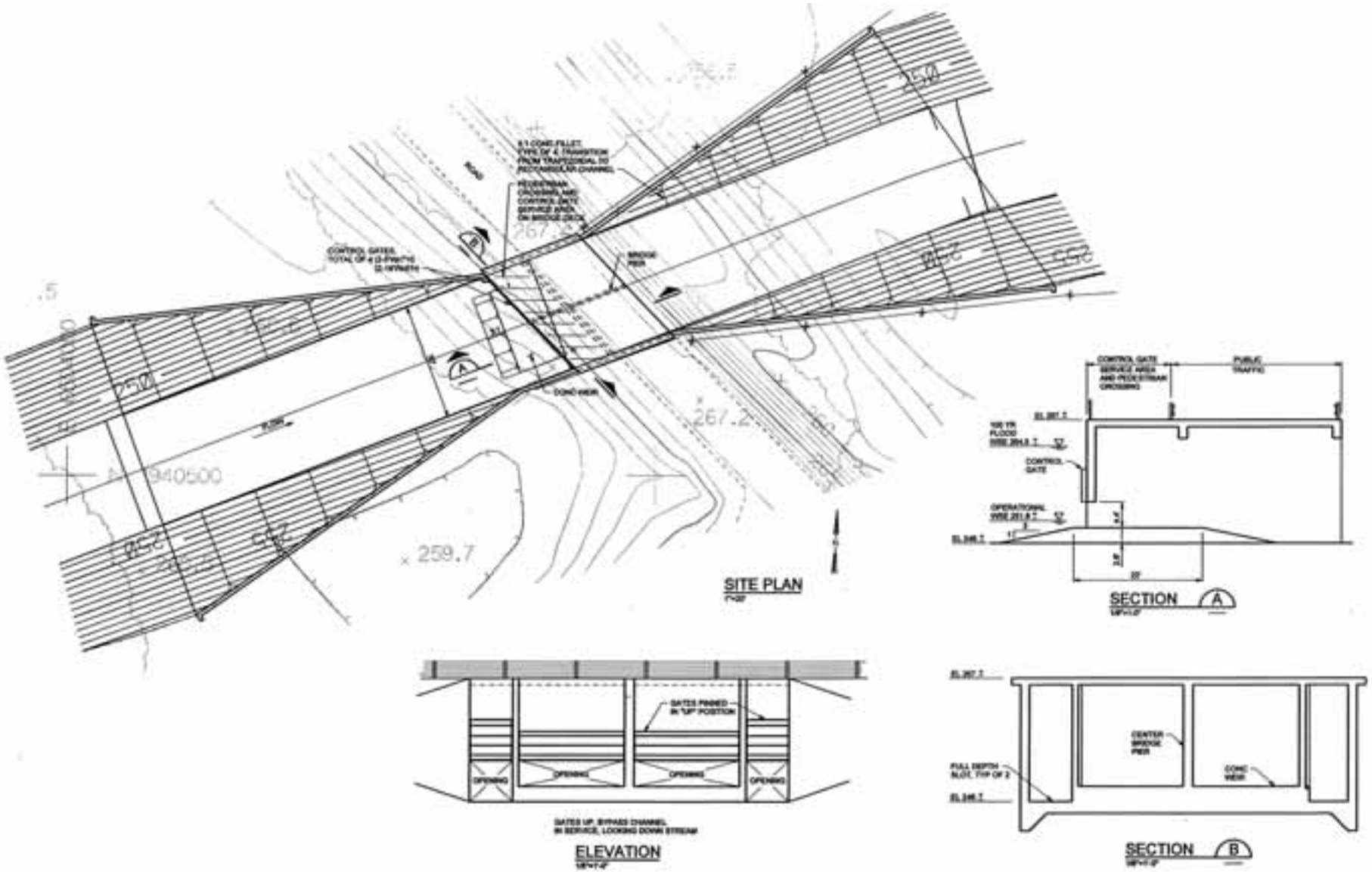


**FIGURE 2.3-3**
**RBDD BYPASS CHANNEL CONTROL STRUCTURE PLAN AND SECTIONS**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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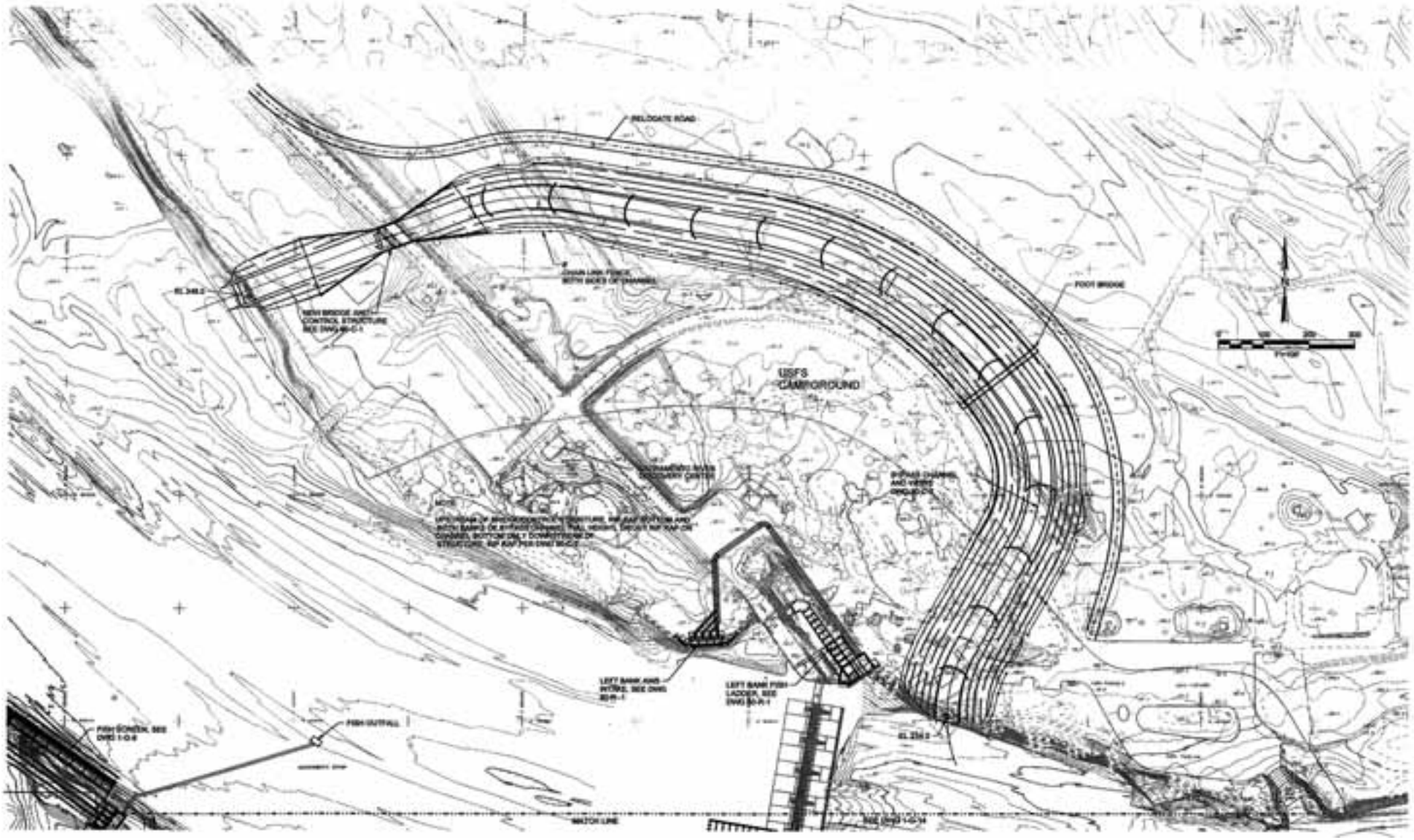


**FIGURE 2.3-4**
**RBDD SITE GRADING PLAN**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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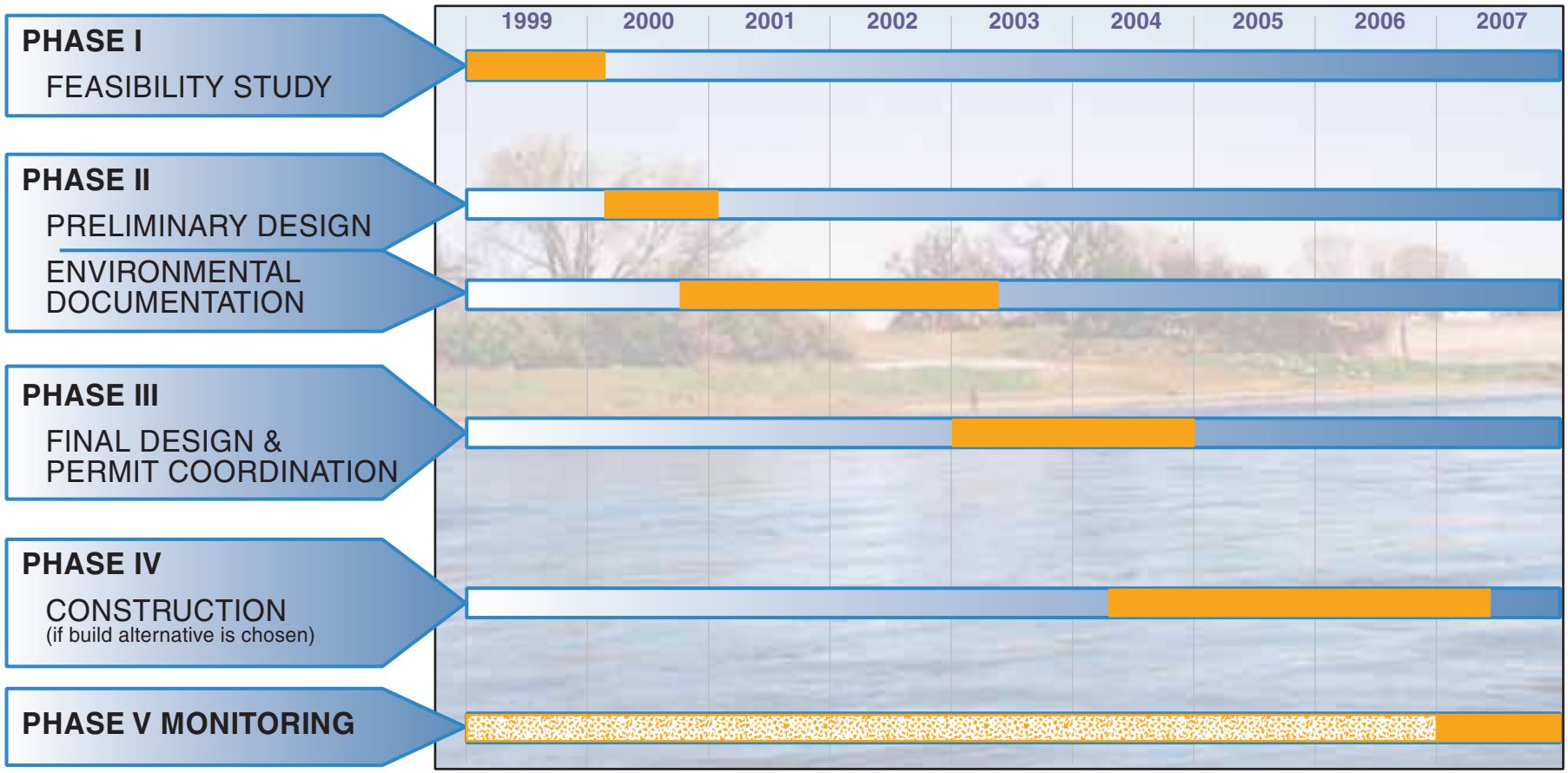


**FIGURE 2.3-5**
**CONSTRUCTION SCHEDULE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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management. These adaptations are necessary because conditions continue to change, and the knowledge base and understanding of systems continues to improve. By including an Adaptive Management Program in all of the alternatives, it is possible to acknowledge areas of uncertainty in a given system and still allow decision makers to take action before scientific consensus is achieved. However, this places a great deal of importance on the design of the Adaptive Management Program. The Draft Adaptive Management Program is included as Appendix H.

***All of the alternatives considered would include an Adaptive Management Program.***

Experiments to evaluate established hypotheses would be designed after a specific alternative is selected. Because the design and implementation of experiments have important ramifications to future gate operations, it is important to also include a feedback loop that includes interested Sacramento River stakeholders, including representatives interested in maximizing gates-in operations. Therefore, the following administrative processes would also constitute an important part of the overall Adaptive Management Program:

- Technical actions would be selected by members of the Adaptive Management Science Team, which would include representatives from USBR, TCCA, USFWS, NMFS, CDFG, and California Department of Water Resources (DWR). Technical Actions would include:
  - Refinement of hypotheses to be tested
  - Design of experiments to test hypotheses
  - Review of applicable monitoring information from other, related efforts in the Sacramento River basin
  - Annual reporting on results of experiments, and summary reporting on results of experiments every 6 to 10 years
- Public workshops or other appropriate mechanisms for policy review would be used to provide an opportunity for stakeholder review and comment on proposed actions and annual and summary reporting of the Adaptive Management Science Team. Membership in the Policy Review Board would include representation from the following agencies/interest groups:
  - USBR
  - TCCA
  - City of Red Bluff
  - Lake Red Bluff special interest
  - Sacramento River sport fishing
  - Salmon commercial fishing

As appropriate, other special interests may be added to the Policy Review Board. The role of the Policy Review Board would be to provide input to the Adaptive Management Science Team regarding overall approach and focus.

# 3.0 Environment and Environmental Consequences

## 3.1 Introduction

Chapter 3 describes the affected environment and the environmental consequences of implementing the various alternatives described in Chapter 2. Issues discussed include the fishery resources, water resources, biological resources, recreation, land use, geology, agricultural resources, power resources, socioeconomics, cultural resources, visual and aesthetic resources, air quality, traffic and circulation, noise, and environmental justice.

Each section includes a discussion of the affected environment (CEQA existing conditions), environmental consequences (CEQA environmental impacts), methodology, significance criteria (if applicable), and mitigation measures (if applicable). Section 4.5, Environmental Commitments and Mitigation and Significant Unavoidable Impacts provides a summary of significant adverse environmental impacts and proposed mitigation, the anticipated level of significance after mitigation is implemented, and those impacts that cannot be avoided and remain significant in accordance with Public Resources Code Section 21100, subd. (b)(2) and *CEQA Guidelines* Section 15126. Section 4.3, Irreversible and Irretrievable Commitments of Resources and Significant Impacts that Would Remain Unavoidable Even after Mitigation, also addresses significant unavoidable impacts. Some sections address issues only required to satisfy federal law (e.g., NEPA), and are not required to comply with CEQA. For example, because CEQA generally does not require lead agencies to consider the purely economic or social effects of proposed projects, Sections 3.10 (Socioeconomics) and 3.16 (Environmental Justice) were not prepared with CEQA compliance in mind. Sections are generally organized in the following manner:

- Affected Environment (CEQA Existing Conditions): These subsections describe the existing regional and local conditions. Information presented is the most current available and is used as the CEQA baseline for analysis for all sections that are qualitatively analyzed.
- Environmental Consequences (CEQA Environmental Impacts): These subsections identify the anticipated impacts within the context of each alternative. Those impacts that are deemed to be potentially significant prior to mitigation are identified as such in

the text. The following subsections are also presented under Environmental Consequences:

- Methodology: These subsections identify the method used to analyze impacts, as well as the key assumptions used in the analysis process.
- Significance Criteria: These subsections present the criteria and thresholds used to identify potentially significant effects on the environment in accordance with Public Resources Code Section 21082.2, and *CEQA Guidelines* Sections 15064 and 15065. Thresholds include guidance provided by Appendix G of the *CEQA Guidelines*, as well as agency standards or legislative or regulatory requirements as applicable, in addition to professional judgement. All impacts that do not exceed the stated significance criteria described for each section are assumed to be less than significant and are therefore not discussed in detail in the document (Public Resources Code Section 21100 and *CEQA Guidelines* Sections 15128).

- Mitigation: These subsections identify what lead agency staff and consultants believe to be potentially feasible mitigation measures that would reduce significant impacts associated with each of the alternatives. Where no feasible mitigation can be identified, such impacts are identified as significant and unavoidable.

Each alternative was analyzed using the criteria identified in Chapter 2. The assumptions are listed below.

**No Action Alternative—**No changes to hydrology or surface-water management would occur. Gates would be operated during the current 4-month gates-in period. Construction activity would be limited to the installation of the fourth pump at RPP. No other construction activity would occur as a result of the No Action Alternative.

**1A: 4-month Improved Ladder Alternative—**Includes a new 1,380-cfs pump station at the Mill Site and new left bank and right bank fish ladders.

**1B: 4-month Bypass Alternative—**Includes a new 1,000-cfs bypass channel on the left bank, a new 1,380-cfs pump station at the Mill Site, and a new right bank fish ladder.

**2A: 2-month Improved Ladder Alternative—**Includes a new 1,680-cfs pump station at the Mill Site and new right bank and left bank fish ladders.

**2B: 2-month with Existing Ladders Alternative—**Includes a new 1,680-cfs pump station at the Mill Site.

**3: Gates-out Alternative—**Includes a new 2,180-cfs pump station at the Mill Site.

# 3.2 Fishery Resources

Fishery resources include fish populations, their habitats, and the harvest of those populations. This section discusses the existing environment within the Sacramento River Basin and Central Valley. The fishery resources in the Sacramento River near RBDD consist of a diverse assemblage of fish species including native anadromous salmonids (NAS), other native anadromous fish (NAO), non-native anadromous fish (NNA), and resident native and non-native fish (RN and RNN). Table 3.2-1, provides a species list of those fish that may likely be found at or near RBDD at some time during their life history.

**TABLE 3.2-1**
Fish Found in the Sacramento River Near Red Bluff

| Common Name | Scientific Name | Group | Native | Introduced |
|---|---|---|---|---|
| Chinook salmon[a] | *Oncorhynchus tshawytscha* | NAS[b] | X | |
| Steelhead[c] | *Oncorhynchus mykiss irideus* | NAS | X | |
| Sockeye salmon | *Oncorhynchus nerka* | NNAS[d] | | X[e] |
| Pink salmon | *Oncorhynchus gorbuscha* | NNAS | | X[f] |
| Pacific lamprey | *Lampetra tridentata* | NAO[g] | X | |
| River lamprey | *Lampetra ayresi* | NAO | X | |
| Green sturgeon | *Acipenser medirostris* | NAO | X | |
| White sturgeon | *Acipenser transmontanus* | NAO | X | |
| Striped bass | *Morone saxatilis* | NNA[h] | | X |
| American shad | *Alosa sapidissima* | NNA | | X |
| Rainbow trout[i] | *Oncorhynchus mykiss* | RN[j] | X | |
| Hitch | *Lavinia exilicauda* | RN | X | |
| Sacramento splittail | *Pogonichthys macrolepidotus* | RN | X | |
| Hardhead | *Mylopharodon conocephalus* | RN | X | |
| Sacramento pikeminnow | *Ptychocheilus grandis* | RN | X | |
| Speckled dace | *Rhinichthys osculus* | RN | X | |
| California roach | *Hesperoleucus symmetricus* | RN | X | |
| Sacramento sucker | *Catostomus occidentalis* | RN | X | |
| Tule perch | *Hysterocarpus traski* | RN | X | |
| Prickly sculpin | *Cottus asper* | RN | X | |
| Riffle sculpin | *Cottus gulosus* | RN | X | |
| Sacramento blackfish | *Orthodon microlepidotus* | RN | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | RN | X | |
| Brown trout | *Salmo trutta* | RNN[k] | | X |
| Threadfin shad | *Dorosoma petenense* | RNN | | X |
| Largemouth bass | *Micropterus salmoides* | RNN | | X |
| Spotted bass | *Microterus punctulatus* | RNN | | X |
| Smallmouth bass | *Micropterus dolomieui* | RNN | | X |
| Green sunfish | *Lepomis cyanellus* | RNN | | X |
| Bluegill | *Lepomis macrochirus* | RNN | | X |
| Redear sunfish | *Lepomis microlophus* | RNN | | X |
| Pumkinseed | *Lepomis gibbosus* | RNN | | X |
| Black crappie | *Pomoxis nigromaculatus* | RNN | | X |

**TABLE 3.2-1**
Fish Found in the Sacramento River Near Red Bluff

| Common Name | Scientific Name | Group | Native | Introduced |
|---|---|---|---|---|
| White crappie | *Pomoxis annularis* | RNN | | X |
| Channel catfish | *Ictalurus punctatus* | RNN | | X |
| White catfish | *Ictaurus catus* | RNN | | X |
| Black bullhead | *Ictalurus melas* | RNN | | X |
| Yellow bullhead | *Ictalurus nalalis* | RNN | | X |
| Golden shiner | *Notemigonus crysoleucas* | RNN | | X |
| Fathead minnow | *Pimephales promelas* | RNN | | X |
| Goldfish | *Carassius auratus* | RNN | | X |
| Carp | *Cyprinus carpio* | RNN | | X |
| Mosquitofish | *Gambusia affinis* | RNN | | X |

Notes:

Sources: Moyle, 1976; Lee et al., 1980; Brown and Killam, pers. comm.

[a]Fall, late-fall, spring, and winter chinook salmon runs
[b]Native anadromous salmonid
[c]Anadromous form of *O. mykiss*
[d]Non-native anadromous salmonid
[e]Likely non-native kokannee salmon
[f]Non-native to the Sacramento River
[g]Other native anadromous
[h]Non-native anadromous
[i]Resident form of *O. mykiss*
[j]Resident native
[k]Resident non-native

*The Sacramento River in the vicinity of RBDD provides essential habitat for the freshwater life stages of chinook salmon and steelhead.*

## 3.2.1 Affected Environment

### Native Anadromous Salmonids (Chinook Salmon and Steelhead)

The Sacramento River in the vicinity of RBDD provides essential habitat for the freshwater life stages of chinook salmon and steelhead. Within California's Central Valley, the Sacramento River provides a corridor for the anadromous salmonid resources between upstream reaches and the tributaries to the Sacramento River and the Pacific Ocean. The Sacramento River is the largest river system in California with more than 90 percent of the Central Valley salmon spawning and rearing within the Sacramento River system. The Sacramento River supports four runs (races) of chinook salmon: fall, late-fall, winter, and spring run. Table 3.2-2 shows the average, low, and high number of chinook salmon and steelhead spawners estimated to pass upstream of RBDD from 1970 through 1999. Table 3.2-3 presents a summary of life history timing for native anadromous salmonids in the Sacramento River near RBDD.

*The Sacramento River supports four runs (races) of chinook salmon: fall, late-fall, winter, and spring run.*

**TABLE 3.2-2**
Estimated Chinook Salmon Spawning Escapement Upstream of RBDD (1970 through 1999)[a]

| Species | Average | Low (year) | High (year) |
|---|---|---|---|
| Fall | 75,017 | 29,898 (1977) | 205,487 (1997) |
| Late-fall | 10,131 | 291 (1994) | 19,261 (1975) |
| Winter | 10,783 | 189 (1994) | 53,089 (1971) |
| Spring | 6,960 | 163 (1998) | 25,095 (1976) |
| Steelhead | 4,189 | 104 (1998) | 13,240 (1970) |

[a]Source: CDFG, unpublished.

**TABLE 3.2-3**
Life History Timing for Native Anadromous Salmonids in the Sacramento River Near RBDD

| Name | Adult Immigration | Spawning | Incubation | Rearing | Juvenile Emigration |
|---|---|---|---|---|---|
| Fall Chinook | Jul-Dec | Oct-Dec | Oct-Mar | Dec-Jun | Dec-Jul |
| Late-fall Chinook | Oct-Apr | Jan-Apr | Jan-Jun | Apr-Nov | Apr-Dec |
| Spring Chinook | Apr-Jul | Aug-Oct | Aug-Dec | Oct-Apr | Oct-May |
| Winter Chinook | Dec-Jul | Apr-Aug | Apr-Oct | Jul-Mar | Jul-Mar |
| Steelhead | Aug-Mar | Dec-Apr | Dec-Jun | Year-round (1 to 2 years) | Jan-Oct |

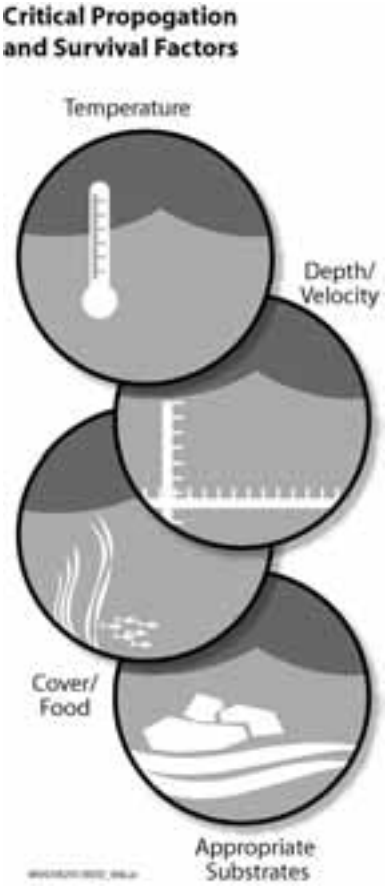
Figure 3.2-1 shows the annual trends in their escapement upstream of RBDD chinook and steelhead over the last 30 years. (Note: the figures pertaining to Section 3.2 reference No Action Alternative as "NAA.")

**Life History Characteristics and Habitat Requirements.** As shown on Figure 3.2-2, each of the five salmonid species have distinct periods when the adults are actively immigrating upstream through the project area. Factors that may affect the timing of adult passage include water-year type, river flows, weather events, and RBDD operations.

*Factors that may affect the timing of adult fish passage include water-year type, river flows, weather events, and RBDD operations.*

Habitat needs of the four runs of salmon and steelhead are similar, but each species differs somewhat in its freshwater habitat requirements. The habitat needs of salmon and steelhead include physical habitat for adult migration and holding, spawning and egg incubation, fry and juvenile rearing, and smolt emigration. Adequate flows, water temperatures, water depths and velocities, appropriate spawning and rearing substrates, and the availability of in-stream cover and food are critical for the propagation and survival of all salmonids in the Sacramento River.

In the vicinity of RBDD, the Sacramento River acts primarily as a transport corridor for adults immigrating upstream, juvenile fry rearing and dispersing, and smolts emigrating downstream. In addition, fall-run chinook salmon and, to a lessor degree, the winter-run and other salmon species are known to spawn in the vicinity of RBDD both immediately upstream and, to a lessor degree, downstream of RBDD.




The periods when juveniles (fry, pre-smolt, and smolt salmon; and fry, sub-yearling, and yearling steelhead) are migrating downstream past RBDD are shown on Figure 3.2-3. In addition to passage, fry and pre-smolt salmon and sub-yearling and yearling steelhead may rear or reside in the vicinity of RBDD. Timing of smolt emigration is dependent on species, flow conditions, and water-year type.

**Species Listed or Proposed for Listing under ESA or CESA.** All five anadromous salmonid species that are present at RBDD during some period in their life history are either listed by CESA and/or the federal ESA, or are listed as candidates under the federal ESA. The following list includes each species' status, date of listing, and their date of Critical Habitat Designation (if applicable):

- Winter-run chinook salmon
  - CESA 9/22/89
  - ESA 1/4/94
  - Habitat Designated 3/32/99
- Spring-run chinook salmon
  - California Threatened 2/5/99
  - Federal Threatened 9/16/99
  - Habitat Designated 2/16/00
- Steelhead-Central Valley chinook salmon Evolutionary Significant Unit (ESU)
  - Federal Threatened 3/19/98
  - Habitat Designated 2/16/00
- Central Valley fall/late-fall chinook salmon ESUs
  - Federal Candidate/Not Warranted for Listing, 9/16/99

***All fiveanadromous salmonid species that are present at RBDD during some period in their life history are either listed by CESA and/or the federal ESA, or are listed as candidates under the federal ESA.***

For Sacramento River winter-run chinook salmon ESU, critical habitat is designated to include the Sacramento River from Keswick Dam, Shasta County (River Mile [RM] 302), to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta); all waters from Chipps Island westward to Carquinez Bridge including Honker Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.

For Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), critical habitat is designated to include all river reaches accessible to listed chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Delta; all waters from Chipps Island westward to Carquinez

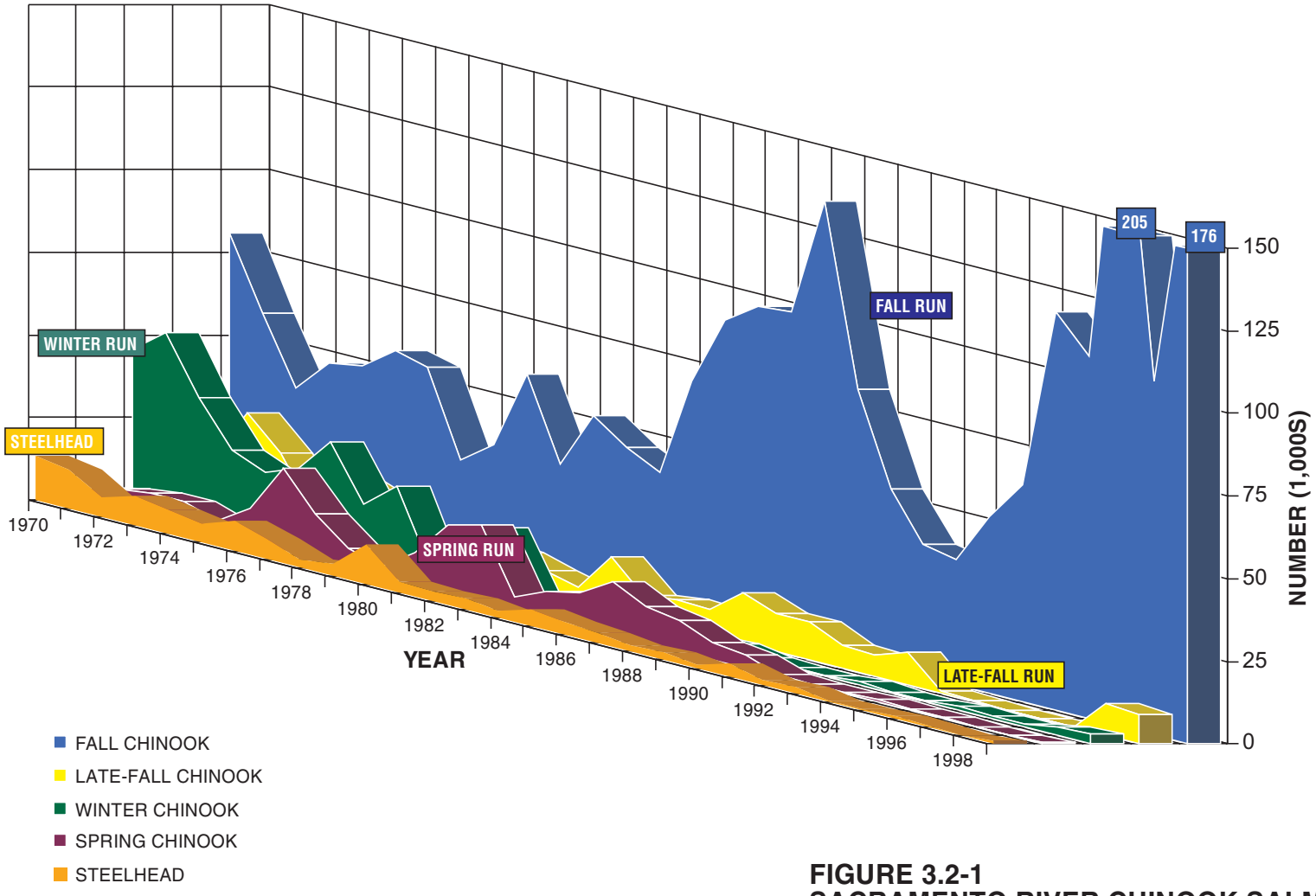



**FIGURE 3.2-1**
**SACRAMENTO RIVER CHINOOK SALMON AND STEELHEAD SPAWNING ESCAPEMENT ESTIMATES FOR 1970 TO 1999 UPSTREAM OF RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_994 (8/19/02)

CH2MHILL

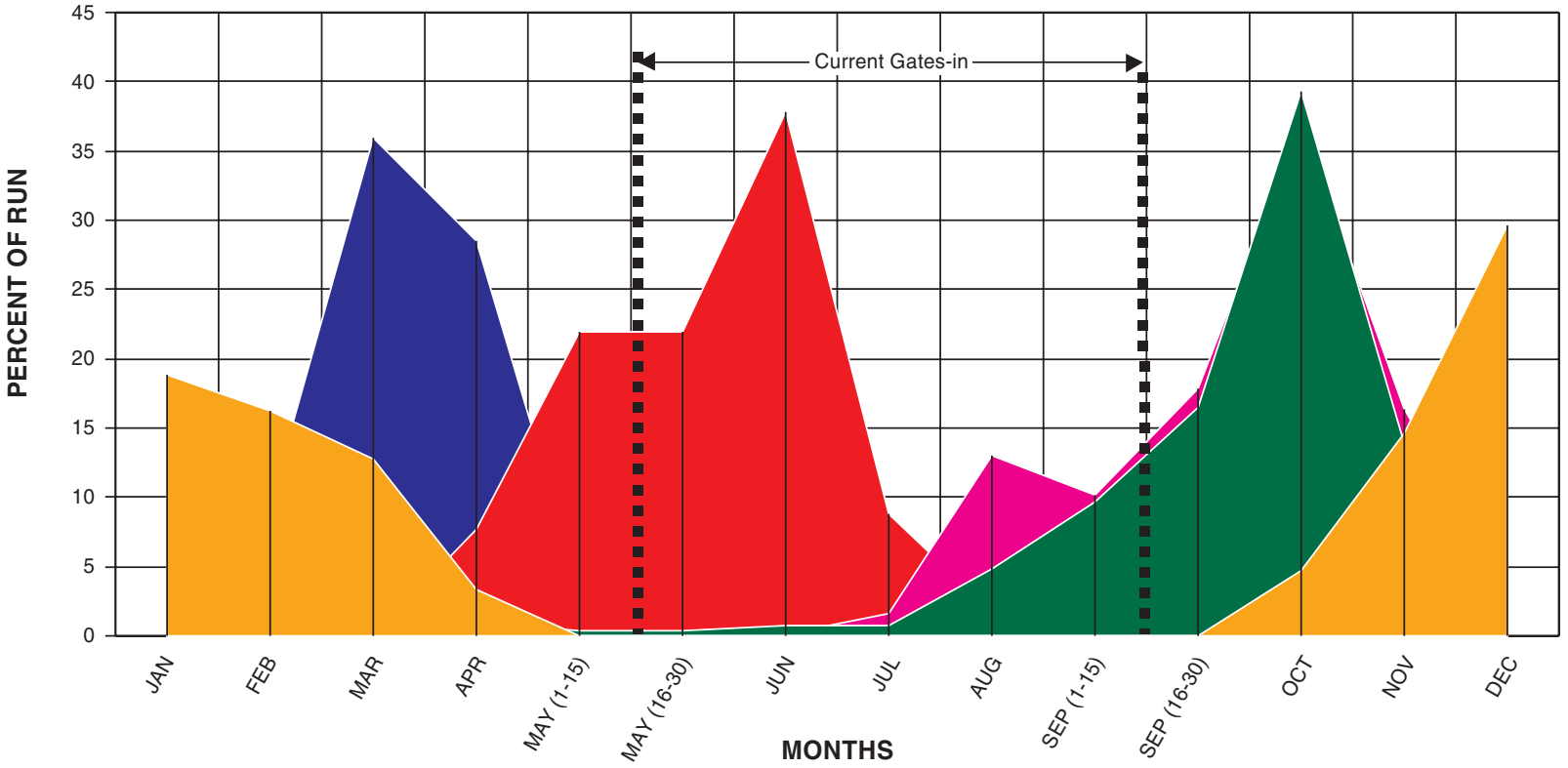



**FIGURE 3.2-2**
**ADULT CHINOOK SALMON AND STEELHEAD PASSAGE AT RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

CH2MHILL

W072002003RDD_09C (8/12/02)

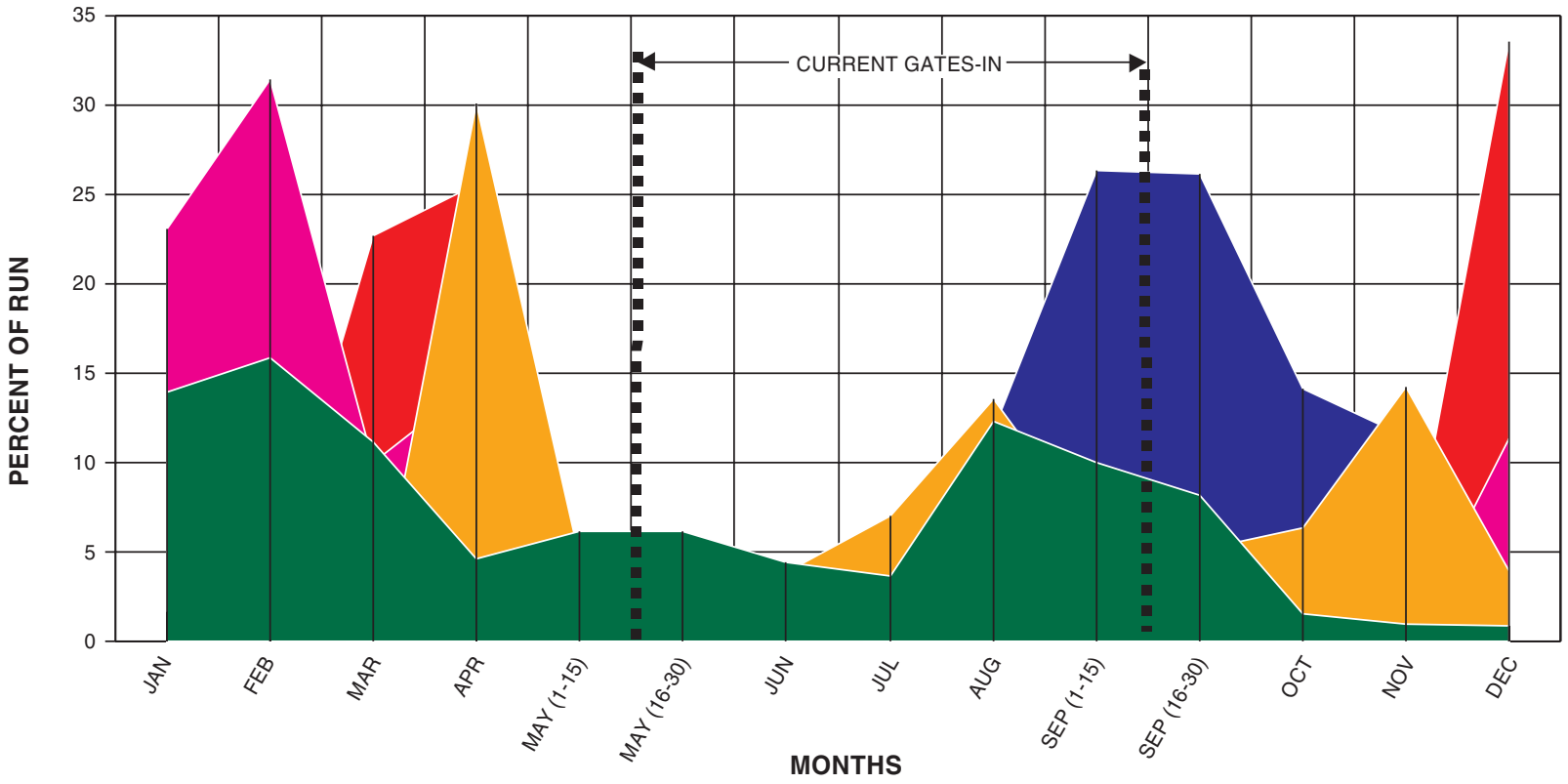



**FIGURE 3.2-3**
**JUVENILE CHINOOK SALMON AND STEELHEAD PASSAGE AT RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

CH2MHILL

W072002003RDD_09D (8/15/02)

Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

Critical habitat for Central Valley steelhead ESU is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin rivers and their tributaries in California. Also included are adjacent riparian zones, as well as river reaches and estuarine areas of the Delta; all waters from Chipps Island westward to Carquinez Bridge including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence, tribal lands, and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

On April 30, 2002, the United States District Court for the District of Columbia approved a NMFS consent decree withdrawing critical habitat designations for 19 salmon and steelhead populations on the West Coast including the Sacramento River winter-run and spring-run chinook salmon and Central Valley steelhead. The move was in response to litigation challenging the process by which this agency established critical habitat. Under the ESA, NMFS is required to analyze the economic impacts on affected businesses, communities, and individuals when designating critical habitat for salmon and steelhead. NMFS is currently conducting a new, more thorough analysis consistent with a recent decision of the United States 10th Circuit Court of Appeals and will re-issue critical habitat designations after that analysis is completed. This action does not significantly affect protection of listed chinook salmon and steelhead. ESA status for these species is unchanged, and Sections 4, 7, 9, and 10 of the ESA involving protective actions remain in effect.

**Impacts of Current Operations on Native Anadromous Salmonids.** Current operation of RBDD includes a 4-month period of time (mid-May through mid-September) when the dam gates are placed in the river, creating a velocity barrier and whitewater turbulence that prevents or impedes adult fish passage. Placement of the dam gates into the river results in blockage and delay of migrating adult salmon and steelhead (Vogel et al., 1988; Hallock et al., 1982; Hallock, 1987). Vogel et. al., (1988) determined from salmon tagging studies conducted from 1983 through 1998, that between 8 percent and 44 percent of adult chinook

salmon, depending on run, were blocked from passing upstream of RBDD. Similarly, Hallock et al., (1982) determined that passage of 15 percent to 43 percent of adult chinook salmon, depending on run, were blocked and RBDD. Fish ladders are currently operational on the east and west ends and at the center of RBDD. These currently operate during the gates-in period to provide upstream passage of adult salmonids. Vogel et al., (1988) determined that the mean time of delay in passage of adult chinook salmon at RBDD was greater than 3 to greater than 13 days depending on the run. Radio telemetry investigations conducted from 1999 to 2001, using adult fall-run chinook salmon, indicate that delay in passage, under existing conditions at RBDD, may average approximately 21 days (USFWS, unpublished data). CDFG has determined the existing fish ladders at RBDD may be inefficient in passing spring-run chinook salmon at RBDD (CDFG, 1998). Currently adult late-fall chinook salmon pass unimpeded at RBDD because they immigrate during months (October through March) when the RBDD gates are out of the water and no barrier exists. Figure 3.2-2 shows timing of adult salmonids in the vicinity of RBDD. The passage timing for adult salmonids was obtained from data collected from fish ladder counts conducted at RBDD from 1982 to 1986 for fall, late-fall, and winter chinook salmon and steelhead (USFWS/CDFG, unpublished data). For spring chinook salmon, some of which may pass RBDD prior to installation of the RBDD dam gates, the current (1995 though 2000) ladder counts were used to estimate passage timing (USFWS/CDFG, unpublished data). For ladder counts made during 1995 and 2000, the average monthly percent (44 percent) of spring chinook passing RBDD during May were distributed equally between the before gates-in (<May 15) and after gates-in (>May 15) periods.

***Spring-run chinook salmon are, by far, the andromous salmonid most affected by current gates-in operations.***

Under current operations, approximately 15 percent of winter chinook adult spawners passing through the project area may be blocked or delayed RBDD (CDFG, 1998; USFWS/CDFG, unpublished data). Up to 25 percent of the annual run of fall chinook salmon may be affected by the current gates-in operation. By far, the greatest effect on adult anadromous salmonids is to spring-run chinook salmon. As many as approximately 72 percent of the annual adult spring chinook passing through the project area must do so during gates-in operation (Figure 3.2-2). Impedance of these adult spring chinook by RBDD operations may adversely affect their ability to successfully pass upstream into and through the Sacramento River and into tributary streams and headwater reaches (CDFG, 1998). It is in these headwater reaches in the tributaries and the most upstream portion of the mainstem Sacramento River that the majority of spring-run chinook salmon must hold throughout the summer months before spawning in the early fall. For migrating adult steelhead, approximately 17 percent of the annual adult steelhead, run may be affected by the current gates-in operation. The biological consequences of blockage or passage delay

at RBDD results in changes in spawning distribution (Hallock, 1987), hybridization with fall chinook (CDFG, 1998), increased adult pre-spawning mortality (USBR, 1985), and decreased egg viability (Vogel et al., 1988), all of which result in the reduction in annual recruitment of this species.

During gates-in periods at RBDD, juvenile life stages of all anadromous salmonids migrate downstream (emigrate) through the project facilities. During gates-in operation, existing pathways for juvenile salmonids at RBDD include passage under the dam gates; the fish ladders and their auxiliary water systems; or the bypass systems at RPP and TC Canal headworks; or impingement on the screens or entrainment into the canal. Existing RBDD operations may result in increased predation of juvenile salmonids by both Sacramento River pikeminnow and striped bass (also known as stripers) congregated immediately below the dam. Vondracek and Moyle (1983) reported that the cause of mortality of juvenile salmonids at RBDD was the result of a dysfunctional predator-prey relationship created by RBDD and Sacramento pikeminnow (formerly squawfish).

Through investigations conducted at RBDD, USFWS (1981) concluded that mortality of up to 42 percent of downstream migrant steelhead and greater than 50 percent of chinook salmon occurred, likely as a result of predation of those juveniles by pikeminnow downstream of the dam. Using divers, surface observations, and stomach contents analysis, Vogel et al., (1988) determined that adult Sacramento pikeminnow were the principal predator on juvenile salmon passing RBDD. Hallock (1987) reported that stomach content analysis confirmed that adult striped bass were also preying on juvenile salmon passing through RBDD. Furthermore, Tucker et al., (1998) determined that during summer months (gates-in operations), approximately 66 percent (by weight) of the stomach contents of Sacramento pikeminnows consisted of juvenile salmonids.

Additionally, predation by avian species, especially on steelhead smolts (Vogel et al., 1988; USFWS/USBR, 1998), may be greater near RBDD as compared to undammed reaches of the Sacramento River. However, the current RBDD operations appear to have substantially reduced rates of predation to juvenile salmonids as compared to operations prior to implementation of the 1993 Biological Opinion (Tucker et al., 1998). The study found that nearly four times as many pikeminows passed the RBDD ladders in May and June of 1981 as compared to May and June of 1996. This is an indication that the densities of these predators are now much lower since the RBDD gates are in only from mid-May through mid-September. The current extent of predation on juvenile salmonids passing RBDD is unknown.

Figure 3.2-3 depicts juvenile salmonid passage at RBDD. The passage timing for juvenile salmonids was obtained from data collected from

rotary screw trapping investigations conducted downstream of RBDD during 1994 through 2000 (Gaines and Martin, 2001). The following discussion is based on the timing information obtained from those investigations. With the current gates-in operations, on average, approximately 8 percent of annual juvenile fall-run chinook salmon passing RBDD are subjected to the operational effects of the dam and its associated diversion facilities. For spring-run chinook on average, less than 1 percent of the annual number of juveniles passing RBDD are vulnerable to operations and facilities at RBDD. However, a potentially large number of late-fall and winter chinook salmon and steelhead juveniles are subject to operations and facilities of RBDD and its associated diversion facilities (Figure 3.2-3). For winter-run chinook salmon, the earliest dispersing and outmigrating juveniles may be subjected to adverse effects from RBDD operations. On average, approximately 39 percent of juvenile winter chinook salmon are subjected to the operational effects of RBDD and its associated diversion facilities, primarily during August through mid-September when the RBDD gates are in. On average, approximately 35 percent of the juvenile late-fall-run chinook salmon passing RBDD and approximately 36 percent of juvenile steelhead passing RBDD during the gates-in period are subject to operational impacts. These effects appear to be small, but are not necessarily absent.

***A potentially large number of late-fall and winter chinook salmon and steelhead juveniles are subject to operations and facilities of RBDD and its associated diversion facilities.***

### Other Native Anadromous Fish (Sturgeon, Pacific Lamprey, and River Lamprey)

In addition to the NAS species found in the vicinity of the project area, several NAO species occupy or have the potential to occupy the Sacramento River at various stages of their life history and during seasonal intervals. These include: white sturgeon (*Acipenser transmontanus*), green sturgeon (*Acipenser medirostris*), Pacific lamprey (*Lampetra tridentata*), and river lampry (*Lampetra ayresi*).

CDFG population estimates derived from their trawling surveys range from 11,000 to 128,000 white sturgeon in the San Francisco Bay estuary (Kohlhorst, 1991 as cited by Moyle et al., 1995). Because of the importance of the white sturgeon fishery in the Sacramento delta, the number and size of the annual white and green sturgeon catch is closely monitored. While there is no direct evidence that populations of green sturgeon are declining in the Sacramento River, the small size of the population increases the risk that a decline in numbers would be difficult to detect until a collapse in the population occurs (Moyle et al., 1995). NMFS is currently considering a petition to list green sturgeon under ESA.

Pacific lamprey are still common in most watersheds in California and throughout the Pacific northwest. In California, dams on several major watersheds have decreased the spawning distribution of Pacific lamprey. Population numbers in the Sacramento River are not known.

Population trends of river lamprey are not known in California, but are assumed to have declined along with losses in habitat quantity and quality - especially within the Sacramento-San Joaquin River system (Moyle et al., 1995).

### Life History Characteristics and Habitat Requirements.

***White and Green Sturgeon.*** White sturgeon have been caught in salt water from Ensanada, Mexico, to the Gulf of Alaska (Miller and Lea, 1972). In California, large populations occur in the Sacramento and Feather rivers (Moyle, 1976). In California, spawning has been confirmed only in the Sacramento and Feather rivers (Moyle, 1976) and the San Joaquin River (Kohlhorst, 1991 as cited by PSMFC, 1992). In the Sacramento River, most spawning seems to occur upstream of the Feather River confluence (Moyle, 1976).

Female sturgeon spawn about once every 5 years, but may produce nearly 5 million eggs (Moyle, 1976). Table 3.2-4 summarizes white sturgeon life history characteristics. Figure 3.2-4 illustrates the estimated timing of white sturgeon spawning. Larval white sturgeon are flushed downstream and rear in the upper reaches of the Delta and Suisun-San Pablo Bay estuary. Except during spawning runs, adult white sturgeon are primarily found in the lower reaches of the Delta and in Suisun/San Pablo and San Francisco bays. White sturgeon are less marine-oriented than green sturgeon and tend to spend most of their lives in the estuaries of large rivers.

USFWS routinely observes adult sturgeon in the vicinity and down-stream of RBDD when the dam gates are in (Brown, pers. comm). It is unclear if these are all adult green sturgeon or not. However, to date, all sturgeon larvae that have been captured at RBDD and grown out to determine species have been green sturgeon (Killam, pers. comm.).

Green sturgeon life history characteristics are summarized in Table 3.2-4. The presumed timing of spawning green sturgeon passing in the vicinity of RBDD is generally March through June (Brown, pers. comm.).

**TABLE 3.2-4**
Life History Timing for Other Native Anadromous Fish in the Sacramento River Near RBDD

| Name | Adult Immigration | Spawning | Incubation | Larval/Juvenile Rearing | Juvenile Emigration |
|---|---|---|---|---|---|
| White Sturgeon | Feb-May | Feb-Jun | Embryos planktonic drifting downstream | Larvae in river, juveniles in Delta | N/A |
| Green Sturgeon | Feb-Jun | Mar-Jul | Embryos planktonic drifting downstream | Larvae in river, juveniles in Delta | Jun-Aug |
| Pacific Lamprey | Feb-Jun | Spring-Summer | Brief followed by ammocoete larval stage | Up to 7 years | Sep-Apr |
| River Lamprey | Feb-Jun | Spring-Summer | Brief followed by ammocoete larval stage | Up to 5 years | Mar-Jun |

N/A = White sturgeon are not known to spawn upstream of RBDD (Brown, pers. comm.).

The passage timing for juvenile green sturgeon was obtained from data collected from rotary screw trapping investigations conducted downstream of RBDD during 1994 through 2000 (Gaines and Martin, 2001). As indicated by trapping data, the majority of green sturgeon juveniles pass through the vicinity of RBDD from June through August (Figure 3.2-5). From investigations conducted at RBDD to date, there is evidence that juvenile salmonids may be less important, and other species (including juvenile sturgeon) may be preferred prey for Sacramento pikeminnows when free-flowing conditions occur at RBDD (Tucker et al., 1998). This suggests that juvenile sturgeon would be less vulnerable to predation as compared to salmonids during the June through August period when juvenile sturgeon are passing RBDD. Juvenile green sturgeon are transported and rear in the Delta and Suisun-San Pablo Bay estuary for one or more years before entering the deeper San Francisco Bay and exiting into the ocean. They enter the ocean primarily during the summer and fall before they are 2 years old (Moyle et al., 1995).

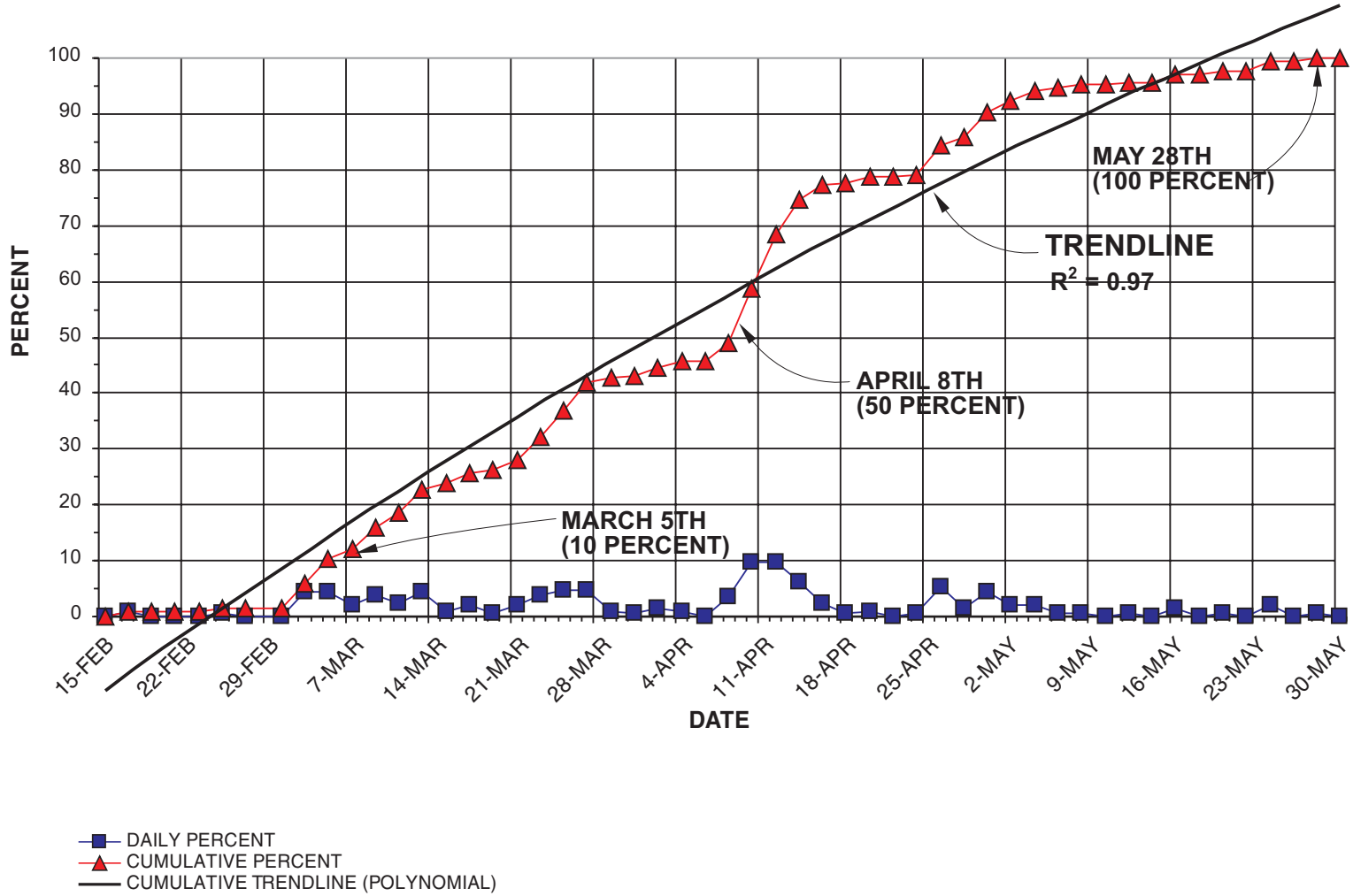
***Pacific Lamprey.*** Pacific lamprey are distributed along the Pacific coast from Unalaska, Alaska, south to California's Santa Ana River, with populations occurring in most coastal watersheds. Spawning runs into freshwater generally occur from April to late July. Trapping information at RBDD indicates that adult Pacific lamprey are migrating upstream past RBDD primarily in the spring and summer months. According to observations by CDFG and USFWS at RBDD, adult Pacific lamprey immigration at RBDD is presumed to occur in March to mid-May (Killam, pers. com).

*Trapping information at RBDD indicates that adult Pacific lamprey are migrating upstream past RBDD primarily in the spring and summer months.*

The timing of lamprey transformer life stages passing RBDD during downstream mitigation was obtained from data collected from rotary screw trapping investigations conducted downstream of the RBDD during 1994 through 2000 (Gaines and Martin, 2001). As indicated by trapping conducted at RBDD, the passage/presence of Pacific lamprey transformers at RBDD primarily occurs during the fall through spring months of September through May. The term transformer refers to an intermediate lamprey life stage that occurs at a body length of approximately 14 to 16 cm. The juvenile ammocoete stage begins to undergo a metamorphosis (transformation) and during this phase lampreys develop into adults with large eyes and an oral sucking disc.

***River Lamprey.*** Adult river lamprey migration is thought to take place in winter months, with spawning taking place in clean, gravelly riffles and pool tails of small tributaries, usually during April and May (Moyle, 1976). The fecundity of female river lamprey is between 11,000 and 37,000 eggs. As indicated by trapping conducted at RBDD (Gaines and Martin, 2001), the passage/presence of river lamprey transformers at RBDD occurs during the spring and early summer months of March through June.

*The passage/presence of river lamprey transformers at RBDD occurs during the spring and early summer months of March through June.*




SOURCE: KOHLHORST, 1976

**FIGURE 3.2-4**
**ESTIMATED TIMING OF WHITE STURGEON SPAWNING IN THE SACRAMENTO RIVER DURING 1973**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

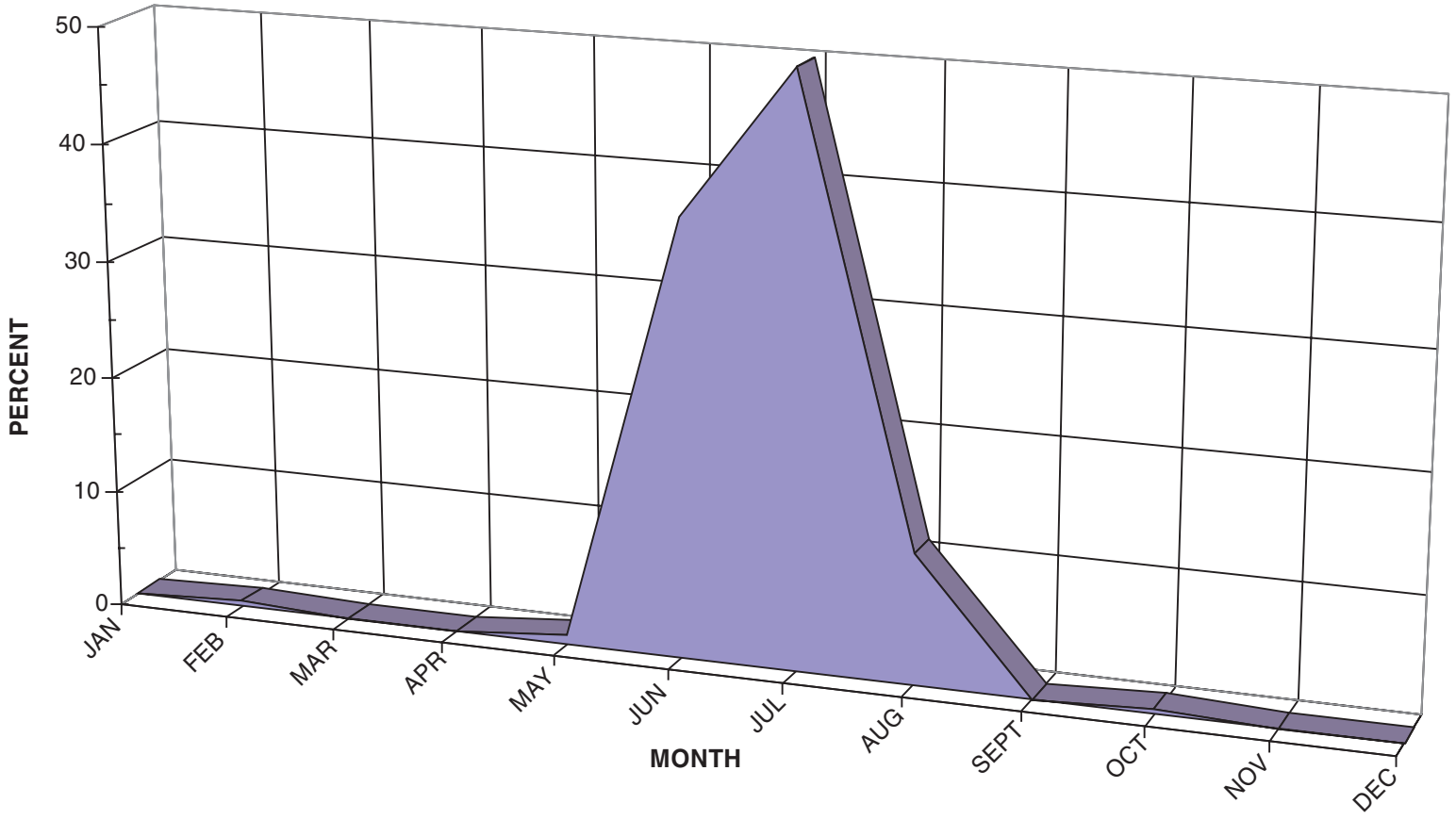



**FIGURE 3.2-5**
**PRESENCE OF JUVENILE GREEN STURGEON IN THE SACRAMENTO RIVER CAPTURED IN THE VICINITY OF RBDD (1995 TO 1999)**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

**Species Listed or Proposed for Listing under ESA or CESA.** None of the four species discussed above is currently listed as endangered or threatened or a candidate for listing as endangered or threatened under ESA or CESA. Green sturgeon was petitioned for listing under ESA (June 11, 2001), but NMFS has not yet issued findings of the review of the petition. However, the green sturgeon is a California Species of Special Concern Class 1: Qualify as Threatened. River lamprey is a California Species of Special Concern Class 3: Watch List. Pacific lamprey is a California Species of Special Concern Class 4: Population Status Apparently Secure (Moyle et al., 1995).

**Impacts of Current Operations on Other Native Anadromous Fish.** Under current operations, on average, approximately 35 percent of adult green sturgeon passing through the project area may be blocked by RBDD. In addition, some adult green sturgeon are delayed in their down-river migration by RBDD after spawning occurs upstream of the dam, if these fish arrive at RBDD on or after May 15 when the dam gates go in. With the current gates-in operations, on average, nearly all of the larval/ juvenile green sturgeon passing RBDD annually are subjected to the operational effects of the dam and its associated diversion facilities. The actual rate of predation of juvenile green sturgeon after passing under the RBDD gates by Sacramento River pikeminnow and striped bass congregated immediately below the dam is currently unknown.

A majority of the adults of the two lamprey species are believed to pass RBDD during the months of February through August. Of these, on average, approximately 25 percent of the annual lamprey spawning run may be affected by the gates-in operation. Although there may be some impedance of migration during gates-in operation, adult lamprey are known to actively pass through fish ladders at RBDD (Killam, pers. comm.). Similar to salmon, lampreys have a limited supply of energy reserves for upstream migration and spawning. Excess use of energy during migration could result in exhaustive stress and ultimately reduce their survival. This may result in delayed passage, changes in adult spawning distribution (temporal and spatial), an increase in adult pre-spawning and mortality, and decreased egg viability, all of which may result in the reduction in annual recruitment of these species.

*Approximately 25 percent of the annual lamprey spawning run may be affected by the gates-in operation.*

With the current gates-in operations, on average, approximately 6 to 7 percent of Pacific lamprey transformers annually passing RBDD are subjected to the operational effects of the dam and its associated diversion facilities. On average, the current gates-in operation annually affects approximately 30 percent of the annual run of river lamprey transformers passing RBDD. The actual rate of predation on juvenile, or transformer lampreys passing through the project area by Sacramento River pikeminnow and striped bass congregated immediately below the dam is unknown.

### Non-native Anadromous Fish (Striped Bass and American Shad)

The two NNA fish species found in the Sacramento River in the vicinity of RBDD are striped bass and American shad (also known as shad). Both of these species were introduced into California from the eastern United States between 1871 and 1882 (Moyle, 1976). Life history characteristics of these species are shown in Table 3.25.

The average adult striped bass population in California during the period from 1967 to 1991 was approximately 1.25 million fish. By 1990, the annual population of adult striped bass had declined to approximately 680,000 adults. Sport catches of striped bass declined from an average annual catch of more than 300,000 fish in the early 1970s to less than 150,000 by the late 1980s (USBR, 1997b). Beginning in 1981, juvenile striped bass were raised in hatcheries and released into the Delta and Bay to supplement the wild populations (USBR, 1997b).

A viable sport fishery for shad remains in the lower Sacramento River to Red Bluff and in the Feather and American rivers. CDFG estimated that population of adult shad in 1976 and 1977 were 3.04 million and 2.79 million adults, respectively (USBR, 1997b).

#### Life History Characteristics and Habitat Requirements.

***Striped Bass.*** Stripers are an anadromous species with adults spawning in freshwater, larvae and juveniles rearing in the Delta, and then adults migrating between the Delta, San Francisco Bay estuary, and Pacific Ocean. Spawning begins in April in the Delta and May in the Sacramento River continuing through June. Spawning is dependent on water temperature, it begins when temperatures exceed approximately 58°C and intensifies when water temperatures are between 63 and 68°C. Approximately 40 percent of stripers spawn in the Delta and the lower San Joaquin River, and 60 percent spawn in the Sacramento River and its tributaries (USBR, 1997b). Spawning occurs during brief "peak" periods when most eggs are released during one or a few days. Moyle (1976) states that there are two major spawning areas in the Central Valley: the San Joaquin River from Venice Island downstream to Antioch and the Sacramento River from Isleton upstream to Butte City (approximately RM 165).

Their movements as juveniles following their first winter is similar to adults, migrating downstream into San Francisco Bay and Pacific Ocean in the summer and into Suisun Bay/Delta in the winter.

Near the project area adult striped bass are known to begin congregating in the late spring/early summer months in the vicinity of RBDD. These fish move into the project area after spawning in downstream areas of the Sacramento River (Tucker, pers. comm.). Investigations conducted to determine predatory habits of Sacramento pikeminnow and striped bass (Tucker et al., 1998) determined that the average catch

**TABLE 3.2-5**

Habitat Requirements for Common Native and Non-native Resident and Anadromous Fish Near RBDD[a]

| Common Name | Scientific Name | Temperature Requirements | Preferred Spawning Habitat; Substrate | Adult Food Preference | Preferred Habitat Types | Notes or Comments |
|---|---|---|---|---|---|---|
| Striped Bass | *Morone saxatilis* | Spawning at 58-70°F (63-68□F optimal) | Broadcast spawns in moving water; N/A | Highly predatory on fish | Open water-pelagic predators | Extensive migratory patterns in the rivers, Delta, San Francisco Bay, and ocean |
| American Shad | *Alosa sapidissima* | Spawning at 59-68°F | Broadcast spawns in moving water over sand, gravel, cobble | Large zooplankton, insects, crustaceans, molluscs | Prefers open water, but young will feed in dead-ended sloughs | Primarily found in saltwater except to spawn and early life stages |
| Sacramento Splittail | *Pogonichthys marcrolepidotus* | Optimal abundance in Delta: 59-73°F | Spawning over flooded vegetation in dead-ended sloughs | Bottom feeders: benthic invertebrates, insects, zooplankton, worms, and molluscs | Slow-moving sections of main channel in rivers and sloughs | Tolerant of salinities up to 10-18 parts per thousand; presently found in very restricted portions of their historical range |
| Hardhead | *Mylopharodon conocephalus* | Warm water conditions typical of low- to mid-elevation streams | Low-velocity riffles with gravel, (thought to be mass spawners) | Filamentous algae, small invertebrates, aquatic plants | Clear, warm streams with large, deep rock and sandy bottom pools | Found in undisturbed sections of larger streams; move into smaller tributaries to spawn |
| Sacramento Pikeminnow | *Ptychocheilus grandis* | Do not flourish in waters less than 59°F; spawn above 57°F | Gravel riffles, congregate to spawn over rocky-gravely areas | Highly predatory on fish and crayfish | Clear well-shaded sand-rock bottomed pools with rocks/logs | Sedentary habits, often remaining in one pool for long intervals; also known to migrate up/downstream to spawn and forage |
| Sacramento Sucker | *Catostomus occidentalis* | Wide temperature range, most abundant in cool streams/ pools | Congregate over clean gravel | Filamentous algae, detritus, invertebrates associated with the bottom | Feed in small groups at head of pools or edge beds of aquatic vegetation; deep pools | Typically spend 2-3 years in natal stream before migrating into larger rivers with high water (in the fall) |

[a]Source: Moyle, 1976.
N/A = not applicable.
□F = degrees Fahrenheit.

per hour for striped bass captured near RBDD peaked in July during the years 1994 to 1996. Striped bass are present near RBDD from May through October (Killam, pers. comm.). During this period, adult striped bass congregate downstream of RBDD to prey on any appropriately sized juvenile fish, including salmonids that pass through the diversion complex (under the dam gates, through the fish ladders, or through the diversion bypasses). Striped bass are not generally known to pass through the fish ladder at RBDD (Tucker, pers. comm.).

***American Shad.*** American shad are anadromous fish that are found in freshwater only when they move inland to spawn. Young shad migrate into saltwater almost immediately after hatching and spend the majority of their lives (3 to 5 years) in saltwater (Moyle, 1976). Adult shad move into the lower San Francisco Bay estuary in the fall but do not move into freshwater until temperatures exceed 50 to 52°C, usually in late March or April. Spawning runs begin in late May or June when water temperatures reach 59°C or greater. Some evidence has indicated that increased flows, as well as temperature, initiate spawning runs not just temperature (Painter et al., 1980 as cited by USBR, 1997b). Spawning runs will continue until water temperatures exceed 68°C, usually in July. Spawning is done in mass in the main channels of the San Joaquin and Sacramento rivers and their tributaries. In the mainstem Sacramento River, shad spawning runs reach as far as unimpeded passage allows. American shad do not pass generally above RBDD when the gates are in (Killam, pers. comm.) and generally do not use ladders to any appreciable extent (Skinner, 1962). Adult shad are commonly found near RBDD between the months of April and July, and larval shad are found near RBDD from May to August.

*Adult shad are commonly found near RBDD between the months of April and July, and larval shad are found near RBDD from May to August.*

**Impacts of Current Operations on Non-native Anadromous Fish.** Gates-in operations at RBDD restricts adult striped bass to reaches downstream of the dam following their spawning in the lower reaches of the Sacramento River. Reflecting either their inability or lack of desire to distribute upstream of RBDD, stripers currently congregate downstream of RBDD and feed on juvenile fish passing the facilities at RBDD (Tucker et al., 1998). Under current conditions, approximately up to 75 percent of the striped bass found at RBDD occur prior to July 1. After that time, apparently many of these fish move downstream within the Sacramento River and into the Delta. However, prior to July 1, near RBDD, predatory striped bass congregate and prey on juvenile fish migrating through the vicinity. Striped bass are not recognized as spawning or rearing in the Sacramento River upstream of RBDD. Therefore, there are no adverse impacts to these life stages as result of RBDD operations.

*Striped bass are not recognized as spawning or rearing in the Sacramento River upstream of RBDD. Therefore, there are no adverse impacts to these life stages as result of RBDD operations.*

American shad generally do not use the existing fish ladders at RBDD. Therefore, the gates-in operations prevent this species from migrating upstream of RBDD to spawn. This restriction however, does not likely adversely affect their population because this reach of the Sacramento River is at the northernmost extent of their geographic range in the Sacramento River watershed. Optimal spawning temperature for American shad is 62 to 70°F (Skinnner, 1962), and these water temperatures are unlikely to occur in the Sacramento River during the period when American shad are in the vicinity of RBDD. Consequently, American shad are only occasionally observed upstream of RBDD (USBR, 1997b).

*RBDD operations do not adversely affect American shad populations.*

### Resident Native and Non-native Fish (Sacramento Pikeminnow, Hardhead, Hitch, Sacramento Splittail, Resident Rainbow Trout, and Sacramento Sucker)

**Life History Characteristics and Habitat Requirements.** A large number of RN and RNN fish species are found in the Sacramento River near RBDD. Principal species include Sacramento pikeminnow, hardhead, hitch, and Sacramento splittail (all *Cyprinid* species); resident rainbow trout; and Sacramento suckers. Life history characteristics for many of these species are shown in Table 3.2-5. A large number of non-native sportfish species including large- and smallmouth bass; various sunfish, catfish, and crappie, as well as brown trout, are commonly found near RBDD. Non-game species such as carp, shiner, minnow, and mosquito fish are also commonly found at RBDD. Many of these species have life histories that require them to move up and downstream of the dam seasonally for spawning, rearing, or foraging life stages.

***Sacramento Pikeminnow.*** Population estimates do not exist for this species. Some recent investigations, however, have determined the seasonal changes in the relative abundance of Sacramento pikeminnow near RBDD (Tucker et al., 1998). Pikeminnow are known to use the existing fish ladders at RBDD to migrate upstream during their spawning season. A summary of the current pattern of Sacramento pikeminnow presence near RBDD is shown on Figure 3.2-6. This figure, based on captures of pikeminnows at RBDD, provides an approximate abundance estimate by month for this species at RBDD.

*Pikeminnow are known to use the existing fish ladders at RBDD to migrate upstream during their spawning season.*

***Rainbow Trout.*** Resident native rainbow trout also are found in the Sacramento River near RBDD. The adults of this species migrate seasonally within the Sacramento River but, unlike steelhead, do not return to the ocean. Adult fish are known to use the existing ladders at RBDD to pass upstream, and juveniles are commonly observed at RBDD (Killam, pers. comm.). Adult rainbow trout migrate through RBDD mainly in August and September. These fish are seeking upstream or tributary locations for spawning and/or are re-distributing within the Sacramento River to forage. Juvenile rainbow trout are difficult to

*Adult trout are known to use the existing ladders at RBDD to pass upstream, and juveniles are commonly observed at RBDD.*

distinguish from steelhead juveniles and are captured while passing through RBDD as shown on Figure 3.2-7. The timing of juvenile rainbow trout passing RBDD was obtained from data collected from rotary screw trapping investigations conducted downstream of RBDD during 1994 through 2000 (Gaines and Martin, 2001).

***Other Resident Species.*** Populations of other RN species including hitch, hardhead, and Sacramento sucker (Killam, pers. comm.) have life histories that include seasonal migrations and re-distributions. Adults of some of these species are known to seasonally pass through the ladders at RBDD (e.g., hardhead and Sacramento sucker). Juveniles of these species are found at RBDD and are less preferred as forage species by the large predators that seasonally congregate at RBDD. Trapping investigations conducted by USFWS have determined the presence and the passage of juvenile hardheads and Sacramento sucker (Gaines and Martin, 2001). The operations of RBDD may largely be inconsequential to populations of non-native resident species such as bass, sunfish, and others. Furthermore, the status of these species' populations is generally unknown.

**Species Listed or Proposed for Listing under ESA or CESA.** The Sacramento splittail was first listed by USFWS as federal threatened on February 8, 1999. This listing applies to this species throughout its entire range within California. Splittail are native to California's Central Valley, where they were once widely distributed (Moyle, 1976). Historically, splittail were found as far north as Redding on the Sacramento River. In recent times, flow reductions caused by dams and diversions have increasingly prevented splittail from upstream access to the large rivers, and the species is now restricted to a small portion of its former range; however, during wet years, they migrate up the Sacramento River as far as RBDD (Moyle and Yoshiyama, 1992 as cited by Federal Register 64:25, February 8, 1999).

**Impacts of Current Operations on Resident Native and Non-native Fish.** Operation of the gates at RBDD may not directly adversely affect populations of most of the resident species, but operations may seasonally limit their access into optimal habitats. Rates of predation on juveniles of species such as rainbow trout and other native fishes near RBDD may be increased over that for an undammed river. This may be due to congregations of adult pikeminnow and striped bass when the RBDD gates are in. However, the extent of any increase in predation as a result of RBDD operations is unknown. Except for juvenile rainbow trout, predation on juvenile RN and RNN fish may be inconsequential, as these species are less-preferred prey.

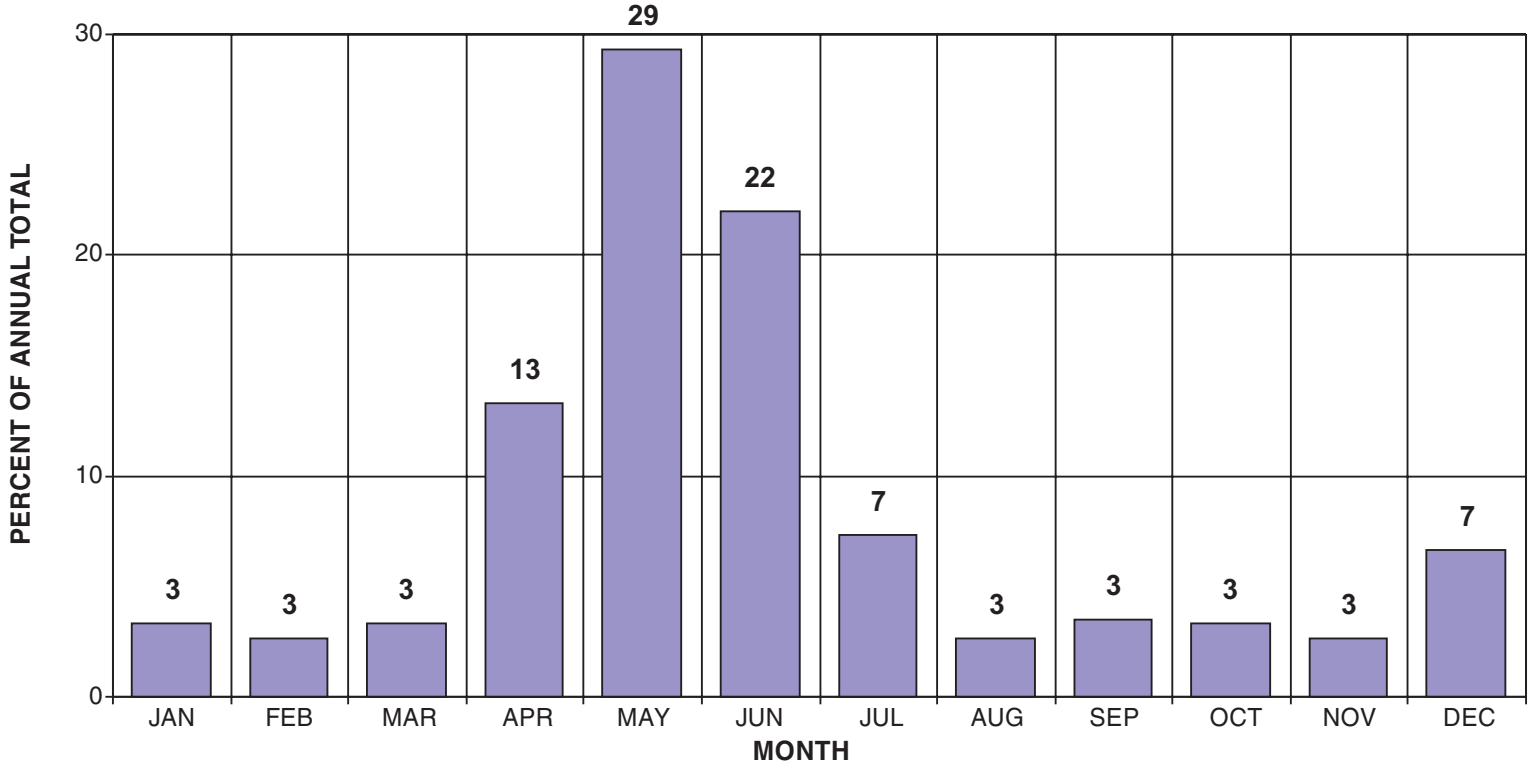



**FIGURE 3.2-6**
**RELATIVE ABUNDANCE OF ADULT SACRAMENTO PIKEMINNOW AT RBDD (1994 TO 1996)**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W072002003RDD_09G (8/15/02)

CH2MHILL

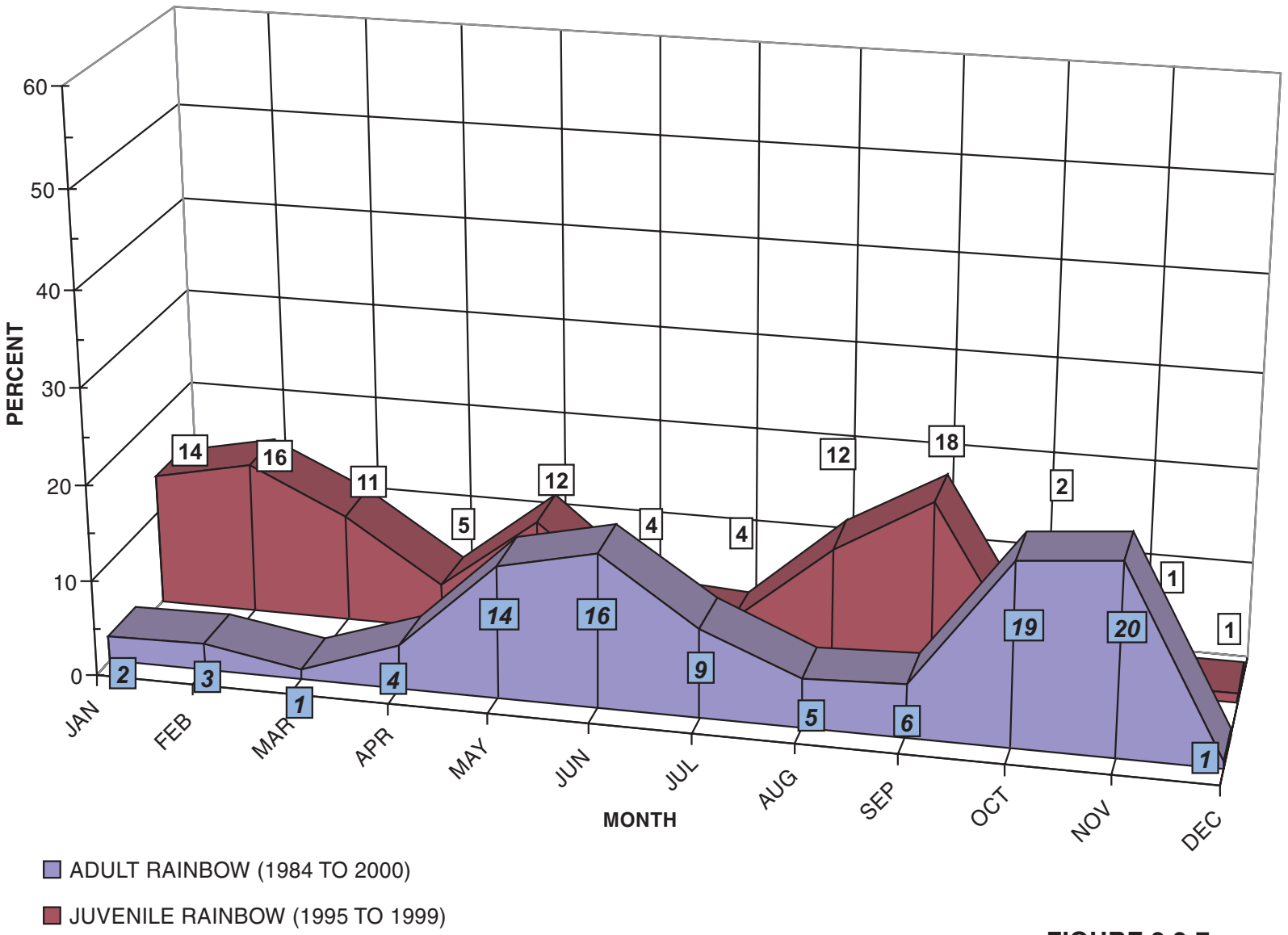



**FIGURE 3.2-7**
**PRESENCE AND PASSAGE OF RAINBOW TROUT AT RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W072002003RDD_09H (8/15/02)

CH2MHILL

## 3.2.2 Environmental Consequences

### Methodology

The analysis of the environmental consequences was conducted by comparing each of the proposed alternatives with the No Action Alternative. To compare the short-term impacts resulting from the construction of project-specific elements, each alternative was qualitatively compared to the No Action Alternative.

Each fish species' adult and juvenile monthly and annual passage indices were calculated with the Fishtastic! analysis tool. Fishtastic! output was used to determine operational effects of the project alternatives. The macro-based spreadsheet tool was developed to calculate an average annual index of fish passage efficiency at RBDD. This index is intended to represent an annual cumulative measure of energy expenditure, stress, delay, blockage, injury or loss, affecting a species as it transits the RBDD project area. The annual index calculated ranges from zero (the species is negatively affected fully) to 100 (the species is unaffected whatsoever). The index values represent the approximate portion of the species and life stage that is unaffected by operations of the RBDD facilities for the entire calendar year. For example, an adult passage index of 89 indicates that approximately 89 percent of the entire annual population would pass RBDD and Lake Red Bluff without blockage, delay, or some loss or injury because of the operation of RBDD. The greater the index value, the less adversely affected the species is.

See Attachment B1 of Appendix B for a detailed description and discussion of the development of Fishtastic!, its methodology, assumptions, and results. The following species were designated as focus species by an inter-agency TAG. The following species warranted additional consideration because of their life history requirement to be upstream of the dam and/or their special or pending status under the federal ESA, CESA, or as a California Species of Special Concern:

- Winter-run chinook salmon
- Spring-run chinook salmon
- Fall-run chinook salmon
- Late-fall-run chinook salmon
- Steelhead
- Rainbow trout
- Green sturgeon
- River lamprey
- Pacific lamprey

For the remaining fish species, a qualitative evaluation was conducted to determine the environmental consequences of project alternatives. It is important to note that the alternatives considered in this DEIS/EIR

were designed to improve fish passage. Therefore, operation of the various alternatives would improve fish passage at the dam, albeit by differing degrees.

Construction impacts to fish species were estimated by evaluating the effects of other similar construction efforts on the Sacramento River. In some cases it was necessary to consider the overall effect of the project, where future benefits offset minor short-term impacts caused by construction.

### Significance Criteria

Significance criteria represent the thresholds that were used to identify whether an impact would be potentially significant. Under CEQA, any adverse impact to state listed species would be considered significant, and mitigation would be required to reduce impacts to less than significant levels.

For the purposes of distinguishing project alternatives from the No Action Alternative, the following significance criteria for evaluating passage improvements were used in the analyses of impacts and benefits:

- No difference in passage indices = No change
- <10 percent difference in passage indices = No measurable impact (-) or benefit (+)
- ≥10 percent to <25 percent difference in passage indices = Measurable impact (-) or benefit (+)
- ≥25 percent difference in passage indices = Large measurable impact (-) or benefit (+)

### Discussion of Results

This section provides a discussion of the consequences of the project alternatives on fishery resources as compared to the No Action Alternative. Additional analyses of the consequences of project alternatives on fishery resources are provided in Attachment B2 of Appendix B. The impact analysis is conducted for four groups of fish commonly found at RBDD:

- Native anadromous salmonid species
- Other native anadromous species
- Non-native anadromous species
- Resident native and non-native species

The results of the project alternatives analysis are summarized and discussed in the sections below. In the case of adult life stages of the four fish groups listed above, a discussion of the consequences of all of the alternatives is provided below by alternative. For analysis purposes, it was assumed the ladder and/or bypass elements of the alternatives

would have no impact or benefit on juvenile life stages; therefore, juveniles are not included in the discussions for those alternatives. The project alternatives analyzed include:

- No Action Alternative (presented for adults and juveniles)
- 1A: 4-month Improved Ladder Alternative (presented for adults and juveniles)
- 1B: 4-month Bypass Alternative (presented for adults)
- 2A: 2-month Improved Ladder Alternative (presented for adults and juveniles)
- 2B: 2-month with Existing Ladders Alternative (presented for adults)
- 3: Gates-out Alternative (presented for adults and juveniles)

Summary tables for adult passage are as follows:

- Table 3.2-6—Native Anadromous Salmonids
- Table 3.2-8—Other Native Anadromous Species
- Table 3.2-10—Native Resident Species (Rainbow Trout)

Summary tables for juvenile passage are as follows:

- Table 3.2-7—Native Anadromous Salmonids
- Table 3.2-9—Other Native Anadromous Species
- Table 3.2-11—Native Resident Species (Rainbow Trout)

The analysis of consequences of changes in passage indices for adult native anadromous salmonids is summarized in Table 3.2-6. In this table, the calculated adult passage indices and their differences from those for the No Action Alternative are presented for each of the five species. Also summarized in Table 3.2-6, for each species, is the percentage improvement from the No Action Alternative and the effect of each alternative compared to the No Action Alternative. In all cases, for all species and all alternatives, the adult passage indices were equal to or greater than those for the No Action Alternative. Therefore, no alternative resulted in significant (measurable) adverse impacts to adults of any of the five native anadromous salmonid species.

***No alternative resulted in significant (measurable) adverse impacts to adults of any of the five native anadromous salmonid species.***

The results of the analyses of changes in juvenile NAS passage indices are summarized in Table 3.2-7. In this table, the calculated juvenile passage indices and their differences from those for the No Action Alternative are presented for each of the five species. Also summarized in Table 3.2-7, for each species, is the percentage improvement from the No Action Alternative and the effect of each alternative compared to the No Action Alternative. In all cases, for all species and all alternatives, the juvenile passage indices were equal to or greater than those for the No Action Alternative. Therefore, no alternative resulted in significant (measurable) adverse impacts to juveniles of any of the five native anadromous salmonid species.

***The Fishtastic! analysis focused on the green sturgeon because this species is known to congregate downstream of RBDD during periods when the dam gates are in place.***

**TABLE 3.2-6**
Index Value, Relative Difference, and Improvement in Passage Index for Adult Anadromous Salmonids

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| **Winter-run Chinook Salmon** | | | | |
| No Action Alternative | 89 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 91 | 2 | 2 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 91 | 1 | 1 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 98 | 8 | 9 | *No Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 98 | 8 | 9 | *No Measurable Benefit* |
| Gates-out Alternative | 100 | 10 | 12 | *Measurable Benefit* |
| **Spring-run Chinook Salmon** | | | | |
| No Action Alternative | 52 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 61 | 8 | 16 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 57 | 5 | 9 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 94 | 41 | 79 | *Large Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 93 | 40 | 77 | *Large Measurable Benefit* |
| Gates-out Alternative | 100 | 48 | 91 | *Large Measurable Benefit* |
| **Fall-run Chinook Salmon** | | | | |
| No Action Alternative | 83 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 86 | 3 | 4 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 85 | 2 | 2 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 91 | 8 | 9 | *No Measurable Benefit* |

**TABLE 3.2-6**
Index Value, Relative Difference, and Improvement in Passage Index for Adult Anadromous Salmonids

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| 2-month with Existing Ladders Alternative | 89 | 6 | 8 | *No Measurable Benefit* |
| Gates-out Alternative | 100 | 17 | 20 | *Measurable Benefit* |
| **Late-fall-run Chinook Salmon** | | | | |
| No Action Alternative | 100 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 100 | 0 | 0 | *No Change* |
| 4-month Bypass Alternative | 100 | 0 | 0 | *No Change* |
| 2-month Improved Ladder Alternative | 100 | 0 | 0 | *No Change* |
| 2-month with Existing Ladders Alternative | 100 | 0 | 0 | *No Change* |
| Gates-out Alternative | 100 | 0 | 0 | *No Change* |
| **Steelhead** | | | | |
| No Action Alternative | 89 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 91 | 2 | 2 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 90 | 1 | 1 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 97 | 8 | 9 | *No Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 96 | 7 | 8 | *No Measurable Benefit* |
| Gates-out Alternative | 100 | 11 | 12 | *Measurable Benefit* |

[a]Rounded to the nearest whole number.

**TABLE 3.2-7**
Index Value, Relative Difference, and Improvement in Passage Index for Juvenile Anadromous Salmonids

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| **Winter-run Chinook Salmon** | | | | |
| No Action Alternative | 96 | n/a | n/a | *No Change* |
| 4-month Gates-in | 96 | 0 | 0 | *No Change* |
| 2-month Gates-in | 99 | 3 | 3 | *No Measurable Benefit* |
| Gates Out | 100 | 4 | 4 | *No Measurable Benefit* |
| **Spring-run Chinook Salmon** | | | | |
| No Action Alternative | 100 | n/a | n/a | *No Change* |
| 4-month Gates-in | 100 | 0 | 0 | *No Change* |
| 2-month Gates-in | 100 | 0 | 0 | *No Change* |
| Gates Out | 100 | 0 | 0 | *No Change* |
| **Fall-run Chinook Salmon** | | | | |
| No Action Alternative | 97 | n/a | n/a | *No Change* |
| 4-month Gates-in | 97 | 0 | 0 | *No Change* |
| 2-month Gates-in | 100 | 2 | 2 | *No Measurable Benefit* |
| Gates Out | 100 | 3 | 3 | *No Measaurable Benefit* |
| **Late-fall-run Chinook Salmon** | | | | |
| No Action Alternative | 93 | n/a | n/a | *No Change* |
| 4-month Gates-in | 93 | 0 | 0 | *No Change* |
| 2-month Gates-in | 98 | 4 | 5 | *No Measurable Benefit* |
| Gates Out | 100 | 7 | 7 | *No Measurable Benefit* |
| **Steelhead** | | | | |
| No Action Alternative | 92 | n/a | n/a | *No Change* |
| 4-month Gates-in | 92 | 0 | 0 | *No Change* |
| 2-month Gates-in | 99 | 6 | 7 | *No Measurable Benefit* |
| Gates Out | 100 | 8 | 8 | *No Measurable Benefit* |

[a]Rounded to the nearest whole number.

**TABLE 3.2-8**
Index Value, Relative Difference, and Improvement in Passage Index for Adult Other Native Anadromous Species

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| **Green Sturgeon** | | | | |
| No Action Alternative | 65 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 65 | 0 | 0 | *No Change* |
| 4-month Bypass Alternative | 69 | 4 | 6 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 100 | 35 | 54 | *Large Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 100 | 35 | 54 | *Large Measurable Benefit* |
| Gates-out Alternative | 100 | 35 | 54 | *Large Measurable Benefit* |
| **Pacific Lamprey** | | | | |
| No Action Alternative | 83 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 86 | 3 | 4 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 85 | 2 | 2 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 97 | 14 | 17 | *Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 96 | 13 | 16 | *Measurable Benefit* |
| Gates-out Alternative | 100 | 17 | 20 | *Measurable Benefit* |
| **River Lamprey** | | | | |
| No Action Alternative | 83 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 86 | 3 | 4 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 85 | 2 | 2 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 97 | 14 | 17 | *Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 96 | 13 | 16 | *Measurable Benefit* |
| Gates-out Alternative | 100 | 17 | 20 | *Measurable Benefit* |

[a]Rounded to the nearest whole number.

**TABLE 3.2-9**
Index Value, Relative Difference, and Improvement in Passage Index for Juvenile (and transformer) Other Native Anadromous Species

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| **Green Sturgeon** | | | | |
| No Action Alternative | 73 | n/a | n/a | *No Change* |
| 4-month Gates-in | 73 | 0 | 0 | *No Change* |
| 2-month Gates-in | 88 | 15 | 21 | *Measurable Benefit* |
| Gates out | 100 | 27 | 38 | *Large Measurable Benefit* |
| **Pacific Lamprey** | | | | |
| No Action Alternative | 99 | n/a | n/a | *No Change* |
| 4-month Gates-in | 99 | 0 | 0 | *No Change* |
| 2-month Gates-in | 100 | 1 | 1 | *No Measurable Benefit* |
| Gates out | 100 | 1 | 1 | *No Measurable Benefit* |
| **River Lamprey** | | | | |
| No Action Alternative | 87 | n/a | n/a | *No Change* |
| 4-month Gates-in | 87 | 0 | 0 | *No Change* |
| 2-month Gates-in | 100 | 13 | 15 | *Measurable Benefit* |
| Gates out | 100 | 13 | 15 | *Measurable Benefit* |

[a]Rounded to the nearest whole number.

**TABLE 3.2-10**
Index Value, Relative Difference, and Improvement in Passage Index for Adult Rainbow Trout between Existing Conditions and the No Action Alternative, and the No Action Alternative and Project Alternatives

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| No Action Alternative | 73 | n/a | n/a | *No Change* |
| 4-month Improved Ladder Alternative | 78 | 5 | 7 | *No Measurable Benefit* |
| 4-month Bypass Alternative | 76 | 3 | 4 | *No Measurable Benefit* |
| 2-month Improved Ladder Alternative | 91 | 18 | 25 | *Large Measurable Benefit* |
| 2-month with Existing Ladders Alternative | 90 | 17 | 23 | *Measurable Benefit* |
| Gates-out Alternative | 100 | 27 | 37 | *Large Measurable Benefit* |

[a]Rounded to the nearest whole number.

**TABLE 3.2-11**
Index Value, Relative Difference, and Improvement in Passage Index for Juvenile Rainbow Trout between Existing Conditions and the No Action Alternative, and the No Action Alternative and Project Alternatives

| Alternative | Index Value[a] | Difference[a] | Percent Improved[a] | Effect |
|---|---|---|---|---|
| No Action Alternative | 92 | n/a | n/a | *No Change* |
| 4-month Gates-in | 92 | 0 | 0 | *No Change* |
| 2-month Gates-in | 99 | 7 | 7 | *No Measurable Benefit* |
| Gates out | 100 | 8 | 8 | *No Measurable Benefit* |

[a]Rounded to the nearest whole number.

The principal NAO fish species occurring at RBDD are green and white sturgeon and Pacific and river lamprey. Of these, the Fishtastic! analysis focused on the green sturgeon because this species is known to congregate downstream of RBDD during periods when the dam gates are in place (Brown, pers. comm.). Fish of an additional NNA species, white sturgeon, are believed to migrate into lower segments of the Sacramento River to approximately Colusa (River Kilometer 231) to spawn (Schaffter, 1997).

However, this species is generally not known to spawn upstream of RBDD (River Kilometer 405). For this reason, it was assumed for the analysis that white sturgeon are not presently affected by operations at RBDD, and further impacts analysis was not conducted.

The timing and passage of both of the lamprey species are less precisely known than the anadromous native salmonid species. Therefore, conclusions concerning these species are based on their general life history characteristics, their physical morphology, and their observed passage at RBDD. The summary of the passage indices for all

alternatives for adult NAO species is shown in Table 3.2-8. Juvenile passage indices for all project alternatives and the No Action Alternative for juvenile green sturgeon and transformer life stages of lampreys are shown in Table 3.2-9.

The adult passage index values for rainbow trout for all alternatives are summarized in Table 3.2-10. The juvenile passage indices for rainbow trout for all alternatives are shown in Table 3.2-11.

### No Action Alternative

Under the No Action Alternative, there would be no impacts or benefits to adult or juvenile fishery resources from the construction/expansion of RPP. The expansion of the existing RPP would be built within the existing off-channel footprint of RPP and not within the Sacramento River proper.

Operations under the No Action Alternative would result in no adverse impacts or benefits to fishery resources compared to existing conditions. Under the No Action Alternative, the RPP's capacity would be expanded to 320 cfs from 240 cfs (existing conditions). There would be no significant adverse impacts or benefits from this operational increase in pumping capacity. The assumption was that, for all new screened diversion elements, all screens and bypasses would meet State of California and federal requirements/criteria for the protection of juvenile fish.

### 1A: 4-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 1A–F1: Construction.*** Impacts from constructing fish ladder and pump stations, including screens and bypasses, would include direct and indirect losses of adult and or juvenile fish. These impacts would principally occur during installation of cofferdams. The construction areas would include areas near the existing east and west bank fish ladders and the new pump station location at the Mill Site. At the Mill Site, a large sheet pile cofferdam would be required, up to approximately 1,400 LF. Construction of the right bank fish ladder would require a 270-LF sheet pile cofferdam. Construction of the left bank fish ladder would require installation of a 166-LF sheet pile cofferdam.

In addition, impacts could also occur at these locations because of dewatering active channel areas following sheet pile installation. Both adults and juveniles may be stranded and lost during dewatering actions following the installation of sheet piling.

These activities would adversely affect migrating adult fish, rearing stages of fry and juveniles, and migrating salmonid smolts. These impacts would be significant and would require mitigation or conservation measures, depending on species, to reduce these impacts to less than significant.

Additionally, direct losses and adverse indirect effects to adults and juvenile life stages could occur as a result of sediment disturbances and turbidity that would result from construction of project fish ladders and pump stations. These impacts would be significant and would require mitigation to reduce them to less than significant. Impacts from construction on all life stages of fish present would be significant. For impacts of sedimentation and turbidity, mitigation/conservation measures are addressed in the Water Quality section (3.3.4).

***The impacts from construction on fishery resources would be significant.***

**Operations-related Impacts.** ***There would be no significant adverse impacts on fishery resources under Alternative 1A; therefore, no mitigation is required.***

Below is a summary of fish passage index values for this alternative.

***Native Anadromous Salmonid Species.***

***Adults.*** As previously discussed and shown in Table 3.2-6, the adult passage index values for Alternative 1A for NAS are equal to or greater than those for the No Action Alternative. The index values for these species are shown on Figure 3.2-8. There is no change in the adult passage index for late-fall chinook salmon from implementing this alternative (Table 3.2-6). This is because this species does not migrate through RBDD during the gates-in operational period (mid-May through mid-September). There are small (2 to 4 percent) improvements in passage indices for adult winter-run and fall-run chinook salmon and steelhead, and modest (16 percent) improvement for adult spring-run chinook salmon. While the percent improvement in the passage index for adult spring-run chinook salmon seems large (16 percent), the overall annual passage index for this species remains a rather low 61 (Table 3.2-6). These small to modest improvements in adult passage are a result of increased efficiencies in attraction to and passage within the new fish ladders featured in this alternative. The magnitude of these improvements however, is generally not sufficiently beneficial to be considered a measurable improvement for adult passage of NAS species. A rather large component (approximately 39 percent) of threatened adult spring-run salmon would continue to be blocked or impeded under this alternative. In addition, approximately 9 percent of endangered winter-run chinook salmon and threatened adult steelhead would also continue to be blocked or impeded by the gates at RBDD under this alternative (Figure 3.2-8).

***Juveniles.*** The juvenile passage indices for the NAS species are rather large (greater than 92 on a scale of 100) (Table 3.2-7). For Alternative 1A, there are no differences in the juvenile passage indices for the NAS species as compared to the No Action Alternative. This result is because of the lack of operational changes (gates in/out) for this alternative that affects the principal impact mechanism (predation) for juvenile anadromous salmonids at RBDD. The juvenile passage indices for the NAS, NAO, and RN/RNN species analyzed using the Fishtastic! tool are presented on Figure 3.2-9.

### *Other Native Anadromous Species.*

***Adults.*** The adult passage indices for the three NAO species for Alternative 1A are equal to or greater than those for the No Action Alternative (Table 3.2-8). These indices are also shown on Figure 3.2-10. There is no improvement in the adult passage index for green sturgeon from implementing this alternative (Table 3.2-8). This is because this species does not generally successfully use fish ladders constructed for salmonid species, and even with improvement in the fish ladders, this species would not benefit.

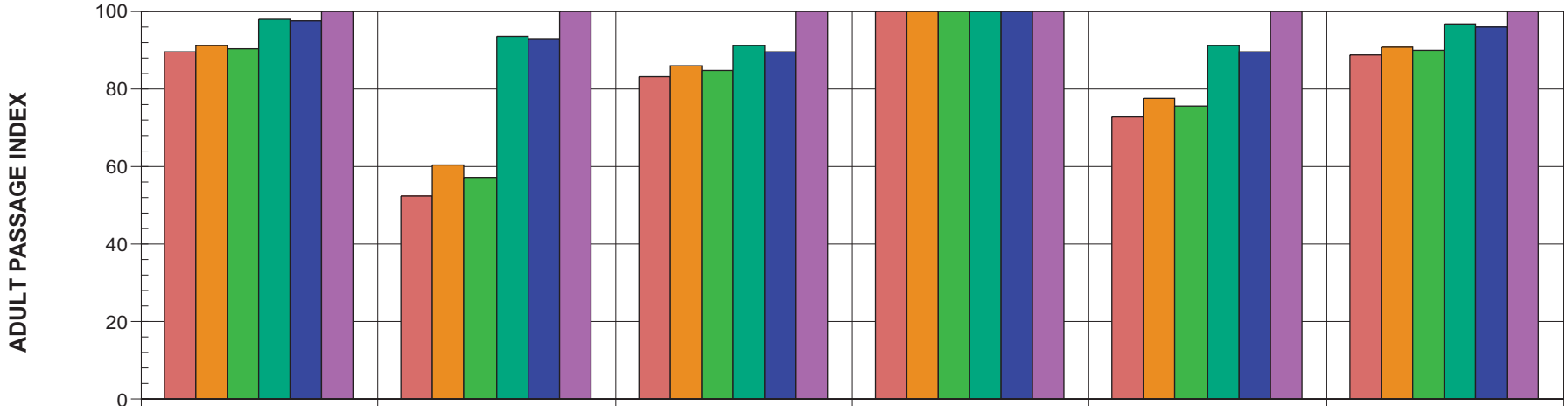
The small (3 percent) improvements in adult Pacific and river lamprey passage indices are a result of increased efficiencies in attraction to and passage within the new fish ladders featured in this alternative.

However, the magnitude of these improvements is not sufficiently beneficial to be a measurable benefit for adult lamprey passage. For all project alternatives and the No Action Alternative, the passage indices for the lamprey species are great (>83 on a scale of 100). This is because of these species' passage timing and the assumption that these species efficiently pass salmonid-type fish ladders (Table 3.2-10). Lamprey are known to transit fish ladders by attaching to the ladder structures with their oral disc (sucker) (Killam, pers. comm.), thereby resting between bursts of swimming activity while passing through the ladder. How much energy is expended by passing through fish ladders as opposed to swimming upstream within an unobstructed river reach is unknown.

***Juveniles.*** For this alternative, there are no differences in the juvenile passage indices for the three NAO species as compared to the No Action Alternative (Table 3.2-11). This result is because of the lack of operational changes for this alternative that affects the principal impact mechanism (predation) for juveniles of these species at RBDD. Juvenile passage indices are shown on Figure 3.2-9.

### *Non-native Anadromous Species.*

***Adults.*** NNA species that may occur periodically at RBDD include American shad (shad), and striped bass (stripers). These species more commonly occur in the lower portions of the Sacramento River and Delta, but seasonally occur at RBDD. It is not necessary for either of these introduced species to migrate to areas upstream of RBDD to



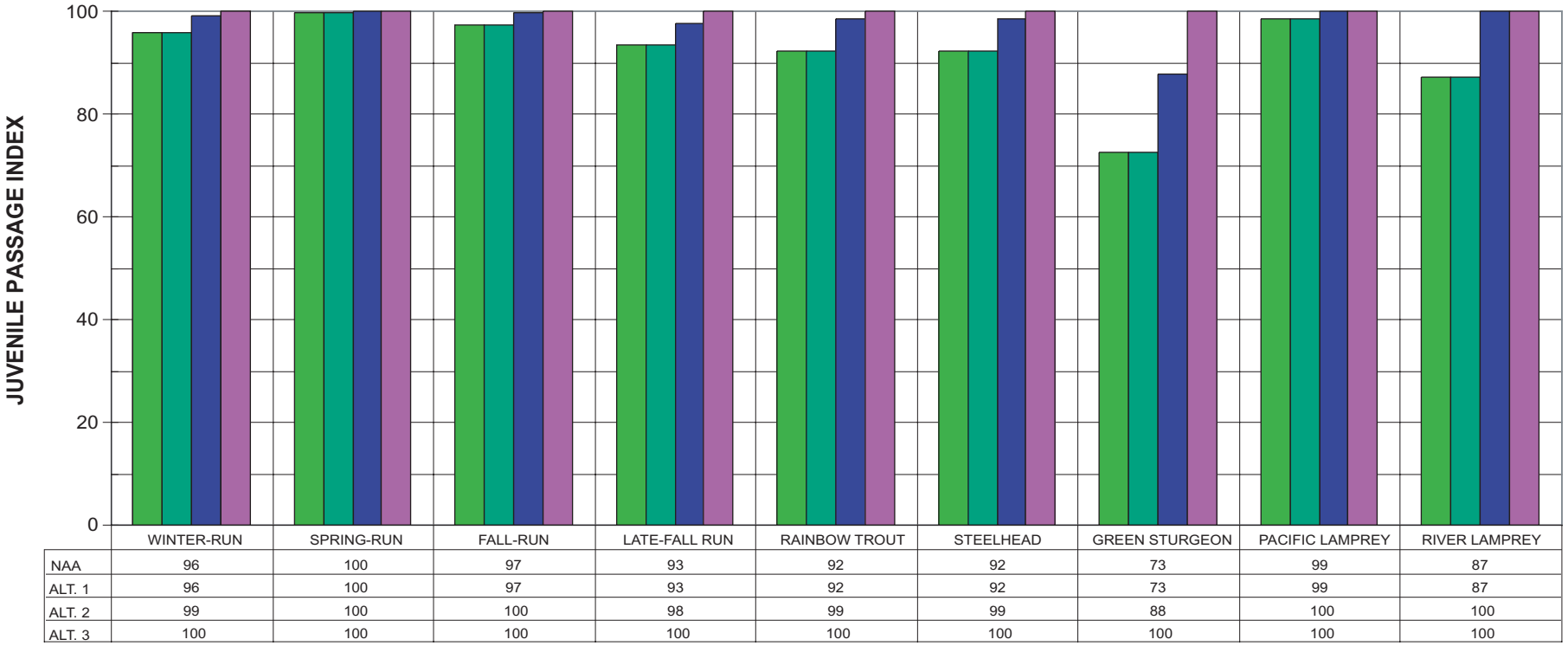

| | WINTER-RUN CHINOOK SALMON | SPRING-RUN CHINOOK SALMON | FALL-RUN CHINOOK SALMON | LATE-FALL-RUN CHINOOK SALMON | RAINBOW TROUT | STEELHEAD |
|---|---|---|---|---|---|---|
| NAA | 89 | 52 | 83 | 100 | 73 | 89 |
| Alt. 1A | 91 | 61 | 86 | 100 | 78 | 91 |
| Alt. 1B | 91 | 57 | 85 | 100 | 76 | 90 |
| Alt. 2A | 98 | 94 | 91 | 100 | 91 | 97 |
| Alt. 2B | 98 | 93 | 89 | 100 | 90 | 96 |
| Alt. 3 | 100 | 100 | 100 | 100 | 100 | 100 |



**FIGURE 3.2-8**
**ADULT PASSAGE INDICES FOR NATIVE ANADROMOUS SALMONID SPECIES AND RESIDENT NATIVE RAINBOW TROUT**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_104.ai (8/19/02)

CH2MHILL



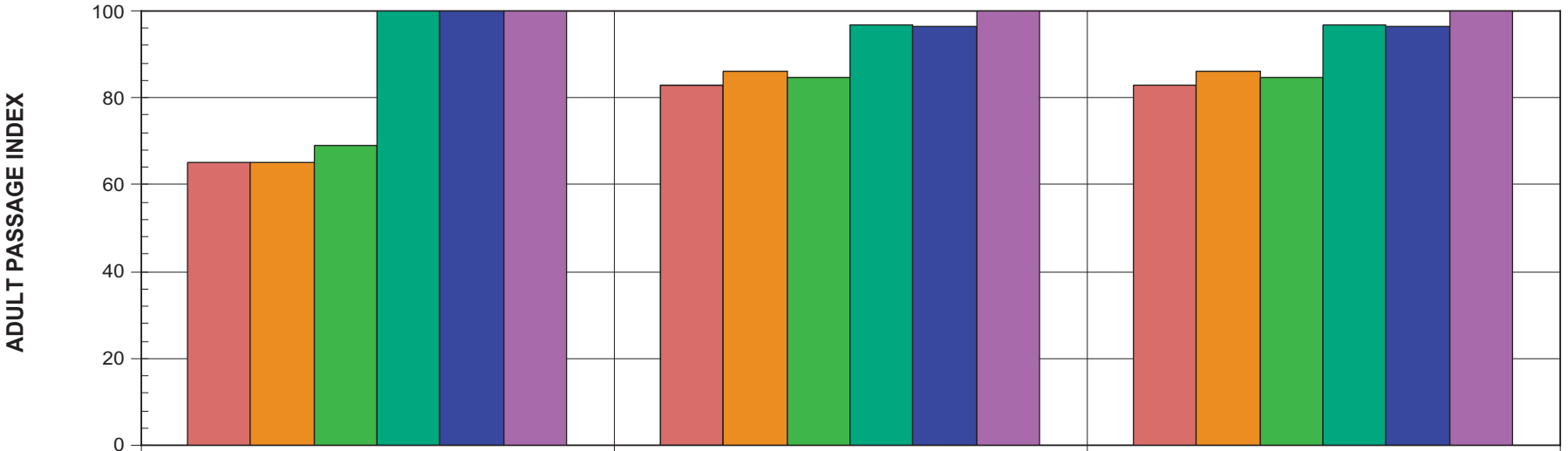

| | WINTER-RUN | SPRING-RUN | FALL-RUN | LATE-FALL RUN | RAINBOW TROUT | STEELHEAD | GREEN STURGEON | PACIFIC LAMPREY | RIVER LAMPREY |
|---|---|---|---|---|---|---|---|---|---|
| NAA | 96 | 100 | 97 | 93 | 92 | 92 | 73 | 99 | 87 |
| ALT. 1 | 96 | 100 | 97 | 93 | 92 | 92 | 73 | 99 | 87 |
| ALT. 2 | 99 | 100 | 100 | 98 | 99 | 99 | 88 | 100 | 100 |
| ALT. 3 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

NAA
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3

**FIGURE 3.2-9**
**JUVENILE PASSAGE INDICES SPECIES ANALYZED USING THE FISHTASTIC! TOOL**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W072002003RDD_222 (8/14/02)

CH2MHILL




| | GREEN STURGEON | PACIFIC LAMPREY | RIVER LAMPREY |
|---|---|---|---|
| NAA | 65 | 83 | 83 |
| ALT. 1A | 65 | 86 | 86 |
| ALT. 1B | 69 | 85 | 85 |
| ALT. 2A | 100 | 97 | 97 |
| ALT. 2B | 100 | 96 | 96 |
| ALT. 3 | 100 | 100 | 100 |

NAA
ALTERNATIVE 1A
ALTERNATIVE 1B
ALTERNATIVE 2A
ALTERNATIVE 2B
ALTERNATIVE 3

**FIGURE 3.2-10**
**ADULT PASSAGE INDICES FOR OTHER NATIVE ANADROMOUS SPECIES**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W072002003RDD_1031.ai (8/14/02)

CH2MHILL

spawn or rear their young. Adult shad would be expected to arrive at RBDD during their spawning run primarily from May through July. However, this species generally does not successfully use fish ladders that are primarily designed to pass salmon, steelhead, or trout. For this species, little if any benefit would be expected to occur from the implementation of Alternative 1A. Furthermore, the continued impedance of shad from passing RBDD is not likely to adversely affect the continued success of this species.

New ladders on the east and west banks would provide additional flow and passage improvement for salmonids but would likely not significantly improve adult passage of striped bass. It has been observed that striped bass arrive at RBDD in the spring/early summer months after spawning in the lower reaches of the Sacramento and Feather rivers. After arriving at RBDD, stripers seem to prefer to remain immediately downstream of the dam. These highly predatory fish continue to forage on juvenile fish passing through the dam (Tucker, pers. comm.). It is unlikely that this alternative would significantly alter this behavior, and therefore, this alternative would not alter adult passage of either American shad or striped bass.

***Juveniles.*** Juvenile striped bass are not likely to be present in the project area as they typically spawn in the lower reaches of the Feather and Sacramento rivers and rear in the Delta. There would be no change from the No Action Alternative in operations that would affect juvenile American shad. Therefore, this alternative would neither benefit nor adversely impact juveniles of either shad or striped bass.

***Resident Native and Resident Non-native Species.***

***Adults.*** Rainbow trout are a species of native resident fish that were analyzed using the Fishtastic! tool. For Alternative 1A, the adult rainbow trout passage is improved approximately 7 percent over that for the No Action Alternative (Table 3.2-11). The small improvement in adult rainbow trout passage for this alternative is a result of increased efficiencies in attraction to and passage within the new fish ladders featured in this alternative. However, the change in adult passage index for this species is small and not considered a significant improvement for rainbow trout, which can pass fairly readily through the existing ladders. A rather large component (approximately 22 percent) of adult rainbow trout remains blocked or impeded by the gates at RBDD with this alternative (Figure 3.2-8).

Other than rainbow trout, the principal resident native species found near RBDD include Sacramento pikeminnow, splittail, hardhead, and Sacramento sucker. These species have evolved within the Sacramento River and have distinct life history characteristics and requirements. All of these species maintain residency within the freshwater portion of the Sacramento River watershed. However, these species do migrate

upstream and downstream throughout the river system to meet their spawning, rearing, and foraging needs; therefore, the operations of RBDD can hinder these species to a greater or lessor degree depending on time of year and the species' needs.

Adult Sacramento pikeminnow (formerly squawfish) are known to migrate upstream in the spring months to spawn, therefore when the RBDD gates go in, these fish tend to congregate below the dam. Operation of RBDD under the Reasonable and Prudent Alternatives specified in the Winter-run Chinook Salmon Biological Opinion (NMFS, 1993), which specified that the gates may not go in prior to May 15th, may reduce the impacts of predation on salmonids from pikeminnow. This species can and does readily pass through the existing fish ladders at RBDD. However, there continues to be a congregation of predators, including pikeminnow, downstream of RBDD under existing conditions and the No Action Alternative when the gates are in. Tucker (1998) found that during sampling in 1994 to 1996, the largest catch/per unit effort (26 percent of annual total) of Sacramento pikeminnow occurred at RBDD during June when the gates were in.

Under Alternative 1A there may be additional passage opportunity provided for adult pikeminnow through the new fish ladders proposed for the left and right banks. However, the incremental increase in ladder passage provided to pikeminnow by the new ladders is likely to be small and not measurably important to this species. Other species such as hardhead and Sacramento sucker are also not likely to significantly benefit from this alternative. These species also are known to successfully use fish ladders, but their passage is greatly restricted by fish ladders principally designed for salmonids. Ladder modifications to attract and pass salmonids may increase their use by these species, but not likely to a large degree. Splittail do not successfully pass fish ladders and, therefore, would not benefit from this alternative.

Adult passage of other resident non-native species (e.g., brown trout) may benefit somewhat from this alternative as this species readily passes fish ladders. Most of the other resident non-native fish such as bass, sunfish, catfish and shiner that are commonly found near RBDD (see Table 3.2-1) would not benefit from this alternative. On the other hand, most of these non-native species have life history characteristics that do not require migration over large geographic distance, and therefore, passage impediments such as RBDD do not greatly affect their populations.

***Juveniles.*** For this alternative, there is no difference in the juvenile rainbow trout passage index when compared to the No Action Alternative (Table 3.2-11). This result is because of the lack of operational changes for the alternative that affects the principal impact mechanism (predation) for juvenile rainbow trout at RBDD. Juvenile passage indices are shown on Figure 3.2-9. Similarly, juveniles of other

RN/RNN species would neither benefit nor be adversely affected by this alternative.

### 1B: 4-month Bypass Alternative

#### Construction-related Impacts.

***Impact 1B–F1: Construction.*** Impacts from constructing a fish bypass channel, new right bank fish ladder, and a pump station, including screens and bypasses, could include direct and indirect losses of adult and or juvenile fish. These impacts would principally occur during installation of cofferdams. The construction areas would include areas near the existing right (west) bank fish ladder, the take-out and put-back confluence areas of the bypass channel on the left (east) bank of the Sacramento River, and the new pump station location at the Mill Site. At the Mill Site, a large sheet pile cofferdam would be required, up to approximately 1,400 LF. Construction of the right bank fish ladder would require a 270-LF sheet pile cofferdam. The exact dimensions of the cofferdammed areas for the bypass channel take-out and put-back areas are unknown.

The impacts would occur during installation of sheet piling and dewatering of project areas following sheet pile installation. Both adults and juveniles may be stranded and lost during dewatering actions following the installation of sheet piling.

These activities would adversely affect migrating adult fish, rearing stages of fry and juveniles, and migrating salmonid smolts. These impacts would be significant and would require mitigation or conservation measures, depending on species, to reduce these impacts to less than significant.

Additionally, direct losses and adverse indirect effects to adults and juvenile life stages could occur as a result of sediment disturbances and turbidity that would result from construction of project bypass channel and the pump station. These impacts would be significant and would require mitigation to reduce them to less than significant. For impacts of sedimentation and turbidity, mitigation/conservation measures are addressed in the Water Quality section (3.3.4).

***The impacts from construction on fishery resources would be significant.***

**Operations-related Impacts.** ***There would be no significant adverse impacts on fishery resources under Alternative 1B; therefore, no mitigation is required.***

Below is a summary of fish passage index values for this alternative.

#### *Native Anadromous Salmonid Species.*

***Adults.*** As shown in Table 3.2-6, the adult passage index values for Alternative 1B for the five NAS species are equal to or greater than

those for the No Action Alternative. The index values for these NAS species are shown on Figure 3.2-8. As was previously stated for Alternative 1A, there is no change or improvement in the adult passage index for late-fall chinook salmon for any project alternative (this species does not immigrate through RBDD during the gates-in operational period). There are small (approximately 1 to 2 percent) improvements in adult passage indices for winter-run, and fall-run chinook salmon and steelhead. These small improvements in adult passage are a result of small incremental increases in adult passage that may occur by these species using the bypass channel and a new right bank fish ladder. A slightly more favorable improvement (approximately 9 percent) in adult passage of spring-run chinook salmon would occur with the implementation of this alternative. However, the magnitudes of these improvements are generally not sufficiently beneficial to be considered a measurable passage improvement for these species. A rather large (approximately 43 percent) component of threatened adult spring-run chinook salmon and smaller components of endangered adult winter-run and threatened adult steelhead (both approximately 9 to 10 percent) remains blocked or impeded by the RBDD gates (Figure 3.2-8).

***Juveniles.*** See the discussion of juvenile passage of NAS species for Alternative 1A.

### *Other Native Anadromous Species.*

***Adults.*** The adult passage indices for the three NAO species for Alternative 1B are greater than those for the No Action Alternative (Table 3.2-8). These indices are shown on Figure 3.2-10. For this alternative, and compared to the No Action Alternative, there is a small (approximately 6 percent) improvement in adult passage of green sturgeon. This is because adult green sturgeon may use the constructed bypass channel. However, the likelihood and ability of this species to use the bypass channel is unknown. Therefore, the uncertainty of adult green sturgeon to successfully pass through this channel is reflected as only a small increase in passage index for this species.

There are similar, small (approximately 2 percent) improvements for passage of adult Pacific and river lamprey. These species may also use the bypass channel to some, but unknown, extent as well as pass through the improved right bank fish ladder featured for this alternative. The magnitude of these improvements as shown in Table 3.2-8 is generally not sufficiently great enough to be considered a measurable benefit for adult of these NAO species. As previously discussed, the passage indices for the lamprey species are high (>85 on a scale of 100) because of these species' life histories and the likelihood that they can pass through salmonid fish ladders even with some loss of efficiency.

***Juveniles.*** See the discussion of juvenile passage of NAO species for Alternative 1A.

### *Non-native Anadromous Species.*

***Adults.*** Adult American shad and striped bass may benefit somewhat by successfully passing RBDD via the bypass channel that would be constructed for the alternative. A low-gradient bypass channel that would be designed to provide slower water velocities and abundant resting segments may assist species like shad and stripers, which have some difficulty with or reluctance to pass conventional fish ladders designed primarily for salmonids. However, the extent to which these two species would successful pass through the bypass channel is unknown. As previously stated, adult stripers currently prefer to remain immediately downstream of RBDD and generally do not pass the existing fish ladders. It is likely that with the RBDD gates in the river (similar to the No Action Alternative), stripers would chose to remain downstream of the gates, preying on juvenile fish rather than re-distributing to upstream areas via the bypass channel.

The benefit to adult passage for either of these species is unknown and is likely small and insignificant. A more likely scenario, for this alternative, is that stripers would remain downstream of RBDD or possibly move into the bypass channel and continue to prey on juvenile salmonids or other species. Furthermore, given the opportunity to transit the bypass channel, shad may or may not actually move farther upstream to spawn.

***Juveniles.*** Juvenile American shad would likely benefit from this alternative by the reduction in the rate at which they are preyed upon by adult striped bass and Sacramento pikeminnow. The RBDD gates would be out until July 1, and would likely discourage predatory species, particularly pikeminnow, from congregating downstream of RBDD. This would lessen the potential for predation and allow a greater number of shad to pass unmolested downstream through the project area. There would be no benefit or adverse impact to juvenile striped bass, as this species does not occur in the project area.

### *Resident Native and Non-native Species.*

***Adults.*** The improvement in passage of adult rainbow trout for Alternative 1B is 4 percent greater than the No Action Alternative (Table 3.2-10). The adult passage indices for this species are shown on Figure 3.2-8. The small improvement in passage index for adult rainbow trout for this alternative is a result of slight increases in efficiencies of attraction and passage in the new right bank fish ladder. There may also be some small but uncertain increase in passage through the bypass channel featured in this alternative. The magnitude of these improvements is generally not sufficient to be considered a measurable improvement in adult passage of rainbow trout, which can pass fairly

readily through the existing ladders. A rather large component (approximately 24 percent) of adult rainbow trout remains blocked or impeded by the gates at RBDD under this alternative (Figure 3.2-8).

Adult passage of other RN/RNN species may benefit from the construction of the bypass channel. The channel would provide lower velocities than the existing fish ladders and would provide long segments of flat water. These conditions would potentially be more suitable for successful passage of most, if not all, of these species. However, the extent and the successful use of this channel to migrate around RBDD is unknown, and therefore, the benefits of this alternative to most RN/RNN species would have to be considered small and likely not measurable.

***Juveniles.*** See the discussion of juvenile passage of RN/RNN species for Alternative 1A.

### 2A: 2-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 2A–F1: Construction.*** Impacts from constructing new left and right bank fish ladders and a pump station, including screens and bypasses, could include direct and indirect losses of adult and or juvenile fish. The major construction impact areas are the, the right and left bank fish ladder vicinities, and the pump station location at the Mill Site. These impacts would principally occur during installation of cofferdams. The construction areas would include areas near the existing east and west bank fish ladders and the new pump station location at the Mill Site. At the Mill Site, a large sheet pile cofferdam would be required, up to approximately 1,400 LF. Construction of the right bank fish ladder would require a 270-LF sheet pile cofferdam. Construction of the left bank fish ladder would require installation of a 166-LF sheet pile cofferdam.

In addition, impacts could also occur at these locations because of dewatering active channel areas following sheet pile installation. Both adults and juveniles may be stranded and lost during dewatering actions following the installation of sheet piling.

These activities would adversely affect migrating adult fish, rearing stages of fry and juveniles, and migrating salmonid smolts. These impacts would be significant and would require mitigation or conservation measures, depending on species, to reduce these impacts to less than significant.

Additionally, direct losses and adverse indirect effects to adults and juvenile life stages could occur as a result of sediment disturbances and turbidity that would result from construction of project fish ladders and the pump station. These impacts would be significant and would require mitigation to reduce them to less than significant. For impacts of

sedimentation and turbidity, mitigation/conservation measures are addressed in the Water Quality section (3.3.4).

***The impacts from construction on fishery resources would be significant.***

**Operations-related Impacts.** ***There would be no significant adverse impacts on fishery resources under Alternative 2A; therefore, no mitigation is required.***

Below is a summary of fish passage index values for this alternative.

***Native Anadromous Salmonid Species.***

***Adults.*** As shown in Table 3.2-6, the adult passage indices for the five NAS species for Alternative 2A are equal to or greater than those for the No Action Alternative. These indices are shown on Figure 3.2-8. As previously stated for all alternatives, there is no change in the adult passage index for late-fall chinook salmon with this alternative. There are, however, modest improvements in adult passage indices for winter-run and fall-run chinook salmon and steelhead (9 percent each). The principal benefit of the alternative occurs for adult spring-run chinook salmon where there was a passage improvement of 79 percent compared to the No Action Alternative (Table 3.2-6). This improvement is clearly a measurably large benefit to this species. The improvement to adult spring-run chinook salmon would occur because the dam gates at RBDD would remain out until July 1, allowing nearly 94 percent of the adults of this species to annually migrate past RBDD unimpeded.

Improvement to adult passage for this alternative also occurs during months of gates-in operation from the new fish ladders on the left and right banks of the river. However, the magnitude of these improvements to the ladders are, by far, less beneficial than the removal of the gates during the early to mid-summer months. The ladder improvements would not generally be considered a significant improvement for adult passage by themselves. This alternative would be effective in reducing the impedance to immigration for adults of NAS species. However, approximately 6 percent of threatened adult spring-run, 2 percent of endangered adult winter-run chinook salmon, and 3 percent of threatened adult steelhead remain blocked or impeded under this alternative (Figure 3.2-8).

***Juveniles.*** Under this alternative, the juvenile passage indices for all five of the NAS species are greater compared to the No Action Alternative (Table 3.2-7). However, the differences are small, and not measurably beneficial. The percent improvement from the No Action Alternative for juvenile passage ranges from no change for spring-run to 5 percent for late-fall-run chinook salmon, and 7 percent for steelhead. These results are because of the reduction in rates of predation of these species during longer gates-out periods, especially during the early to mid-summer

months (mid-May through June 30). The operational changes (gates-out) featured in the alternative reduces the effects of the principal impact mechanism (predation) for juvenile NAS species. Juvenile passage indices are shown on Figure 3.2-9.

***Other Native Anadromous Species.***

***Adults.*** The adult passage indices for the three NAO species Alternative 2A are all greater than those for the No Action Alternative (Table 3.2-8). The index values for these NAO species are shown on Figure 3.2-10. This alternative provides a large (54 percent) improvement in adult passage of green sturgeon compared to the No Action Alternative (Table 3.2-8). This benefit occurs because adults of this species principally migrate past RBDD in the late spring to early summer months ending July 1. This alternative would likely eliminate blockage and impedance of adult green sturgeon at RBDD.

There are also smaller (17 percent), but measurably beneficial improvements in passage of adult Pacific and river lampreys from the implementation of this alternative (Table 3.2-10). For this alternative, adult passage of the lamprey species may be improved to nearly 97 percent of unobstructed passage.

***Juveniles.*** For this alternative, there are modest but measurable passage improvements compared to the No Action Alternative for juvenile green sturgeon (21 percent) and river lamprey transformers (15 percent) (Table 3.2-11). As compared to the No Action Alternative, there is only a small (approximately 1 percent), passage improvement for Pacific lamprey transformers. Juvenile passage indices are shown on Figure 3.2-9.

***Non-native Anadromous Species.***

***Adults.*** The construction of new ladders as part of this alternative would provide little, if any, benefit for stripers because this species generally do not readily pass fish ladders designed principally for salmonid fish.

See the discussion of adult passage of NAS species for Alternative 1A.

***Juveniles.*** Juvenile American shad would likely benefit from this alternative by the reduction in the rate at which they are preyed upon by adult striped bass and Sacramento pikeminnow. The RBDD gates would be out until July 1, and would likely discourage predatory species, particularly pikeminnow, from congregating downstream of RBDD. This would lessen the potential for predation and allow a greater number of shad to pass unmolested downstream through the project area. There would be no benefit or adverse impact to juvenile striped bass, as this species does not occur in the project area.

***Resident Native and Non-Native Species.***

***Adults.*** For this alternative, adult rainbow trout passage index is approximately 25 percent greater than that for the No Action Alternative (Table 3.2-12). The indices for this species are shown on Figure 3.2-8. The improvement in adult rainbow trout passage for this alternative is a result of the gates-out operational period through June 30. A substantial number of adult rainbow trout pass RBDD during the period from May 15 through June 30. The adult passage index for this alternative is 91 (on a scale of 100). The magnitude of the passage improvement is considered measurably beneficial. However, approximately 9 percent of adult rainbow trout remain blocked or impeded by the gates at RBDD under this alternative (Figure 3.2-8).

This alternative would provide measurably beneficial conditions for passage of other adult RN/RNN species. The removal of the RBDD gates for 2 months from mid-May to June 30 and after September 1 would remove passage impedance for these species for 2 months compared to the No Action Alternative. The construction of a new fish ladder as a feature of this alternative would provide little or no benefit to most adults of RN/RNN species, with the exception of rainbow and brown trout.

***Juveniles.*** For this alternative, there is a small improvement (approximately 7 percent) in passage for juvenile rainbow trout as compared to the No Action Alternative (Table 3.2-13). This small improvement in juvenile passage would not measurably benefit this species. The change in passage index is because of the reduction in rates of predation of these species during longer gates-out periods, especially during the early to mid-summer months (through June 30). The operational changes of this alternative reduce, although not significantly, the effects of the principal impact mechanism (predation) for juvenile rainbow trout. Juvenile passage indices are shown on Figure 3.2-9.

Other juvenile RN/RNN species would likely benefit from this alternative by reducing the rate somewhat at which they are preyed upon by adult striped bass and Sacramento pikeminnow. The RBDD gates would be out through June 30 and would likely discourage predatory species, particularly pikeminnow, from congregating downstream of RBDD. This would lessen the potential for predation and allow a greater number of juveniles of the RN/RNN species to pass unmolested downstream through the project area. This benefit, however, may be offset by the removal of Lake Red Bluff for 2 months. Under this alternative, the juvenile passage indices for all five of the NAS species are greater compared to the No Action Alternative (Table 3.2-9). However, the differences are small, and not measurably beneficial. The percent improvement from the No Action Alternative for juvenile passage ranges from no change for spring-run to 5 percent for

late-fall-run chinook salmon, and 7 percent for steelhead. These results are because of the reduction in rates of predation of these species during longer gates-out periods, especially during the early to mid-summer months (mid-May through June 30). The operational changes (gates-out) featured in the alternative reduce the effects of the principal impact mechanism (predation) for juvenile NAS species. Juvenile passage indices are shown on Figure 3.2-9. Habitats that are preferred by many of the RN/RNN species, particularly the non-native bass, sunfish, and catfish, would be reduced significantly under this alternative, especially nesting sites and rearing habitats for many RNN species.

### 2B: 2-month with Existing Ladders Alternative

#### Construction-related Impacts

***Impact 2B–F1: Construction.*** Impacts from constructing a pump station, including screens and bypasses, could include direct and indirect losses of adult and or juvenile fish. The major construction impact areas are at the pump station location at the Mill Site. These impacts would occur during installation of sheet piling. At the Mill Site, a large sheet pile cofferdam would be required, up to approximately 1,400 LF.

In addition, impacts could also occur at these locations because of dewatering active channel areas following sheet pile installation. Both adults and juveniles may be stranded and lost during dewatering actions following the installation of sheet piling.

These activities would adversely affect migrating adult fish and rearing stages of fry and juveniles, and migrating salmonid smolts. These impacts would be significant and would require mitigation or conservation measures, depending on species, to reduce these impacts to less than significant.

Additionally, direct losses and adverse indirect effects to adults and juvenile life stages could occur as a result of sediment disturbances and turbidity that would result from construction of the pump station. These impacts would be significant and would require mitigation to reduce them to less than significant. For impacts of sedimentation and turbidity, mitigation/conservation measures are addressed in the Water Quality section (3.3.4).

***The impacts from construction on fishery resources would be significant.***

**Operations-related Impacts.** ***There would be no significant adverse impacts on fishery resources under Alternative 2B; therefore, no mitigation is required.***

Below is a summary of fish passage index values for this alternative.

### *Native Anadromous Salmonid Species.*

***Adults.*** For Alternative 2B, the adult passage indices for all five NAS species are equal to or greater than those for the No Action Alternative (Table 3.2-6). These indices are shown on Figure 3.2-8. As previously stated for other alternatives, there is no beneficial impact in the adult passage index for late-fall chinook salmon for this alternative. There are modest differences in passage indices for adult winter-run chinook salmon (9 percent), fall-run chinook salmon (8 percent), and steelhead (8 percent). The principal benefit of adult NAS passage at RBDD occurs to spring-run chinook salmon. For this species, the adult passage index increased nearly 77 percent compared to the No Action Alternative (Table 3.2-6). This is clearly a significantly large benefit to this species. The large improvement to migrating adult spring-run chinook salmon occurs because the dam gates at RBDD would remain out until July 1, allowing approximately 93 percent of this species to pass RBDD unimpeded. However, when compared to Alternative 2A, Alternative 2B benefits are nearly identical.

This alternative is quite effective in reducing RBDD's impedance to the NAS species. However, approximately 7 percent of threatened adult spring-run, 2 percent of endangered adult winter-run chinook salmon, and 4 percent of threatened adult steelhead remain blocked or impeded under this alternative (Figure 3.2-8).

***Juveniles.*** See the discussion of juvenile passage of NAS species for Alternative 2A.

### *Other Native Anadromous Species.*

***Adults.*** The adult passage indices for all three NAO species for Alternative 2B are greater than those for the No Action Alternative (Table 3.2-8). The index values for these species are shown on Figure 3.2-10. For this alternative, there is a large (54 percent) improvement in the adult passage index for green sturgeon (Table 3.2-8). This is a significantly beneficial passage improvement and occurs because this species primarily migrates past RBDD during late spring to early summer ending July 1. This alternative would eliminate blockage and impedance of adult green sturgeon at RBDD. The relative benefits of this alternative to the NAO species are nearly identical to those for Alternative 2A.

There are smaller (16 percent), but significantly beneficial, improvements in passage indices for adult Pacific and river lamprey from the implementation of this alternative (Table 3.2-8). Adult passage for the lamprey species may be improved to nearly 96 percent of unobstructed passage.

***Juveniles.*** See the discussion of juvenile passage of NAS species for Alternative 2A.

### *Non-native Anadromous Species.*

***Adults.*** For this alternative, the RBDD gates would remain out until July 1. This gate operation would likely result in less congregation of predatory striped bass than would occur if gates remained in during this period. Stripers would either choose to move farther upstream of RBDD, remain in the deeper holding pools at RBDD, or possibly would not remain at RBDD in search of prey. This alternative, while it provides less restriction of upstream movement for stripers, may not be beneficial to this species because it removes the physical impediment that disorients and injures prey fish as they pass through the RBDD gates. Lake Red Bluff, which offers good habitat for predatory species like stripers, would exist for only 2 months annually under this alternative. This is a disadvantage for striped bass that have greater ambush opportunities to prey on juvenile salmonids and other species when they are transiting Lake Red Bluff. This alternative would allow adult stripers additional opportunity to migrate upstream as far as Redding, which may result in undesirable increases in predation of juvenile salmonid upstream of RBDD.

Upstream passage of adult shad upstream of RBDD would likely improve with this alternative. Approximately 80 percent of the annual spawning run would transit RBDD unimpeded during the gates-out period under this alternative. This would be in contrast to approximately 35 percent for the No Action Alternative. The removal of the gates until July 1 each year would allow shad to move farther upstream into habitats that may (or may not) be more suitable for successful spawning, incubation, and early fry rearing. This however, may not provide benefits to the species because the reach of the Sacramento River upstream of RBDD is at the northernmost extent of their geographic range in the Sacramento River watershed. Furthermore, optimal spawning temperatures for shad range from 62 to 70°F (Skinnner, 1962), and these water temperatures are unlikely to occur in the Sacramento River upstream of RBDD during the months when shad would have access upstream of RBDD.

***Juveniles.*** See the discussion of juvenile passage of NNA species for Alternative 2A.

### *Resident Native and Resident Non-native Species.*

***Adults.*** The adult rainbow trout passage index value for Alternative 2B is approximately 23 percent greater than that for the No Action Alternative (Table 3.2-10). The passage indices for this species are shown on Figure 3.2-8. The improvement in adult rainbow trout passage indices for this alternative is a result of gates-out operations through June 30. A substantial number of adult rainbow trout pass RBDD during the period ending June 30. The magnitude of these passage improvements is sufficient to be considered a significant improvement for adult rainbow trout. However, approximately

10 percent of adult rainbow trout remain blocked or impeded by the gates at RBDD under this alternative (Figure 3.2-8).

This alternative would result in the same benefits and liabilities to other adult RN/RNN species as described in the discussion of operational impacts of Alternative 2A.

***Juveniles.*** See the discussion of juvenile passage of RN/RNN species for Alternative 2A.

### 3: Gates-out Alternative

#### Construction-related Impacts.

***Impact 3–F1: Construction.*** Impacts from construction on fishery resources under Alternative 3 would be the same as those identified for Alternative 2B (see Impact 2B–F1).

***The impacts from construction on fishery resources would be significant.***

**Operations-related Impacts.** ***There would be no significant adverse impacts on fishery resources under Alternative 3; therefore, no mitigation is required.***

Below is a summary of fish passage index values for this alternative.

#### *Native Anadromous Salmonid Species.*

***Adults.*** The adult passage indices for all five NAS species for Alternative 3 are equal to or greater than those for the No Action Alternative (Table 3.2-6). In all instances, the adult passage indices indicate unobstructed passage (optimal fish passage conditions = adult passage index of 100). The index values for these NAS species are shown on Figure 3.2-8. As previously stated for other alternatives, there is no impact or improvement in the adult passage index for late-fall chinook salmon from implementing this alternative (Table 3.2-6). There are significant differences (improvements) in passage indices for adult winter-run (12 percent) and fall-run (20 percent) chinook salmon, and steelhead (12 percent). The principal benefit for passage of adult NAS species occurs to spring-run chinook salmon. The passage index for spring-run chinook increased 91 percent compared to the No Action Alternative (Table 3.2-6). This is a significant and large benefit for passage for this species. These increased improvements to migrating adult NAS species occur because the dam gates at RBDD would remain out year-round and allows those species to pass unimpeded.

***Juveniles.*** The juvenile passage indices for all NAS species are improved, but do not significantly benefit these species when compared to the No Action Alternative (Table 3.2-7). These juvenile passage improvements range from no change for spring-run to 7 percent for late-fall-run chinook salmon, and 8 percent for steelhead. These benefits are

because of the reduction in rates of predation of these species when the RBDD gates are removed throughout the entire year, thereby eliminating the congregations of predatory fish downstream of the gates. Juvenile passage indices are shown on Figure 3.2-9.

### *Other Native Anadromous Species.*

***Adults.*** The adult passage indices for all three NAO species for Alternative 3 are greater than those for the No Action Alternative (Table 3.2-8). The index values for these species are shown on Figure 3.2-10. For green sturgeon adults, there is a large (54 percent) improvement from the No Action Alternative with this alternative (Table 3.2-8). For Pacific lamprey and river lamprey, adult passage indices indicate improved passage by greater that 20 percent over that for the No Action Alternative. This alternative would result in unimpeded passage (index of 100) for adults of the NAO species.

***Juveniles.*** For Alternative 3 there is a significantly large difference (38 percent) in the juvenile passage index for green sturgeon Table 3.2-9. For juvenile river lamprey, a smaller (15 percent) but significantly beneficial increase in the passage index occurs. As compared to the No Action Alternative, there is a small (1 percent) but not significant improvement in the juvenile passage index for Pacific lamprey. Under Alternative 3, juvenile passage is optimal (indices of 100) for all NAO species. These results are because of the reduction in rates of predation of these species when the RBDD gates are removed throughout the entire year, thereby eliminating the congregations of predatory fish downstream of the gates and in Lake Red Bluff. Juvenile passage indices are shown on Figure 3.2-9.

### *Non-native Anadromous species.*

***Adults.*** This alternative would allow full, unimpeded passage of both American shad and striped bass to upstream habitat. However, as stated in the discussion for the 2-month Improved Ladder Alternative, this may or may not be beneficial for adults of these species. The alternative would allow adult stripers to migrate unimpeded as far as Redding, and by doing so, may result in undesirable increases in predation of rearing anadromous salmonids in the Sacramento River upstream of RBDD.

***Juveniles.*** American shad would benefit from Alternative 3. This would occur because of dispersal of predator species like striped bass and particularly Sacramento pikeminnow. No benefit or adverse impact would occur to juvenile striped bass as they would not be expected to occur at RBDD.

### *Resident Native and Non-native Species.*

***Adults.*** The adult rainbow trout passage index for Alternative 3 is approximately 37 percent greater than that for the No Action Alternative (Table 3.2-10). The index values for rainbow trout is shown on Figure 3.2-8. The passage improvement in adult rainbow trout for

this alternative is a result of gates-up operations year-round. The magnitude of these improvements over the No Action Alternative is sufficiently beneficial to be considered a significant improvement for passage of adult rainbow trout. This alternative would result in unimpeded passage of adult rainbows.

For the other resident native species at RBDD, this alternative would also greatly benefit adult passage. The reach of the Sacramento River at Red Bluff would return to natural riverine habitats with the RBDD Alternative 3. With the gates removed year-round, unrestricted movement for reproduction, rearing, and foraging needs would occur. Many of the resident non-native species however, would suffer losses in preferred habitats with this alternative. The lacustrine (lake) habitat created by Lake Red Bluff would be lost with Alternative 3. Many of the non-native species prefer these habitats, and without the lake, habitat quantity and quality would diminish. As a result, resident non-native species abundance may decline. This however, may be a benefit to the resident native and the anadromous native species because of less competition with and predation from aggressive and predatory species such as bass and crappie.

***Juveniles.*** For Alternative 3, there is a small difference (approximately 8 percent) in the juvenile rainbow trout passage index compared to the No Action Alternative (Table 3.2-11). This difference in and of itself would not be significant, but with the implementation of Alternative 3, juvenile rainbow passage is optimal with an index of 100. The small improvement is because of the reduction in rates of predation of these species during the entire year by eliminating the congregations of predatory fish downstream of the gates. Juvenile passage indices are shown on Figure 3.2-9.

Juveniles of the resident native and non-native species would benefit from less predation downstream of RBDD than under the No Action Alternative. Furthermore, as previously described for the 2-month Alternative, juvenile resident native fish would benefit from less predation if Lake Red Bluff were to no longer exist. Juveniles of resident non-native species may not benefit from the elimination of Lake Red Bluff, as rearing habitats favoring these species would be lost.

## 3.2.3 Mitigation

This section discusses mitigations for each significant impact described in Environmental Consequences.

### 1A: 4-month Improved Ladder Alternative

**Mitigation 1A–F1.** Any in-stream construction activity would be conducted during season periods most likely to minimize the potential to impact listed, candidate, and/or Species of Special Concern. The most desirable in-stream construction activity period to avoid and/or

minimize impacts to adult and juvenile salmonids and sturgeon would be during the months of June and July. To avoid impacts to the majority of the focus species, sheet pile installation and in-stream heavy equipment activity would be coordinated with USFWS, USBR, CDFG, and NMFS to avoid and or minimize potential impacts.

The construction activities within the wetted perimeter of the active channel would be observed and monitored by a qualified fisheries monitor to eliminate direct impacts to adult or juvenile fish. In-stream construction activities would cease, if the fisheries monitor determines there is potential for direct harm or harassment of fish species in the immediate vicinity of any in-stream activity.

All dewatered areas within sheet piling would be pumped down using a screened intake on the dewatering pumps. Pumping will continue until water levels within the contained areas are suitable for salvage of any juvenile or adult fish occupying these areas. Fish would be removed by methods approved by NMFS, USFWS, and CDFG prior to final dewatering.

Implementation of these measures would reduce any impacts of construction related activity to less than significant.

#### 1B: 4-month Bypass Alternative

**Mitigation 1B–F1.** See Mitigation 1A–F1.

#### 2A: 2-month Improved Ladder Alternative

**Mitigation 2A–F1.** See Mitigation 1A–F1.

#### 2B: 2-month with Existing Ladders Alternative

**Mitigation 2B–F1.** See Mitigation 1A–F1.

#### 3: Gates-out Alternative

**Mitigation 3–F1.** See Mitigation 1A–F1.

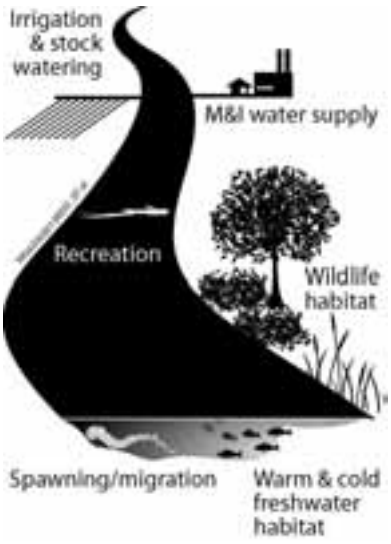
# 3.3 Water Resources

## 3.3.1 Surface-water Hydrology and Management

RBDD is located on the Sacramento River about 2 miles southeast of the City of Red Bluff. The Sacramento River is the largest river in California, flowing more than 300 miles southward from Lake Shasta to Collinsville in the Delta, and serving as the main drainage for the Sacramento River Basin.

The Delta is the region of lowest elevation in the Central Valley and consists of a maze of channels, sloughs, and dredger cuts covering an area of about 1,200 square miles. The Sacramento and the San Joaquin River systems join at the Delta and flow through Susuin Bay and the Carquinez Straights into the San Francisco Bay and eventually into the Pacific Ocean (USFWS et al., 1999).

The Sacramento River has an average annual runoff of 22.4 million acre-feet (maf) and yields 35 percent of the state's water supply (DWR, 1994). The Sacramento River is also the largest contributor of surface water within the Delta's watershed, providing approximately 80 percent of all the inflow to the Delta. The annual flow into the Delta varies from year to year; however, average annual flow into the Delta is approximately 21 maf per year. This volume represents approximately 42 percent of all surface water in California. Average outflow from the Delta is slightly higher at approximately 21.7 maf (30,000 cfs); but in summer months of critically dry years, flows can decrease ten-fold to approximately 3,000 cfs.




Flows in the upper Sacramento River are largely controlled by upstream CVP storage facilities that are operated by USBR and local irrigation districts. CVP facilities affecting upper Sacramento flows include Shasta, Keswick, Trinity, Lewiston, Whiskeytown, and Spring Creek Debris dams; RBDD; and TC and Corning canals.

Flows in the upper Sacramento River are primarily regulated by Shasta Dam, and are re-regulated 15 miles downstream at Keswick Dam. The watershed above Shasta Dam drains approximately 6,650 square miles with an average runoff of 5.7 maf (USFWS et al., 1999). Shasta Dam, which was completed in 1944, provides floodwater control and stores surplus winter runoff in Shasta Lake for irrigation use in the Sacramento and San Joaquin valleys. With a capacity of 4.6 maf, Shasta Lake is larger than any other reservoir in the state. Releases range from approximately 9 maf in wet years to 3 maf in dry years (USFWS et al., 1999).

Flows released into the Sacramento River support a variety of beneficial uses including: Municipal and industrial water supply, navigation and electric generation, agricultural practices of irrigation and stock

watering, recreational uses, warm and cold freshwater habitat, warm- and cold-water fishery migration, and spawning and wildlife habitat. Minimum releases are determined most frequently on the basis of river temperature objectives and Delta water quality objectives, and occasionally on hydropower requirements, irrigation, or navigation needs. The Sacramento River Basin and it tributaries are shown on Figure 3.3-1.

### Affected Environment

RBDD is located approximately 60 river miles downstream from Shasta and Keswick dams. Much of the river in the reach between RBDD and Keswick Dam flows through confined canyons, although portions have a broader floodplain. About 40 miles below Keswick Dam, the river widens to about 500 feet before entering the alluvial plains of the Sacramento Valley below the City of Red Bluff (Figure 3.3-1). Shasta and Keswick dams are the ultimate barriers to anadromous fish migrations in the Sacramento River. More than 75 percent of naturally spawning chinook salmon in the Sacramento River use the reach from Kewsick Dam to RBDD (CALFED Bay-Delta Program, 1999).

*Shasta and Keswick dams are the ultimate barriers to anadromous fish migrations in the Sacramento River.*

The reach of the Sacramento River that extends from Keswick Dam to RBDD receives inflow from Bear, Cow, Inks, Stillwater, Anderson, Battle, and Paynes creeks. These creeks drain on the east side of the river. To the west, this reach of the Sacramento River receives flow from Anderson, Clear, Cottonwood, and Spring creeks, which drain portions of the Klamath Mountains and the northern Coast Range Mountains.

The gates on RBDD are in place from mid-May to mid-September (gates-in period). When RBDD gates are in, the water level in the Sacramento River just above the dam rises and is maintained at an elevation of 252.5 feet above msl, which results in the formation of Lake Red Bluff. The lake is considered a major recreational feature in the City of Red Bluff, and when the water level reaches its full pool, the lake contains approximately 3,900 acre-feet of water and extends approximately 6 miles upstream through the City of Red Bluff.

Along with forming the lake, the lowering of RBDD gates also allows for the diversion of up to 2,530 cfs of irrigation water into the Corning Canal and the TC Canal. The Anderson-Cottonwood Irrigation District's (ACID) flashboard dam in Redding operates as a second diversion dam along the upper Sacramento River. The ACID dam diverts approximately 400 cfs. In addition to the gravity diversions provided by RBDD and ACID, several other pumped water diversions are located along the mainstem Sacramento River (see Figure 3.3-2). The largest is Glenn-Colusa Irrigation District's Hamilton City Pumping Plant on an oxbow off of the Sacramento River. It diverts up to 3,000 cfs of water into the Glenn-Colusa Canal. In addition, hundreds of unscreened diversions

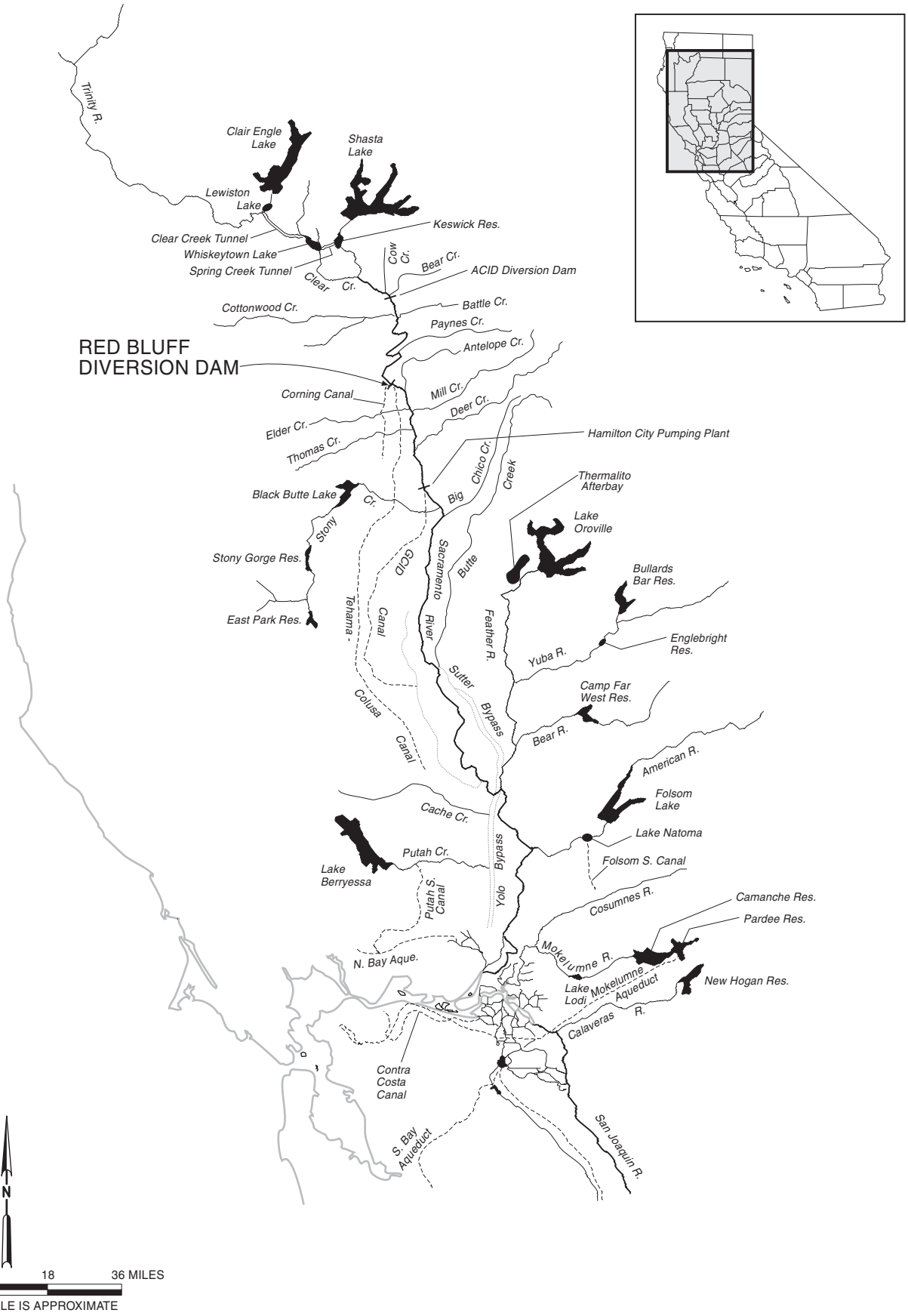



**FIGURE 3.3-1**
**SACRAMENTO RIVER BASIN AND TRIBUTARIES**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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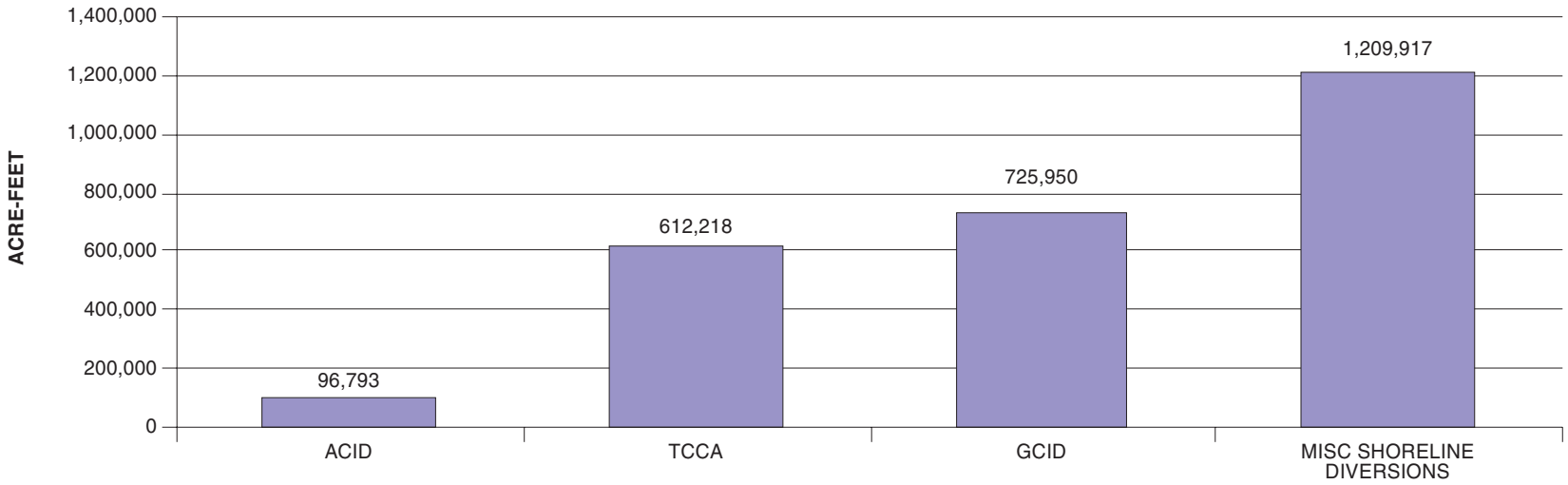


**FIGURE 3.3-2**
**WATER DIVERSIONS FROM THE SACRAMENTO RIVER (KESWICK TO THE AMERICAN RIVER)**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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located along the river operate primarily in the spring through fall irrigation season. Approximately 20 of these are considered large diversions (>250 cfs), and the majority of these, accounting for about 80 percent of the volume diverted, are screened (CALFED Bay-Delta Program, 1999). All other water diversions along the river are shoreline diversions.

The following sections summarize the flows measured in the Sacramento River in the vicinity of RBDD. The summary of the flow measurements presented below includes the period prior to the construction of RBDD and the flows following construction of the RBDD. Flow conditions in the Sacramento River before and after the construction of RBDD are shown as average monthly flows. The hydrologic data used in this analysis were derived from daily stream gage records collected by both DWR and U.S. Geological Survey (USGS) at the USGS gaging station on the Sacramento River at Bend Bridge upstream of the present RBDD. Creek and groundwater in-flows between Bend Bridge and RBDD also contribute to the total flow of the Sacramento River, but were not quantified in this assessment. The location of RBDD and the Bend Bridge gaging station is presented on Figure 3.3-3.

### Sacramento River Flow Conditions Prior to RBDD Construction

The average monthly flow of the Sacramento River for the period prior to the construction of RBDD was determined by analyzing flow data for a 15-year interval ranging from 1945 to 1960. This interval was selected because it spans the interval from the completion of Shasta Dam in 1944 to a time just before the startup of construction on RBDD in 1962, and thus, represents a period of unrestricted Sacramento River flow in the local area of RBDD.

*The average monthly flow of the Sacramento River for the period prior to the construction of RBDD was determined by analyzing flow data for a 15-year interval ranging from 1945 to 1960.*

Average monthly flow data that were recorded at the Bend Bridge gage from 1940 to 2000 are presented on Figure 3.3-4. A comparison of the monthly average flow in the Sacramento River prior to and following the construction of the dam is displayed on Figure 3.3-5. The average daily flows recorded during the periods considered are the basis for the monthly averages illustrated on these figures. The difference in the pre- and post-RBDD flows reflect both the natural variations in winter rainfall and evolving operational changes during the summer months.

### Sacramento River Flow Following RBDD Construction

Figure 3.3-6 provides a comparison of the minimum, average, and maximum recorded flows in the Sacramento River following construction of RBDD. These data are presented for the period 1980 to 2000; as with the data presented for the period prior to dam construction, this information was determined on a monthly basis. The time period from 1980 to 2000 was selected to coincide with the completion of Reach

Eight, the final section of the TC Canal and diversion of water to the reach. Reach Eight was completed on May 30, 1980. Similar to the data presented on Figures 3.3-4 and 3.3-5, the average daily flow data were compiled by month to develop the statistical results presented on Figure 3.3-6.

### Sacramento River Floodplain at RBDD

*RBDD impacts river surface elevations upstream of the dam.*

RBDD impacts river surface elevations upstream of the dam. During the gates-in period (May 15 through September 15), the surface-water elevation at the dam is maintained at 252.5 feet. During the gates-out period (September 16 through May 14), surface-water elevations at RBDD range from approximately 238.5 feet (at 4,000 cfs) to 254 feet (at 100,000 cfs). The estimated 100-year flood elevation at RBDD is 262.3 feet (at 206,000 cfs) (CH2M HILL, 2001). Figure 3.3-7 presents the current 100-year floodway and the 100- and 500-year floodplains in the vicinity of RBDD.

### Stony Creek

*As an interim measure, CVP water stored in Black Butte Reservoir is released to Stony Creek for subsequent rediversion to the TC Canal.*

As an interim measure, CVP water stored in Black Butte Reservoir is released to Stony Creek for subsequent rediversion to the TC Canal. This diversion is conducted to partially offset the loss of gravity flow diversion at RBDD. Black Butte Reservoir diversions can be made only when the water is available, and does not represent a reliable water diversion into the TC Canal. Regular use of these diversions is planned to be discontinued as soon as a permanent solution is implemented at RBDD.

Since April 1993, water has been diverted from the Black Butte Reservoir through a CHO that is located on the canal at the Stony Creek Canal siphon. Although it has never been used for its intended purpose, the CHO was originally installed to enhance aquatic habitat conditions through the release of TC Canal water into Stony Creek (USBR, 1998). A maximum of 38,296 acre-feet (approximately 53 cfs) may be diverted annually from Stony Creek to TC Canal (Stamets, 2001, pers. comm.).

In 1993, USBR first applied for a permanent change to the point of diversion permit with SWRCB to redivert water from Stony Creek to TC Canal. A temporary permit was granted by SWRCB, and CHO rediversion subsequently commenced on April 25, 1993. A second temporary permit for diversion was granted by SWRCB for the spring and fall of 1994. USBR again filed a petition for a permanent permit in June 1995. The permanent permit was issued by SWRCB on April 1, 1996 (USBR, 1998).

Stony Creek rediversions during 1993 and 1994 partially overlapped with the gates-in period at RBDD, complementing the concurrent

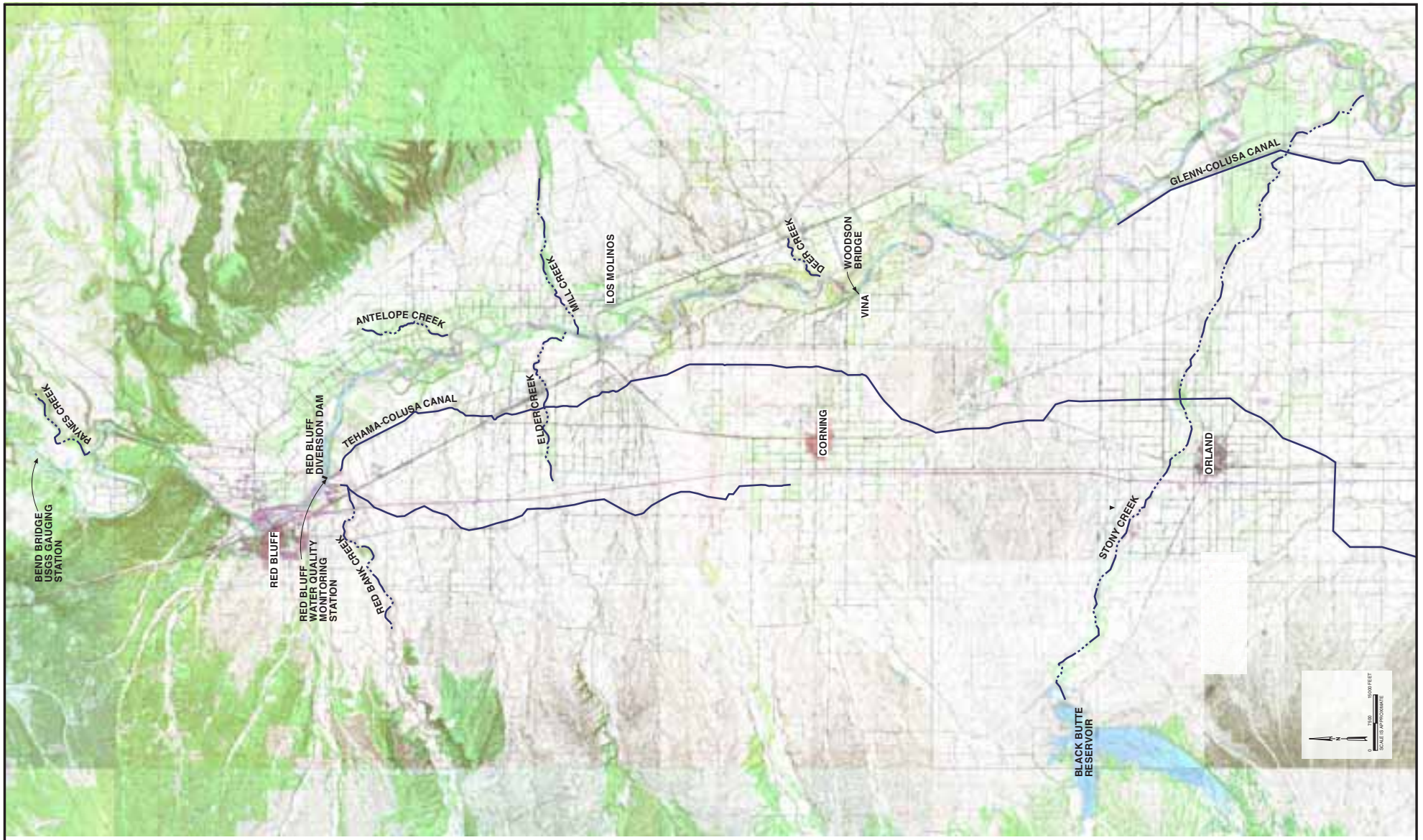


**FIGURE 3.3-3**
**USGS GAGING STATIONS**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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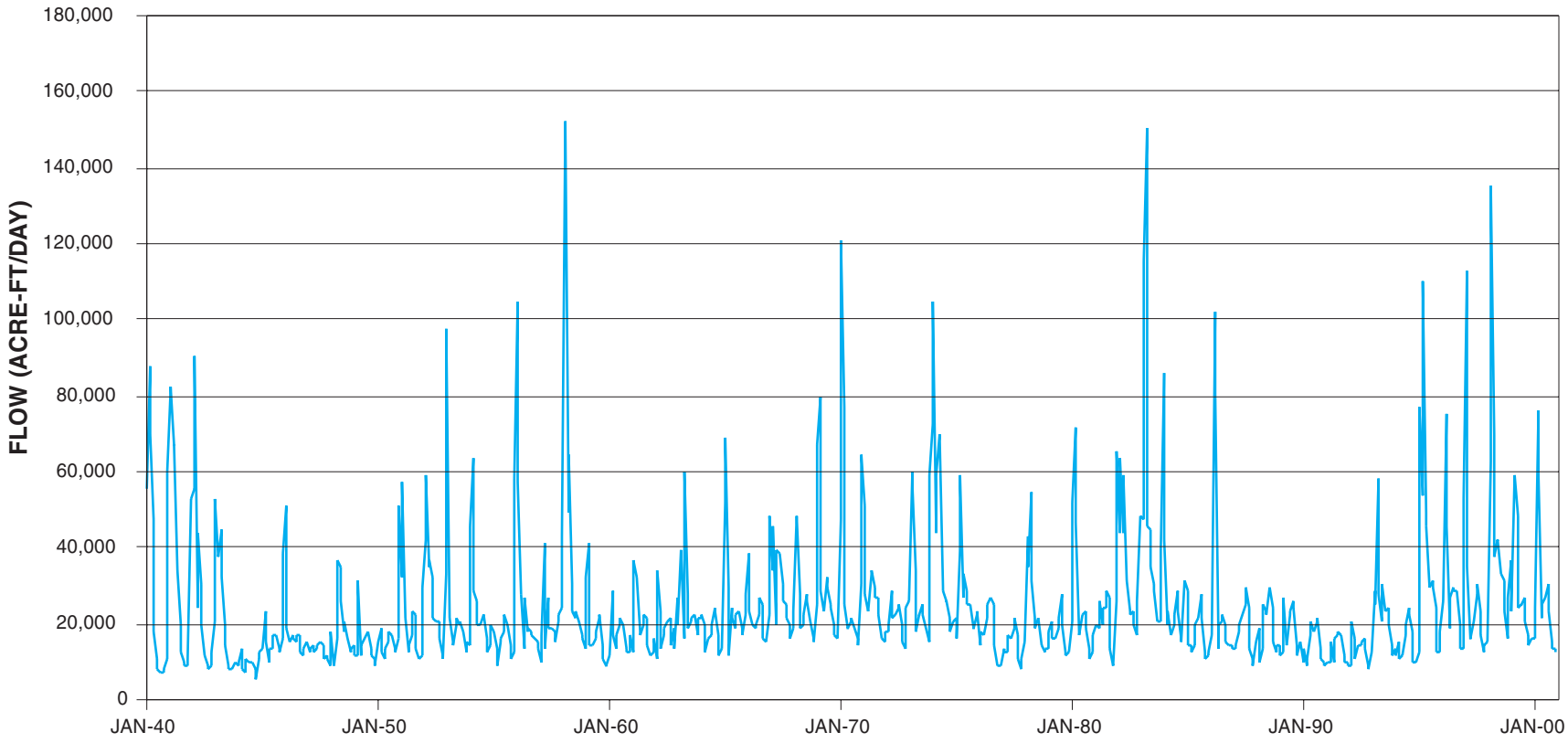


**FIGURE 3.3-4**
**AVERAGE MONTHLY SACRAMENTO RIVER FLOW AS MEASURED AT BEND BRIDGE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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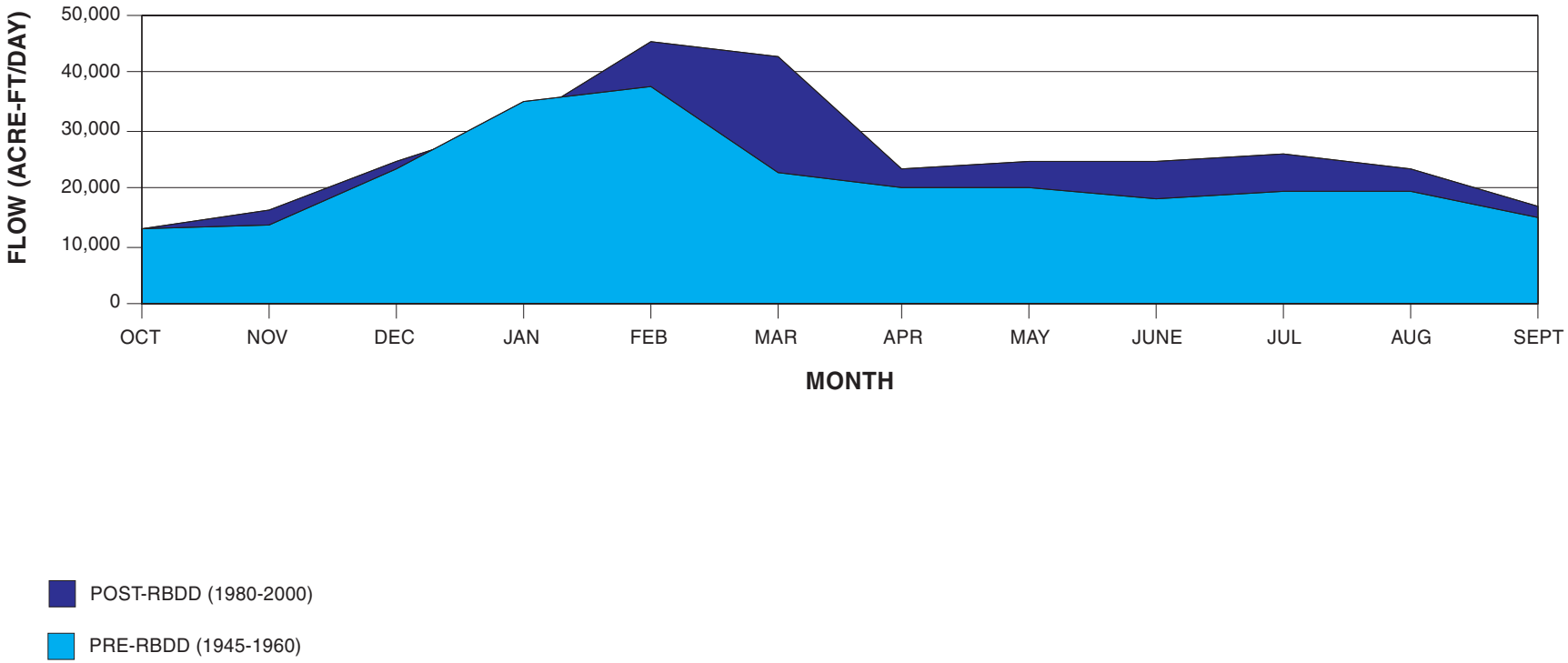


**FIGURE 3.3-5**
**SACRAMENTO RIVER FLOW AS MEASURED AT BEND BRIDGE GAGING STATION**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

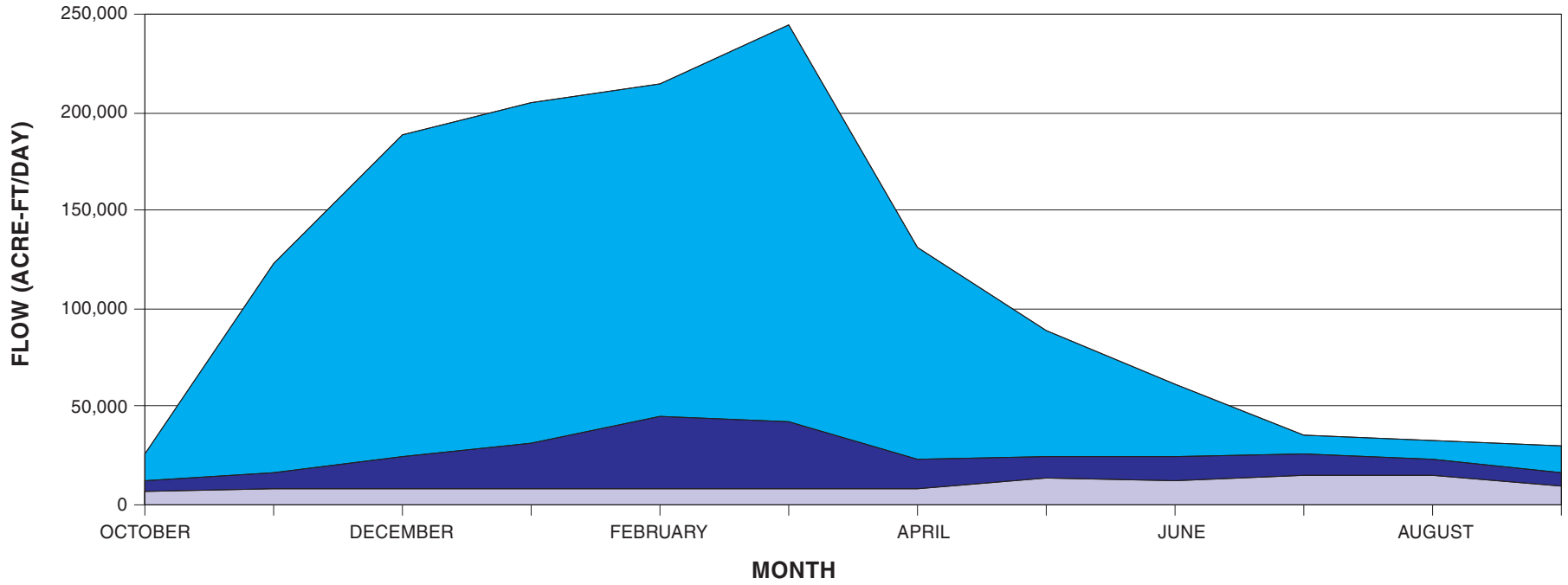


**FIGURE 3.3-6**
**MINIMUM, AVERAGE, AND MAXIMUM MONTHLY SACRAMENTO RIVER FLOWS FOLLOWING RBDD CONSTRUCTION (1980 TO 2000)**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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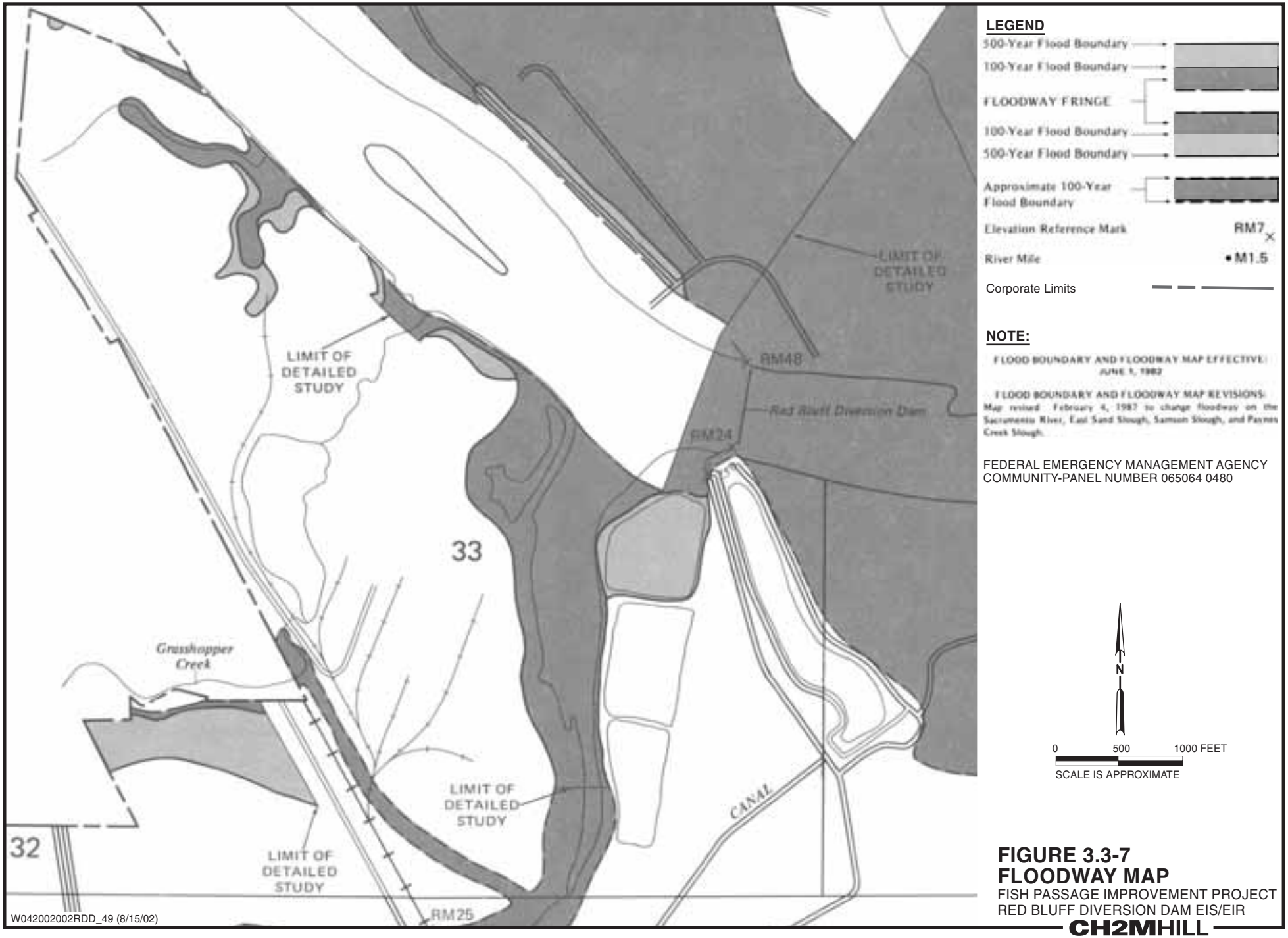


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**FIGURE 3.3-7**
**FLOODWAY MAP**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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diversions from the Sacramento River. Since 1994, rediversions from Stony Creek have only occurred during gates-out intervals to extend the period of delivery to water districts. Rediversions are currently limited by permit to the 45-day periods between April 1 and May 15 and between September 15 and October 29, although water has not been diverted from Stony Creek during the fall since 1996. An average of approximately 14,800 acre-feet per year has been rediverted from Stony Creek since rediversions were initiated, with the exception of 1998, when no water was rediverted from Stony Creek. The greatest volume of annual diversions occurred in 1996, when 26,168 acre-feet of water was diverted from Stony Creek. Figure 3.3-8 presents the contributions of the Stony Creek rediversion water to the total monthly TC Canal diversion flow for the years 1993 through 2000.

### Environmental Consequences

**Methodology.** Potential impacts to hydrology and water management were assessed through the review of existing documents, flood maps, contacts with resource agencies, and database reviews.

**Significance Criteria.** Standards of significance represent the thresholds that were used to identify whether an impact would be potentially significant. These criteria are based on Appendix G of the *CEQA Guidelines* and professional judgment with regard to the study area.

Impacts on surface-water hydrology and management would be significant if they would result in any of the following:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or offsite.
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

- Place within a 100-year flood hazard area structures that would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.
- Expose people or structures to a significant risk of loss, injury, or death from inundation by seiche, tsunami, or mudflow.

### No Action Alternative

No changes to hydrology or surface-water management would occur. Gates would be operated during the current 4-month gates-in period. Construction activity would be limited to the installation of the fourth pump at RPP. No other construction activity would occur as a result of the No Action Alternative.

### 1A: 4-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 1A–WR1: Hydrology and Water Management.*** Construction of the proposed facilities under Alternative 1A would not affect hydrology or water management in the project area.

***There would be no construction-related impacts on hydrology or water management; therefore, no mitigation is required.***

#### Operations-related Impacts.

***Impact 1A–WR2: Hydrology and Water Management.*** Operations of the left bank and right bank fish ladders would not change basic hydrology or water management of the project area. Operation of the pump station associated with Alternative 1A would potentially increase the amount of water diverted from the Sacramento River, although this would be offset by a decrease in diversions from Stony Creek, particularly in the May 1 through 14 period. The net effect of increased Sacramento River diversion capacity in the May 1 through 14 period would be less than significant.

***The impacts from operations on hydrology and water management would be less than significant; therefore, no mitigation is required.***

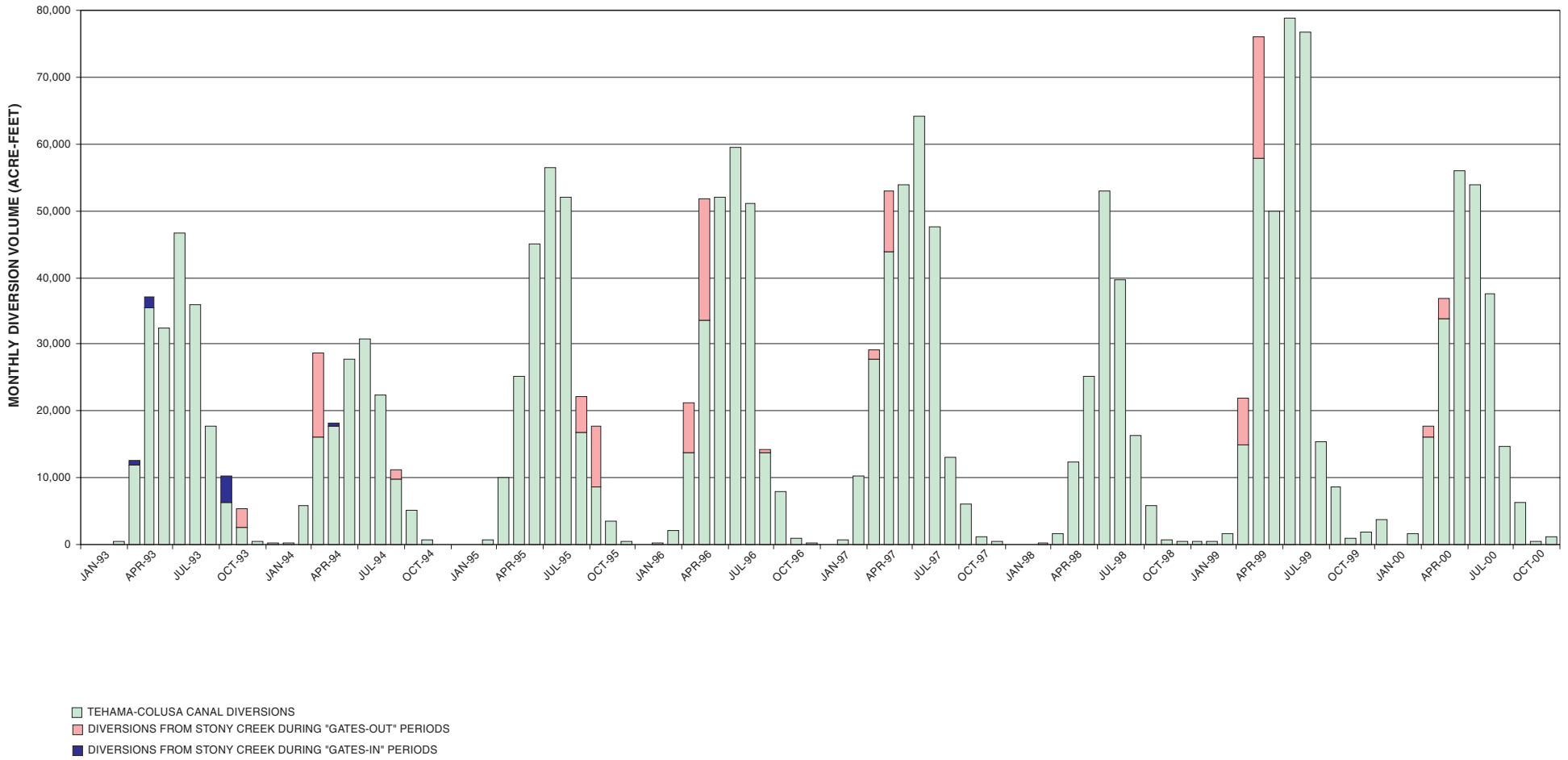


**FIGURE 3.3-8**
**STONY CREEK CONTRIBUTIONS TO TC CANAL DIVERSION FLOW**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_47 (8/15/02)

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### 1B: 4-month Bypass Alternative

#### Construction-related Impacts.

***Impact 1B–WR1: Hydrology and Water Management.*** The impacts from construction on hydrology and water management under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–WR1).

***There would be no construction-related impacts on hydrology or water management; therefore, no mitigation is required.***

#### Operations-related Impacts.

***Impact 1B–WR2: Hydrology and Water Management.*** The impacts from operations on hydrology and water management under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–WR2).

***The impacts from operations on hydrology and water management would be less than significant; therefore, no mitigation is required.***

### 2A: 2-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 2A–WR1: Hydrology and Water Management.*** The impacts from construction on hydrology and water management under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–WR1).

***There would be no construction-related impacts on hydrology or water management; therefore, no mitigation is required.***

#### Operations-related Impacts.

***Impact 2A–WR2: Hydrology and Water Management.*** Operations of the left bank and right bank fish ladders would not change basic hydrology or water management of the project area. Operation of pump station associated with this alternative would potentially increase the capacity to pump water from the Sacramento River, although this would be offset by a decrease in diversions from Stony Creek, particularly in the May 1 through 14 period. Additionally, under the 4-month gate operation, there is greater capacity for diverting water than under a 2-month gate operation; therefore, there is actually a reduction in usable capacity under this alternative. The net effect of increased Sacramento River diversion capacity in the May 1 through 14 period would be less than significant.

***The impacts from operation on hydrology and water management would be less than significant; therefore, no mitigation is required.***

### 2B: 2-month with Existing Ladders Alternative

#### Construction-related Impacts.

***Impact 2B–WR1: Hydrology and Water Management.*** The impacts from construction on hydrology and water management under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–WR1).

***There would be no construction-related impacts on hydrology or water management; therefore, no mitigation is required.***

#### Operations-related Impacts.

***Impact 2B–WR2: Hydrology and Water Management.*** The impacts from operations on hydrology and water management under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–WR2).

***The impacts from operation on hydrology and water management would be less than significant; therefore, no mitigation is required.***

### 3: Gates-out Alternative.

#### Construction-related Impacts

***Impact 3–WR1: Hydrology and Water Management.*** The impacts from construction on hydrology and water management under Alternative 3 would be the same as those identified for Alternative 1A (see Impact 1A–WR1).

***There would be no construction-related impacts on hydrology or water management; therefore, no mitigation is required.***

#### Operations-related Impacts.

***Impact 3–WR2: Hydrology and Water Management.*** Alternative 3 would not require fish ladders. Operations of the pump station associated with this alternative would potentially increase the capacity to pump water from the Sacramento River, although this would be offset by a decrease in diversions from Stony Creek, particularly in the May 1 through 14 period. Additionally, under the 4-month gate operation, there is greater capacity for diverting water than under a 0-month gate operation; therefore, there is actually a reduction in usable capacity under this alternative. The net effect of increased Sacramento River diversion capacity in the May 1 through 14 period would be less than significant.

***The impacts from operations on hydrology and water management would be less than significant; therefore, no mitigation is required.***

### Mitigation

No negative impacts from construction or operations of the proposed alternatives have been identified; therefore, no mitigation is provided.

## 3.3.2 Water Quality

The following sections summarize water quality data including temperature, dissolved oxygen, and turbidity for the Sacramento River in the vicinity of RBDD. These data were collected from a water quality monitoring station located immediately upstream of RBDD (see Figure 3.3-3).

*Water temperature is an important factor in controlling survival, development, and growth of fish during all life history stages, and is the only water quality constituent in the Sacramento River at RBDD that regularly exceeds state water quality standards or objectives.*

Water temperature is an important factor in controlling survival, development, and growth of fish during all life history stages, and is the only water quality constituent in the Sacramento River at RBDD that regularly exceeds state water quality standards or objectives. According to SWRCB's Order 90-5, the temperature objective for the operation of CVP for the upper Sacramento River from Keswick Dam to RBDD is less than or equal to 56°F (CALFED Bay-Delta Program, 1999).

The water temperature objective that was stipulated by Order 90-5 was exceeded 85 percent of the time during the gates-in period for 1998 through 2000. The average temperature of Lake Red Bluff for the gates-in period during this interval was 56.7°F.

The range of temperatures measured by DWR at the RBDD monitoring station from January 1998 through December 2000 is presented on Figure 3.3-9. The average year-round temperature during this period was 53.8°F, with roughly 38 percent of the data exceeding the 56°F water temperature standard. The highest temperature recorded during this period was 60.8°F (on September 18, 2000). Temperatures greater than 60°F are unsuitable for some fish species (see Section 3.2 Fishery Resources).

The trend in average daily temperature at RBDD, as shown on Figure 3.3-9, illustrates that temperatures have decreased since 1990. While temperatures in Lake Red Bluff peaked at 62°F to 63°F during the 1990 through 1992 gates-in period, temperatures recorded for the same period during more recent years have declined and peaked at 58°F to 59°F. Only three daily average measurements exceeded 60°F during the period of 1998 through 2000.

This reduction in temperature is most likely attributed to the actions taken as a result of the 1993 NMFS Biological Opinion for endangered winter-run chinook salmon, one of which was the temperature control device located at the Shasta Dam. The Biological Opinion designated 56°F as the temperature to be maintained in the river from Keswick Dam to Bend Bridge, and requires a gates-out operation for a greater portion of the year. A decrease in water temperature followed the transition of the gates-out period from 4 months per year to 8 months per year. This decrease is likely caused by a reduction in the warming of water in Lake Red Bluff that may have occurred because of a decrease in retention time of water in the pool behind RBDD.

*Data suggest that RBDD has a warming effect on the Sacramento River.*

For comparison, Figure 3.3-9 also includes year-round temperature data from the same period for Bend Bridge, which is located upstream of RBDD. The average water temperature at Bend Bridge for the entire January 1998 through December 2000 period was 52.8°F, with 13.5 percent of the data exceeding the water temperature standard of 56°F. The average temperature during gates-in is 53.8°F. These data further suggest that RBDD has a warming effect on the Sacramento River, as temperatures measured at RBDD (in Lake Red Bluff) are, on average, approximately 3°F higher than temperatures measured at Bend Bridge during the gates-in period.

### Dissolved Oxygen

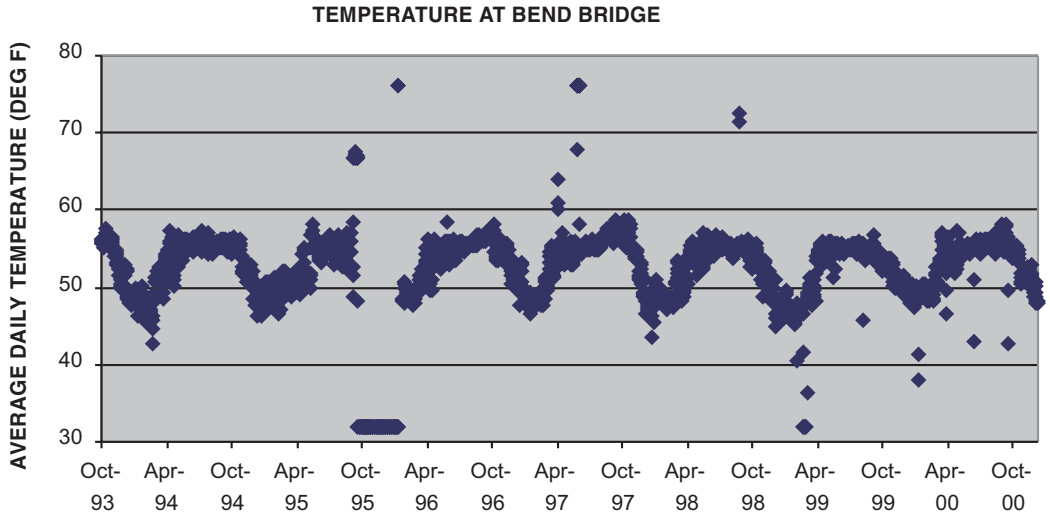
*Average dissolved oxygen concentrations at RBDD exceed minimum water quality criteria, and thus, do not pose a significant risk to the aquatic habitat in the Sacramento River.*

Average dissolved oxygen (DO) concentrations at RBDD exceed minimum water quality criteria, and thus, do not pose a significant risk to the aquatic habitat in the Sacramento River. According to the Regional Water Quality Control Board Basin Plan (Basin Plan) for the Sacramento and San Joaquin basins, DO water quality objectives for the Sacramento River from Keswick Dam to Hamilton City are set at 9.0 milligrams per liter (mg/L) for the period from June 1 to August 31. (The Basin Plan also stipulates that when natural conditions lower DO levels below 9.0 mg/L, the concentration shall be maintained at or above 95-percent saturation.) In comparison, the average DO concentration during the gates-in periods in 1999 and 2000 was 10.0 mg/L, while the average gates-out DO concentration for the November 1998 through December 2000 period was 11.0 mg/L. The average overall DO concentration for the entire gates-in and gates-out period from November 1998 through December 2000 was 10.9 mg/L. Only 1.0 percent of DO measurements during this interval was less than 2 mg/L.

For comparison, DO data collected by DWR at Bend Bridge on the Sacramento River were also analyzed. The average concentration at Bend Bridge was 10.8 mg/L for the period from November 1998 through December 2000, with only 1.9 percent of DO measurements during this interval being less than 2.0 mg/L. The average DO concentration during gates-in periods during this interval was 7.9 mg/L, while the average gates-out DO concentration was 9.0 mg/L. DO concentrations at RBDD and Bend Bridge during this interval are shown on Figure 3.3-10.

### Turbidity and Sediment Deposition

The Basin Plan does not set specific turbidity levels for the Sacramento River, but rather, it prescribes limits that are based on incremental increases in turbidity over natural conditions. According to a review of water quality data and comparison to the limits in the Basin Plan, the turbidity of the Sacramento River is not a water quality concern, although it does contribute to sediment deposition upstream of RBDD. Figure 3.3-11 illustrates the average monthly turbidity measurements



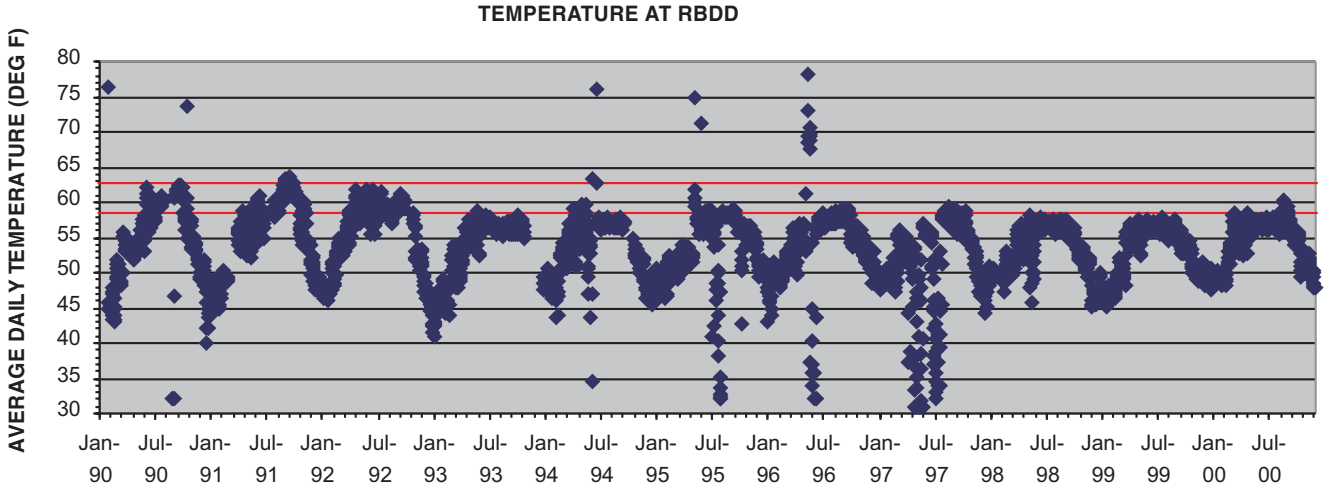




**FIGURE 3.3-9**
**AVERAGE DAILY TEMPERATURES AT BEND BRIDGE AND RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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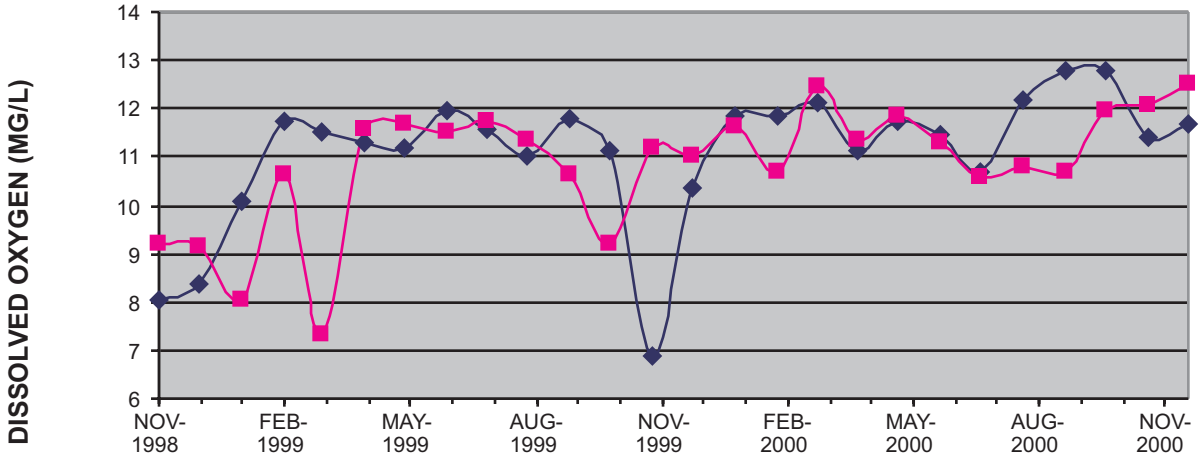


**FIGURE 3.3-10**
**AVERAGE MONTHLY DISSOLVED OXYGEN AT RBDD AND BEND BRIDGE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W072002003RDD_13 (8/15/02)

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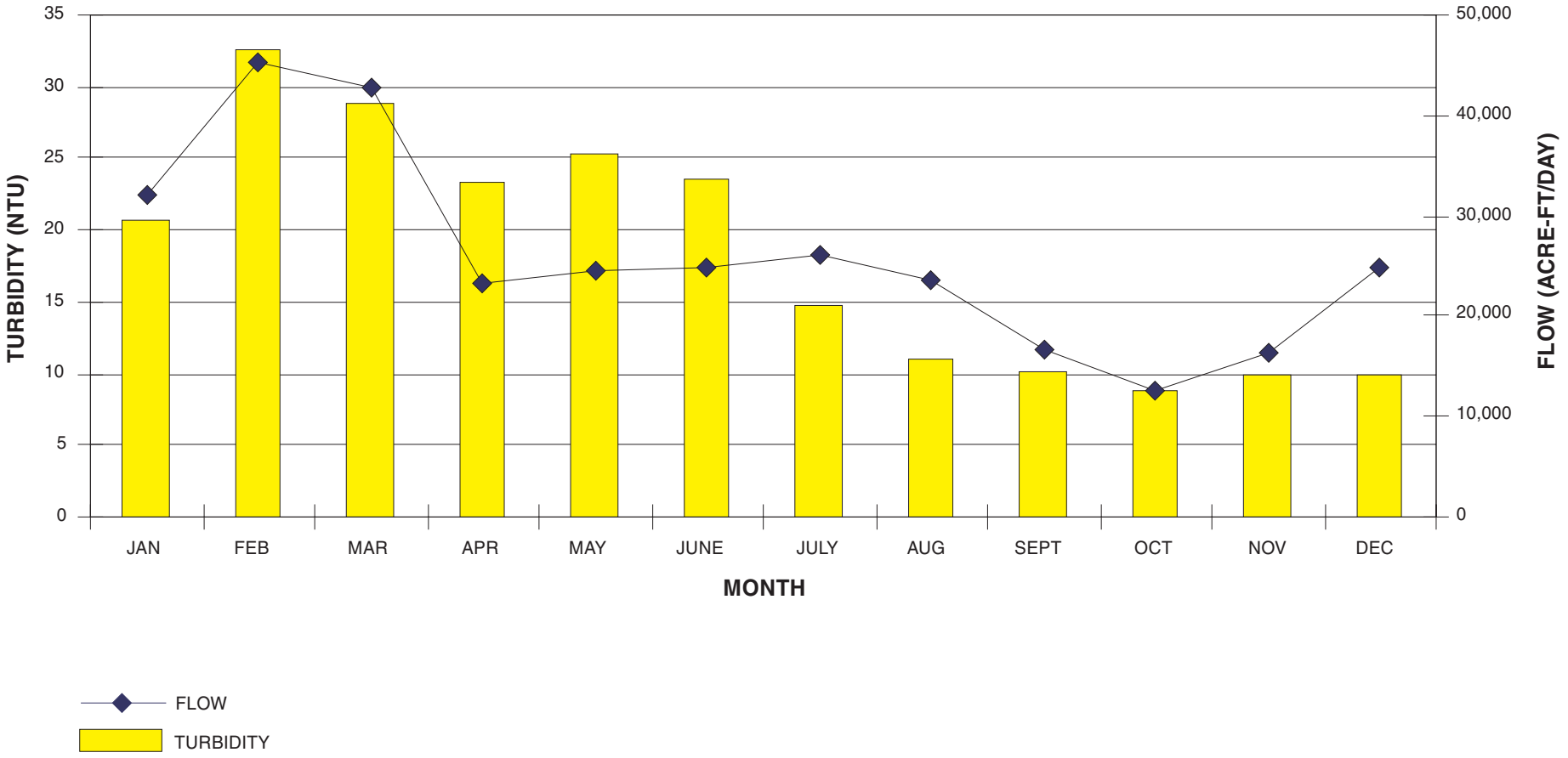



**FIGURE 3.3-11**
**AVERAGE MONTHLY TURBIDITY AND FLOW AT RBDD**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_993 (8/15/02)

CH2MHILL

for 1990 through 2000 and provides a baseline for current conditions within the vicinity of RBDD. (It should be noted that data collected from July 1994 to May 1998 were not used in this evaluation because, according to DWR, the data are unreliable because of technical difficulties. In addition, data collected from August 8 to September 12, 1999, were determined to be unrepresentative of typical turbidity conditions and were therefore not included in this analysis.)

***The turbidity of the Sacramento River is not a water quality concern, although it does contribute to sediment deposition upstream of RBDD.***

Red Bank Creek (as shown on Figure 3.3-3), which enters the Sacramento River just upstream of RBDD, contributes a large amount of sediment to the river. The average annual contribution of sediment to the Sacramento River by Red Bank Creek is 66,000 CY (USBR, 1992). Bedload sediment depths upstream of the RBDD foundation have been measured at 3 to 7 feet deep (Stodolski, 1999, pers. comm.).

### Environmental Consequences

**Methodology.** Potential impacts to hydrology and water management were assessed through the review of existing documents, contacts with resource agencies, and database reviews.

**Significance Criteria.** Standards of significance represent the thresholds that were used to identify whether an impact would be potentially significant. These criteria are based on Appendix G of the *CEQA Guidelines* and professional judgment with regard to the study area.

Impacts on water quality would be significant if they would result in any of the following:

- Violate any water quality standards or waste discharge requirements.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or offsite.
- Otherwise substantially degrade water quality.

### No Action Alternative

No changes to hydrology or surface-water management would occur. Gates would be operated during the current 4-month gates-in period. Construction activity would be limited to the installation of the fourth pump at RPP. No other construction activity would occur as a result of the No Action Alternative.

### 1A: 4-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 1A–WQ1: Increased Erosion as a Result of Grading and Excavating.*** Construction of the proposed facilities would require extensive grading

and excavation. Impacts to surface waters could occur during grading and excavation necessary for construction of the proposed fish ladders, as well as the proposed pumping plant and associated conveyance facilities.

***Impacts on water quality would potentially occur from site grading and excavation.***

***Impact 1A–WQ2: Increased Potential for Spill of Hazardous Materials.*** Construction efforts would include use of materials and equipment that require hazardous materials. Examples include diesel fuel and cleaning solvents. Although not intentional, it is possible that the use and handling of hazardous materials could result in spills that could impact nearby waterways.

***Impacts from construction on water quality would potentially occur from spills of hazardous materials.***

**Operations-related Impacts.**

***Impact 1A–WQ3: Water Quality.*** Operations of the proposed facilities under Alternative 1A would not affect local water quality in the project area.

***There would be no operations-related impacts on water quality; therefore, no mitigation is required.***

### 1B: 4-month Bypass Alternative

**Construction-related Impacts.**

***Impact 1B–WQ1: Increased Erosion as a Result of Grading and Excavating.*** Impacts from construction under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–WQ1).

***Impacts on water quality would potentially occur from site grading and excavation.***

***Impact 1B–WQ2: Increased Potential for Spill of Hazardous Materials.*** Impacts from spill of hazardous materials during construction under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–WQ2).

***Impacts from construction on water quality would potentially occur from spills of hazardous materials.***

**Operations-related Impacts.**

***Impact 1B–WQ3: Water Quality.*** Impacts from operations on water quality under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–WQ3).

***There would be no operations-related impacts on water quality; therefore, no mitigation is required.***

### 2A: 2-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 2A–WQ1: Increased Erosion as a Result of Grading and Excavating.*** Impacts from construction under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–WQ1).

***Impacts on water quality would potentially occur from site grading and excavation.***

***Impact 2A–WQ2: Increased Potential for Spill of Hazardous Materials.*** Impacts from spill of hazardous materials during construction under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–WQ2).

***Impacts from construction on water quality would potentially occur from spills of hazardous materials.***

#### Operations-related Impacts.

***Impact 2A–WQ3: Water Quality.*** Impacts from operations on water quality under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–WQ3).

***There would be no operations-related impacts on water quality; therefore, no mitigation is required.***

### 2B: 2-month with Existing Ladders Alternative

#### Construction-related Impacts.

***Impact 2B–WQ1: Increased Erosion as a Result of Grading and Excavating.*** Impacts from construction under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–WQ1).

***Impacts on water quality would potentially occur from site grading and excavation.***

***Impact 2B–WQ2: Increased Potential for Spill of Hazardous Materials.*** Impacts from spill of hazardous materials during construction under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–WQ2).

***Impacts from construction on water quality would potentially occur from spills of hazardous materials.***

#### Operations-related Impacts.

***Impact 2B–WQ3: Water Quality.*** Impacts from operations on water quality under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–WQ3).

***There would be no operations-related impacts on water quality; therefore, no mitigation is required.***

### 3: Gates-out Alternative

#### Construction-related Impacts.

***Impact 3–WQ1: Increased Erosion as a Result of Grading and Excavating.*** Impacts from construction under Alternative 3 would be the same as those identified for Alternative 1A (see Impact 1A–WQ1).

***Impacts on water quality would potentially occur from site grading and excavation.***

***Impact 3–WQ2: Increased Potential for Spill of Hazardous Materials.*** Impacts from spill of hazardous materials during construction under Alternative 3 would be the same as those identified for Alternative 1A (see Impact 1A–WQ2).

***Impacts from construction on water quality would potentially occur from spills of hazardous materials.***

#### Operations-related Impacts.

***Impact 3–WQ3: Water Quality.*** Operations of the proposed facilities would not affect local water quality in the project area.

Section 402(b) of the Clean Water Act establishes the framework for regulating stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) Program. The regulations require that stormwater associated with industrial activity that discharges directly to surface waters must be regulated by a NPDES permit. If necessary, a Stormwater Pollution Prevention Plan (SWPPP) would be prepared for the plant. The general permit that would be required includes development and implementation of a SWPPP emphasizing Best Management Practices (BMP). The General Permit requires development and implementation of a monitoring program to sample stormwater locations. Monitoring would be required of the discharge of any stormwater from the site, and would include at a minimum total suspended solids, pH, specific conductance, and oil and grease.

***There would be no operations-related impacts on water quality; therefore, no mitigation is required.***

### Mitigation

This section discusses mitigations for each significant impact described in Environmental Consequences.

### 1A: 4-month Improved Ladder Alternative

***Mitigation 1A–WQ1.*** The following mitigation measure would reduce the potential for sedimentation in the Sacramento River or Red Bank Creek to a less than significant level:

- Construction contractor shall obtain a General Construction Storm Water Permit, to comply with Clean Water Act Section 402(b) for

construction of all facilities. As part of this permit, the contractor shall prepare a SWPPP, which would include the following BMPs:

- All ground-disturbing activities would be limited to the dry season (mid-May through mid-October) to the extent possible
- Vegetation would be left in place to the degree possible to reduce potential sedimentation
- All stockpiled material would be placed so that potential erosion is minimized
- Filter fabric, straw bales, and/or sediment basins would be used to reduce erosion and the potential for in-stream sedimentation
- Seeding and re-vegetation would be initiated as soon as possible (timed properly to coincide with fall/winter precipitation) after construction completion

***Mitigation 1A–WQ2.*** Implementation of construction BMPs and development of a Spill Prevention Control and Countermeasures would minimize the risk of an uncontrolled spill and consequent contamination of the creek during project operations. The identification of staging areas for fueling and maintenance of heavy equipment would limit potential spills to designated areas where observation and cleanup could be readily accomplished. Should an oil or fuel spill occur during construction or maintenance activities, all work would cease immediately; the Central Valley RWQCB, CDFG, and USBR would be notified immediately if the quantity of the spill were above state and/or federal reporting requirements; and cleanup procedures would begin immediately.

**1B: 4-month Bypass Alternative.**

***Mitigation 1B–WQ1.*** See Mitigation 1A–WQ1.

***Mitigation 1B–WQ2.*** See Mitigation 1A–WQ2.

**2A: 2-month Improved Ladder Alternative.**

***Mitigation 2A–WQ1.*** See Mitigation 1A–WQ1.

***Mitigation 2A–WQ2.*** See Mitigation 1A–WQ2.

**2B: 2-month with Existing Ladders Alternative.**

***Mitigation 2B–WQ1.*** See Mitigation 1A–WQ1.

***Mitigation 2B–WQ2.*** See Mitigation 1A–WQ2.

**3: Gates-out Alternative.**

***Mitigation 3–WQ1.*** See Mitigation 1A–WQ1.

***Mitigation 3–WQ2.*** See Mitigation 1A–WQ2.

## 3.3.3 Groundwater and Groundwater Quality

### Affected Environment

*The depth to groundwater increases from the central portions of the basin toward the margins. Levels are usually highest in the spring and lowest in the fall.*

The significant water-producing geologic units of the Sacramento Valley trough in the vicinity of RBDD, are the unconsolidated to semi-consolidated non-marine sediments. These units range in age from the Oligocene to Miocene epochs (13 to 25 million years ago) to recent time. Generally, unconfined groundwater exists in the relatively shallow alluvial fan, floodplain, and stream channel deposits of these units. It is partially confined in and under the flood-basin deposits and is confined beneath impervious clay and mudflow strata in the older Pleistocene and Pliocene (1.8 to 5 million years ago) formations.

The depth to groundwater increases from the central portions of the basin toward the margins. Levels are usually highest in the spring and lowest in the fall. Permeability values for the claybound soils range from $10^{-5}$ to $10^{-7}$ centimeters per second, indicating relatively impermeable strata (RWQCB, 1990).

**Data Collection Activities.** Groundwater elevation data and groundwater quality data have been collected at regular intervals since the early 1990s in the vicinity of RBDD. Specifically, quarterly monitoring is conducted at five established monitoring wells located within and adjacent to the Pactiv Corporation (Pactiv) paper sludge landfill (see Figure 3.3-1). Water level data and water quality data collected at the Pactiv landfill from 1996 through 1999 were summarized in the *Groundwater Monitoring Data Report* produced by URS Corporation in March 2000.

*Locally, groundwater in the immediate vicinity of Lake Red Bluff is greatly affected by the annual filling of the lake.*

CH2M HILL (2002) conducted an environmental site investigation from February through May 2002 specifically to address the area potentially impacted by the project alternatives. One of the objectives of this investigation was to characterize groundwater flow direction and groundwater quality. Data collected from this investigation and the results of prior monitoring were used to describe site conditions and evaluate potential impacts.

**Groundwater Flow.** Regionally, groundwater replenishment occurs through deep percolation of streamflow, precipitation, and applied irrigation water. Most of the recharge occurs in the north and east sides of the valley where precipitation is the greatest. Regionally, groundwater in the North Valley moves in the general direction of the Sacramento River. In the valley south of Sutter Buttes, the groundwater gradient is nearly flat, sloping toward the Sacramento River or the Delta; however, intensive development of groundwater has created pumping depressions along the east side from Marysville to Sacramento County and on the west side of Solano County.

Locally, groundwater in the immediate vicinity of Lake Red Bluff is greatly affected by the annual filling of the lake (groundwater area of influence). As discussed in Section 3.3.1, the filling of Lake Red Bluff coincides with the gates-in period from May 15 through September 15 of each year. This change in the surface elevation of the Sacramento River, which subsequently becomes Lake Red Bluff, corresponds to a change in the groundwater hydraulic gradient and direction. This gradient change is evidenced by recent groundwater elevation measurements presented in Tables 3.3-1 and 3.3-2 obtained during the gates-in and gates-out periods. These data are graphically displayed on Figures 3.3-12 and 3.3-13, which include estimated groundwater elevation contours and flow direction for the gates-in and gates-out scenarios, respectively.

Data collected from monitoring wells (MW) in the vicinity of RBDD during the gates-out periods from 1996 to 2001 indicate that the mean lateral hydraulic gradient ranges from 0.002 to 0.005 foot per foot generally to the north to northeast. The mean lateral hydraulic gradient during gates-in periods from 1996 to 2001 ranged from 0.002 to 0.008 foot per foot to the west to northwest. Data were collected during the 2002 site investigation during the week immediately following the lowering of the RBDD gates to determine the affect on groundwater flow gradients. These water level data were collected on May 17 and May 22, 2002, two and seven days after lowering the gates. As expected, much steeper groundwater flow gradients of 0.024 and 0.01 foot per foot, with flows generally to the west, were observed during this period.

**TABLE 3.3-1**
Groundwater Elevation Measurements during Gates-in Period

| | Monitoring Well Piezometric Elevations (feet above mean sea level) | | | | | |
|---|---|---|---|---|---|---|
| **Date** | **MW-1** | **MW-2** | **MW-3** | **MW-4** | **MW-5** | **River Level** |
| Apr-90 | 252.39 | 252.43 | 243.38 | 248.13 | 251.25 | 252.6 |
| Jun-96 | 252.52 | 252.41 | 248.01 | -- | 251.84 | 252.58 |
| Sep-96 | 252.51 | 252.42 | 247.51 | -- | 251.35 | 252.55 |
| Jun-97 | 252.45 | 252.37 | 247.92 | -- | 251.51 | 252.56 |
| Jun-98 | 252.62 | 252.55 | 250.63 | -- | 253.49 | 252.64 |
| Jun-99 | 252.49 | 252.39 | 248.65 | -- | 252.71 | 252.51 |
| May-00 | 252.43 | 252.32 | 247.92 | 250.65 | 252.36 | 252.46 |
| Aug-00 | 252.48 | 252.33 | 247.58 | 249.47 | 252.14 | 252.48 |
| May-01 | 252.4 | 252.29 | 245.87 | -- | 250.75 | 252.54 |
| Aug-01 | 252.41 | 252.28 | 246.73 | 247.1 | 251.41 | 252.4 |
| 16-May-02 | 250.19 | 249.52 | 238.76 | 244.8 | 248.17 | -- |
| 17-May-02 | 251.94 | 251.94 | 239.39 | 245.06 | 248.87 | -- |
| 22-May-02 | 252.3 | 252.22 | 244.78 | 245.78 | 249.98 | -- |
| 11-Jul-02 | -- | -- | -- | 245.27 | 248.65 | -- |
| **Average** | **252.24** | **252.11** | **245.93** | **247.03** | **251.03** | **252.53** |

**TABLE 3.3-2**
Groundwater Elevation Measurements during Gates-out Period

| | Monitoring Well Piezometric Elevations (feet above mean sea level) | | | | | |
|---|---|---|---|---|---|---|
| **Date** | **MW-1** | **MW-2** | **MW-3** | **MW-4** | **MW-5** | **River Level** |
| Dec-89 | 239.93 | 243.14 | 244.3 | 248.1 | 247.9 | 240.2 |
| Mar-96 | 241.99 | 243.85 | 243.84 | -- | 249.08 | 241.58 |
| Dec-96 | 242.77 | 243.96 | 241.92 | -- | 247.24 | 243.09 |
| Mar-97 | 241.41 | 243.27 | 242.06 | -- | 248.01 | 241.21 |
| Sep-97 | 241.54 | 243.16 | 242.12 | -- | 247.21 | 241.38 |
| Dec-97 | 242.03 | 243.5 | 239.64 | -- | 247.53 | 241.85 |
| Mar-98 | 242.84 | 244.99 | 246.79 | -- | 251.49 | 242.53 |
| Sep-98 | 242 | 243.82 | 243.63 | -- | 247.91 | 241.76 |
| Dec-98 | 243.41 | 244.58 | 246.64 | -- | 248.47 | 243.34 |
| Mar-99 | 245.32 | 245.35 | 244.47 | -- | 250.41 | 246.15 |
| Sep-99 | 241.66 | 243.23 | 243.31 | -- | 248.52 | 243.87 |
| Dec-99 | 241.25 | 242.83 | 239.65 | -- | 246.84 | 241.1 |
| Jan-00 | 242.6 | 244.43 | 245.07 | -- | 250.34 | 242.3 |
| Nov-00 | 241.18 | 242.67 | 239.4 | -- | 246.84 | 241 |
| Feb-01 | 242.73 | 243.68 | 240.3 | -- | 248.04 | 242.78 |
| Nov-01 | 241.17 | 241.99 | 237.82 | 243.07 | 245.08 | 241.15 |
| 15-Mar-02 | 241.85 | 242.99 | 241.04 | 245.27 | 246.49 | -- |
| **Average** | **242.10** | **243.61** | **242.47** | **245.48** | **248.08** | **242.21** |

***Data indicate that the surface elevation of the Sacramento River increases approximately 10 feet during the gates-in period.***

The data above indicate that the surface elevation of the Sacramento River increases approximately 10 feet during the gates-in period. This difference in surface elevation is consistent with the difference in groundwater elevation observed in MW-1 (located about 100 feet south of the riverbank). The influence of the river level is less discernable at MW-5 (1,300 feet south of the riverbank) where an increase of about 3 feet in piezometric surface elevation is observed during the gates-in period.

**Groundwater Quality.** Groundwater quality is generally excellent in the region. An analysis of groundwater conditions conducted in 1991 indicated that, total dissolved solids (TDS) in the Red Bluff area were classified as less than 200 mg/L, which is below U.S. Environmental Protection Agency (EPA) and SWRCB Maximum Contaminant Levels (MCL) for drinking water. No evidence of elevated levels of boron, nitrates, arsenic, or selenium has been found in the groundwater in the Red Bluff area.

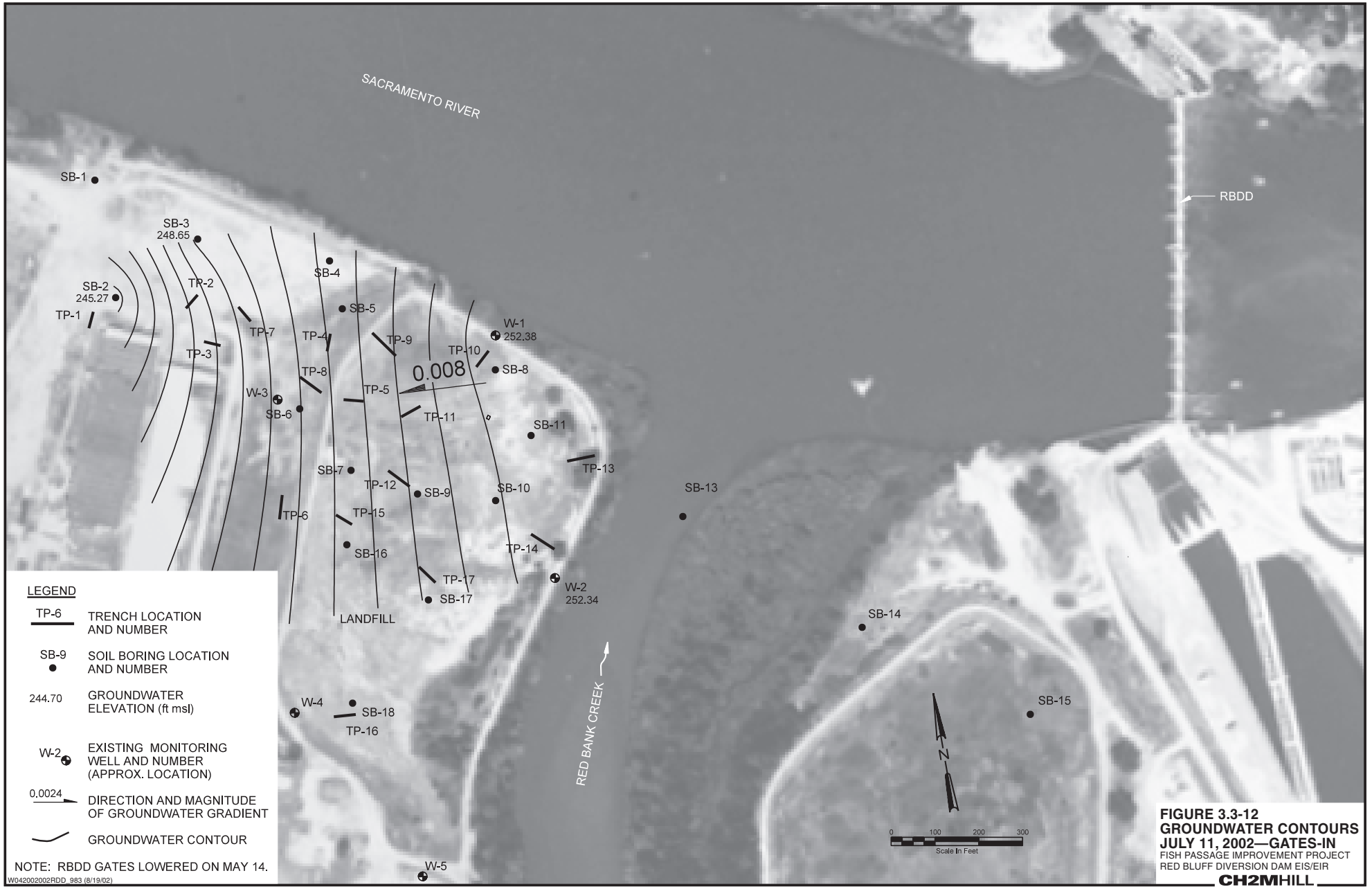



**FIGURE 3.3-12**
**GROUNDWATER CONTOURS**
**JULY 11, 2002—GATES-IN**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR
CH2MHILL


**FIGURE 3.3-13**
**GROUNDWATER CONTOURS**
**MARCH 15, 2002—GATES-OUT**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR
CH2MHILL

A site investigation and groundwater sampling program conducted by CH2M HILL in 2002 indicated the presence of toluene in groundwater near the Mill Site. Groundwater samples were analyzed for a suite of organic and inorganic compounds. However, analytical results from the groundwater samples revealed that toluene concentrations are well below the EPA's MCL of 150 micrograms per liter (μg/L) for toluene in drinking water. All other volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls, diesel range total petroleum hydrocarbons, and motor oil were below detection limits.

Trace concentrations of barium, nickel, vanadium, and chromium were also detected in groundwater at the Mill Site. It is uncertain if the metals concentrations represent background (natural) conditions or if the metals concentrations originate from the landfill. However, it should be noted that these concentrations are all well below EPA's Preliminary Remediation Goals (PRG) for cleaning up industrial sites.

**Soil Contamination.** CH2M HILL (2002) advanced 14 soil borings and completed 8 test pits (see Figure 3.3-12) within the project site to assess the quality of soils that may be impacted as the result of project construction. In general, soil was found to be free of significant contamination throughout the site. However, motor oil was detected in several soil samples, chromium was found to exceed state hazardous waste criteria in one soil sample, and polychlorinated biphenyls were detected above the EPA Region IX industrial PRG in one sample.

*The only organic compound detected in groundwater samples collected from the site was toluene.*

With the exception of the high chromium found in one of the test pits at the Mill Site (TP-12), all other sample locations contained metals below their respective PRG values. Contaminants such as volatile and semivolatile organic compounds were below method reporting limits in all samples analyzed.

*In general, soil was found to be free of significant contamination throughout the site.*

**Mineral Resources.** Mineral resources in the vicinity of the site include two gravel and sand quarries. The Red Bluff Quarry is located approximately 7 miles south of the site, and Valley Rock Products is located in Corning, approximately 27 miles south of the site. This project is not anticipated to impact quarry operations at these two locations.

**Water Supply Wells.** Three water supply wells were identified in the project vicinity by Woodward-Clyde (1989). Two of these wells are on the Pactiv property (owned by Meyer-Crest, Ltd., also known as Meyer Motels) and a third on the Meyer Motels property. Pactiv operates two water supply wells to supply drinking water and process water for its manufacturing plant (URS Corporation, 2000). The two wells were installed between 1956 and 1960, and each pumps approximately 1,200 gallons per minute (gpm). The wells operate, one at a time, on a 24-hour basis. The two wells are completed at about 600 feet below ground surface (URS Corporation, 2000).

Environmental Data Resources, Inc., (EDR) searched for publicly available information on wells within a 0.5-mile radius of the Pactiv property (EDR, 2000). EDR did not identify any active wells in the search area. The fact that the two Pactiv water supply wells were not identified by EDR suggests that the databases and information searched may not include records on some older wells.

### Environmental Consequences

**Significance Criteria.** Standards of significance represent the thresholds that were used to identify whether an impact would be potentially significant. These criteria are based on Appendix G of the *CEQA Guidelines* and professional judgment with regard to the study area. Impacts on groundwater resources would be significant if they would result in the following:

- Cause any water quality standards or waste discharge requirements to be exceeded.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).
- Otherwise substantially degrade water quality.

### No Action Alternative

No changes to hydrology or surface-water management would occur. Gates would be operated during the current 4-month gates-in period. Construction activity would be limited to the installation of the fourth pump at RPP. No other construction activity would occur as a result of the No Action Alternative.

### 1A: 4-month Improved Ladder Alternative

#### Construction-related Impacts.

***Impact 1A–GW1: Contaminants.*** Soil contamination at the Pactiv site represents potential impacts to local groundwater resources if contaminated soil is allowed to come in contact with groundwater as a result of project construction activities. Additionally, leaching of soluble or mobile contaminants from soil to groundwater may occur over time if contaminated soil is stockpiled onsite for a long period of time or relocated to a disposal area onsite, through infiltration and other transport processes.

***Groundwater quality could be significantly impacted if soil contaminants come in contact with groundwater at the Mill Site.***

**Operations-related Impacts.**

***Impact 1A–GW2: Groundwater Quality.*** No impacts involving groundwater are expected from the operations of Alternative 1A.

***There would be no operations-related impacts on groundwater; therefore, no mitigation is required.***

### 1B: 4-month Bypass Alternative

**Construction-related Impacts.**

***Impact 1B–GW1: Contaminants.*** Impacts on groundwater from construction under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–GW1).

***Groundwater quality could be significantly impacted if soil contaminants come in contact with groundwater at the Pactiv site.***

**Operations-related Impacts.**

***Impact 1B–GW2: Groundwater Quality.*** Impacts on groundwater quality from operations under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–GW2).

***There would be no operations-related impacts on groundwater; therefore, no mitigation is required.***

### 2A: 2-month Improved Ladder Alternative

**Construction-related Impacts.**

***Impact 2A–GW1: Contaminants.*** Impacts on groundwater from construction under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–GW1).

***Groundwater quality could be significantly impacted if soil contaminants come in contact with groundwater at the Pactiv site.***

**Operations-related Impacts.**

***Impact 2A–GW2: Groundwater Quality.*** Impacts on groundwater quality associated with varying the periods of time the RBDD gates would be insignificant. Groundwater in the vicinity is generally clean and does not present a significant threat to surface-water quality regardless of gradient and flow direction.

The reduced gates alternative would result in a reduction in the amount of time Lake Red Bluff would be formed. This would ultimately change seasonal elevations of groundwater in the project area.

In the vicinity of the project, two water supply wells were identified, both on the Pactiv property. The existence of these wells do not appear to have a significant affect on the flow direction or gradient of the shallow groundwater system (URS Corporation, 2000). These are deep wells and are located between 1,400 and 2,000 feet from the banks of the Sacramento River. A deep groundwater aquifer supplies these wells

with up to 1,200 gpm year-round, regardless of the RBDD gates position.

Additional wells could exist in the vicinity of Lake Red Bluff that have not been identified during the development of this EIS/EIR. Wells that depend on the additional groundwater recharge and head provided by Lake Red Bluff could require alternate water supplies if the gates remain out during the dry season. However, because the gates are currently out most of the year, wells in the aquifer areas influenced by the filling of Lake Red Bluff are probably already designed to supply water regardless of gates position.

***The amount of groundwater available for beneficial use will not be significantly impacted by changes in gate operations.***

### 2B: 2-month with Existing Ladders Alternative

#### Construction-related Impacts.

***Impact 2B–GW1: Contaminants.*** Impacts on groundwater from construction under Alternative 2B would be the same as those identified for Alternative 1A (see Impact 1A–GW1).

***Groundwater quality could be significantly impacted if soil contaminants come in contact with groundwater at the Pactiv site.***

#### Operations-related Impacts.

***Impact 2B–GW2: Groundwater Quality.*** Impacts on groundwater quality from operations under Alternative 2B would be the same as those identified for Alternative 2A (see Impact 2A–GW2).

***The amount of groundwater available for beneficial use will not be significantly impacted by changes in gate operations.***

### 3: Gates-out Alternative

#### Construction-related Impacts.

***Impact 3–GW1: Contaminants.*** Impacts on groundwater from construction under Alternative 3 would be the same as those identified for Alternative 1A (see Impact 1A–GW1).

***Groundwater quality could be significantly impacted if soil contaminants come in contact with groundwater at the Pactiv site.***

#### Operations-related Impacts.

***Impact 3–GW2: Groundwater Quality.*** Impacts on groundwater quality from operations under Alternative 3 would be the same as those identified for Alternative 2A (see Impacts 2A–GW2).

***The amount of groundwater available for beneficial use will not be significantly impacted by changes in gate operations.***

### Mitigation

This section discusses mitigations for each significant impact described in Environmental Consequences.

**1A: 4-month Improved Ladder Alternative.**
***Mitigation 1A–GW1.*** In the event that contaminated soil is encountered, the contractor shall follow and comply with all applicable federal, state, and local regulations. Soil should be removed immediately from the project area and taken to an appropriate disposal area. If soil should be temporarily stockpiled in the project area, an impermeable liner should be used to prevent direct contact with non-contaminated areas.

The following mitigation measures would reduce the potential for contamination in groundwater in the proposed project area to a less than significant level:

- Construction contractor shall obtain a General Construction Storm Water Permit, to comply with Clean Water Act Section 402(b) for construction of all facilities. As part of this permit, the contractor shall prepare an SWPPP, which will include the following BMP:
  - All ground-disturbing activities would be limited to the dry season (mid-May through mid-October) to the extent possible.
  - All stockpiled material would be placed so that potential erosion and contamination is minimized. Methods shall include, but not be limited to:
    - Covering the stockpile with plastic sheeting or tarps
    - Installing a berm around the stockpile to prevent runoff from leaving the area
    - Plant temporary vegetation if stockpiled material would be kept onsite for a longer duration of time

**4B: 4-month Bypass Alternative.**
***Mitigation 1B–GW1.*** See Mitigation 1A–GW1.

**2A: 2-month Improved Ladder Alternative.**
***Mitigation 2A–GW1.*** See Mitigation 1A–GW1.

***Mitigation 2A–GW2.*** If it is determined that wells in the project area are affected by the seasonal fluctuation of Lake Red Bluff, these wells could be relocated or extended to greater depths to meet continuous or seasonal water demands. This would reduce the impact to a less than significant level.

**2B: 2-month with Existing Ladders Alternative.**
***Mitigation 2B–GW1.*** See Mitigation 1A–GW1.

***Mitigation 2B–GW2.*** See Mitigation 2A–GW2.

**3: Gates-out Alternative.**

***Mitigation 3–GW1.*** See Mitigation 1A–GW1.

**Mitigation 3–GW2.** See Mitigation 2A–GW2.

# 3.4 Biological Resources

This section describes existing conditions within the project study area regarding biological resources including special-status wildlife species, special-status plant species, and special or unique habitats.

## 3.4.1 Affected Environment

### Wildlife Habitat and Wildlife

The project area consists of approximately 100 acres near and adjacent to RBDD. RBDD spans the Sacramento River near Red Bluff, California, and the project area consists of land on both sides of the Sacramento River. The area is predominantly agricultural or formerly agricultural. The few areas of native vegetation generally occur adjacent to or near the river corridor, in old river meanders, or in natural low-lying wet areas. The project site contains seven primary habitats:

*The project area consists of approximately 100 acres near and adjacent to RBDD. RBDD spans the Sacramento River near Red Bluff, California, and the project area consists of land on both sides of the Sacramento River.*

- Riparian
- Freshwater marsh
- Mixed woodland
- Restored
- Annual grassland
- Disturbed
- Parkland

Each of these habitats and the associated wildlife is described below.

**Riparian Habitat.** Riparian forests are a special habitat type represented by transitional areas between aquatic and upland zones, encompassing sharp environmental gradients, unique ecological processes, and diverse communities (Naimen et al., 1993). Riparian zones provide important resources to both riparian species and upland species. Species diversity is typically higher in riparian zones than in upland vegetated zones, and the diversity of wildlife species using these zones is related to habitat diversity.

Riparian habitat along the Sacramento River has been substantially reduced as a result of flood control, water supply projects, and urban and agricultural development that have altered the native riparian landscape. Remaining areas of riparian habitat generally consist of narrow bands of vegetation along levee banks. The largest and most significant tract of riparian forest remaining along the Sacramento River is a stretch between Chico Landing and Red Bluff. Maintenance of riparian communities along the Sacramento River is dependent upon the occurrence of appropriate flow regimes.

***The immediate project area contains about 26 acres of riparian habitat. Most of the riparian habitat occurs along Red Bank Creek, with additional narrow bands located along the mainstem of the Sacramento River.***

The immediate project area contains about 26 acres of riparian habitat. Most of the riparian habitat occurs along Red Bank Creek, with additional narrow bands located along the mainstem of the Sacramento River (Figure 3.4-1). Primary plant species are cottonwoods *(Populus fremontii*), willows (*Salix* sp.), and sycamores (*Platamus racemosa*).

The campground on the north (left) bank of the Sacramento River has retained some mature sycamores, but shrubs and native forbs or grasses are largely absent. Blackberry (*Rubus* sp.) bushes also are common in association with these riparian plant species.

Nine elderberry shrubs and/or groups of shrubs occur in riparian habitat in the project area on both the left and right banks of the Sacramento River (Figure 3.4-2). Five of the shrubs or groups of shrubs occur in the project footprint.

In addition to the riparian habitat in and adjacent to the dam site, small amounts of riparian habitat occur adjacent to Lake Red Bluff. This is a seasonal lake created when the gates at RBDD are down. Under current operation, the gates at RBDD are down from mid-May to mid-September. The lake is formed as the areas adjacent to the current riverbed and an old river meander are inundated. Isolated cottonwood trees and riparian shrubs such as willows and blackberry occur in a narrow band on the margins of the lake. The portion of the lake that is seasonally inundated lacks vegetation. A number of elderberry shrubs occur on the elevated riparian area west of the dam that becomes an island when gates are in the water, and is accessible by land when gates are out of the water. These are not in the project footprint (Figure 3.4-2). Many species of terrestrial wildlife use the remaining strips of riparian vegetation in the Sacramento Valley for foraging, cover, nesting, and roosting. Wildlife associated with riparian areas include a variety of songbirds and raptors, and mammals such as muskrat (*Ondatra zibethica*), otter (*Lutra canadensis*), mink (*Mustela vison*), and beaver (*Castor canadensis*). Special-status species associated with riparian habitat along the Sacramento River include, among others, Swainson's hawk (*Buteo Swainsoni*), bald eagle (*Haliaectus leucocephalus*), bank swallow (*Riparia riparia*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*).

The value of the riparian habitat in the project area to wildlife is limited because it occurs as small, isolated patches and has limited species diversity. In addition, riparian habitat in the project area receives recreational use or is adjacent to industrial lands that collectively further limit the value of riparian habitat for wildlife. As a result of these conditions and area disturbance, sensitive species are unlikely to occur in the project area. Nonetheless, diverse wildlife species are using the area.


**FIGURE 3.4-1**
**HABITAT TYPES IN PROPOSED PROJECT AREA**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

THOR\CART1\RDDGIS\TCCA\MXD\HAB_3_4_1.MXD

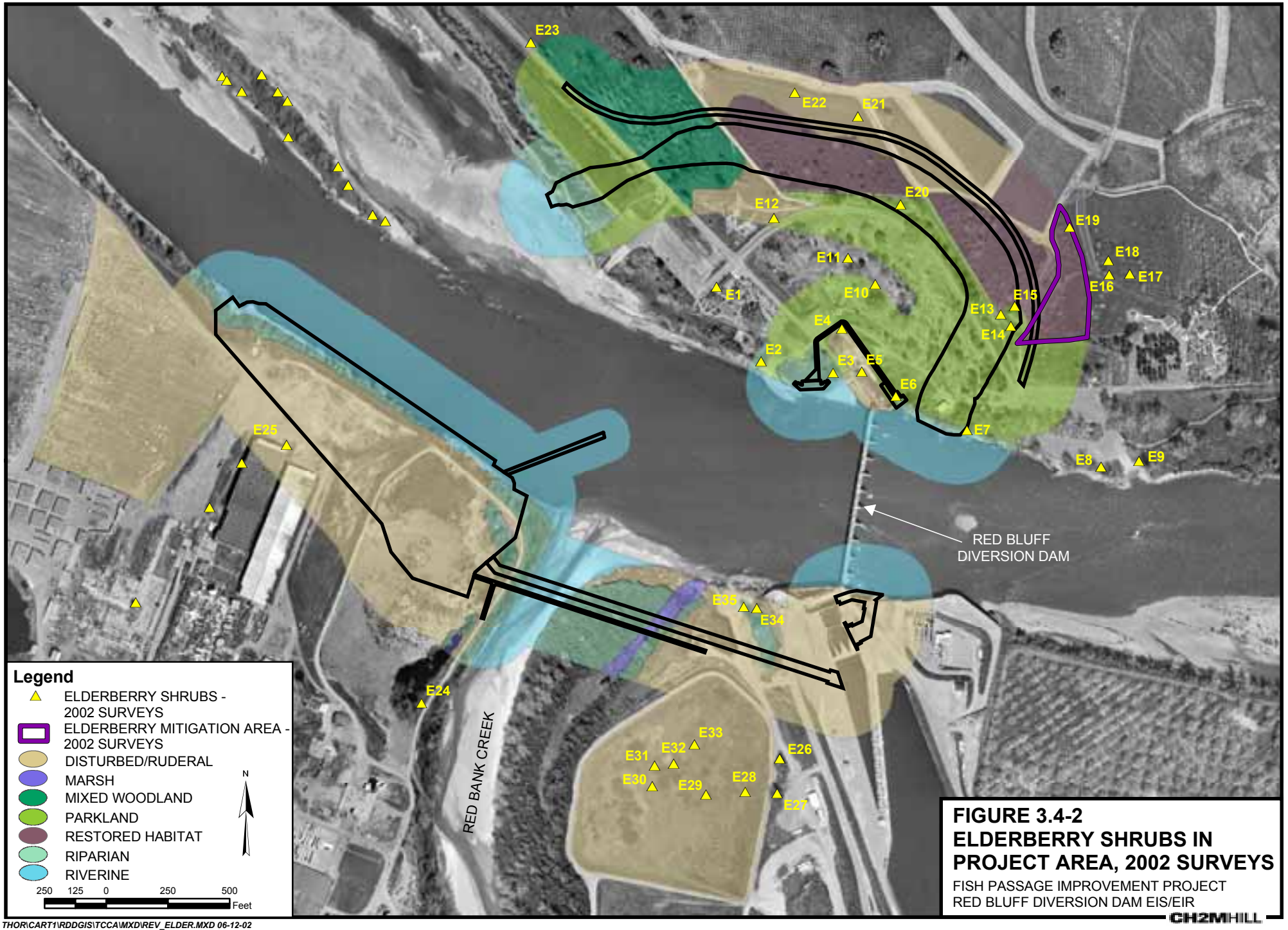



**FIGURE 3.4-2**
**ELDERBERRY SHRUBS IN PROJECT AREA, 2002 SURVEYS**

FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

CH2MHILL

THOR\CART1\RDDGIS\TCCA\MXD\REV_ELDER.MXD 06-12-02

**Freshwater Marsh Habitat.** Historically, the Central Valley contained about 4 million acres of freshwater marshes. About 1.5 million acres in the Delta and the Tulare Basin were permanent marshes, and the remaining 2.5 million acres were seasonal marshes created by winter rains and spring snowmelt from the Sierra Nevada. Today, about 300,000 acres (or 13 percent of the historical acreage) of marshlands remain; 100,000 acres are publicly owned by state and federal refuges, and 200,000 acres are privately owned (USBR, 1989).

Freshwater marshes are characterized by specialized plant species that require moist soils and inundation but are tolerant of periodic drying. Species composition within and among marshes varies according to hydroperiod, soils, water chemistry, and climate, among other factors. The outermost margins of marshes are saturated and inundated only periodically. Moist-soil plant species such as big leaf sedge (*Carex amplifolia*), baltic rush (*Juncus balticus*), redroot (*Cyperus erythrorhizos*), and nutgrass (*Cyperus esculentus*) inhabit these portions of wetlands. On wetter sites or in portions of marshes with deeper or more regular inundation, cattail (*Typha* spp.), tule (*Scirpus* spp.), bulrush (*Scirpus* spp.), and arrowhead (*Sagitaria* spp.) species dominate. Thus, the characteristics of freshwater marshes are intimately linked with the marsh's water regime.

***The project site supports about 2.1 acres of freshwater marsh habitat in two distinct areas.***

The project site supports about 2.1 acres of freshwater marsh habitat in two distinct areas (Figure 3.4-1). The larger area (1.56 acres) is located in a low-lying band parallel to the right bank of Red Bank Creek and is adjacent to a disturbed area located just southwest of RBDD. The second and much smaller area (0.45 acre) occurs on the west side (left bank) of Red Bank Creek in the adjacent industrial area. This is an artificially created marsh, established from the drainage area of the Pactiv plant. Plant species in both marshes consist of cattail, willow, and some patches of spike rush (*Scirpus acutus*). The larger marsh adjacent to Red Bank Creek likely meets the criteria of jurisdictional wetlands under the Clean Water Act. Because of the artificial origin of the marsh on Pactiv property, this smaller marsh is not likely jurisdictional. Jurisdictional waters are discussed further in Chapter 5.

Freshwater marsh habitats are among the most productive wildlife habitats in California. They provide food, cover, and water for more than 160 species of birds, and numerous mammals, amphibians, and reptiles. Wildlife commonly found in this habitat include waterfowl, songbirds, and a variety of amphibians and rodents. Several species of raptors often visit marshes while foraging. The marsh habitat in the project area provides little wildlife value because of its small size and location adjacent to highly disturbed areas. As a result, the diversity and abundance of wildlife using the marshes in the project area is low.

*The project area contains one area best characterized as mixed woodland. This 7.5-acre area occurs as an isolated block northwest of RBDD adjacent to the road entering the campground.*

**Mixed Woodland Habitat.** The project area contains one area best characterized as mixed woodland. This 7.5-acre area occurs as an isolated block northwest of RBDD adjacent to the road entering the campground (Figure 3.4-1). Vegetation consists of a mix of ponderosa pine *(Pinus ponderosa)*, Oregon white oak *(Quercus garryanus)*, and sycamore. Larger trees are clustered in two general areas, with shrubs and grasses covering the remainder of the area. It is surrounded by disturbed land, parkland, grassland, and restored habitat.

The large trees and structural complexity added by shrubs and smaller trees make this area potentially attractive to a variety of wildlife, including ground squirrel (*Spermophilus beecheyi*), red fox (*Vulpes vulpes*), western fence lizard (*Sceloporus occidentalis)*, and many bird species including red-tailed hawk (*Buteo jamaicencis*), scrub jay (*Aphelocoma californica*), California quail (*Callipepla californica*), oak titmouse (*Baeolophus inornatus*), Bewick's wren (*Thryomanes bewickii*), bushtit (*Psaltriparus minimus*), and acorn woodpecker (*Melanerpes formicivorus*). However, the area's small size, current isolation, and proximity to human activity reduce its wildlife habitat value. As the adjacent areas of restored habitat develop, the value of mixed woodland for wildlife will increase as a larger, contiguous block of woodland vegetation develops.

*Restored habitat comprises about 64 acres of the project site.*

**Restored Habitat.** Restored habitat consists of mitigation plantings to create oak woodland and riparian forest habitat. This habitat comprises about 64 acres of the project site on the north side of the river adjacent to the campground (Figure 3.4-1). Plants used in the mitigation sites consist of oak, sycamore, pine, and cottonwood trees. Restoration areas have an orchard-like appearance, as they are planted in rows and are either currently irrigated or were previously irrigated. These mitigation sites have been established for less than 10 years. As the plants develop, the restoration sites will augment the existing mixed woodland habitat. A number of elderberry shrubs have been planted at the restoration site. Three elderberry shrub groupings occur in the project area (Figure 3.4-2), with one grouping occurring in the project footprint. The restoration sites currently provide only limited habitat value for wildlife because of their young age. Species using open habitats and early successional-stage riparian habitat probably use these areas. Such species could include ground squirrel, red fox, scrub jay, western fence lizard, and red-tailed hawk. As the restoration sites develop, they will provide habitat for species associated with riparian habitat and oak woodland.

**Annual Grassland Habitat.** Annual grassland habitats are open habitats composed primarily of annual grass species. Many of these species also occur as understory plants in valley oak woodland and other habitats. Introduced annual grasses are the dominant plant species in this habitat and include wild oat (*Avena fatua*), soft chess (*Bromus mollis*), ripgut brome (*Bromus diandrus*), wild barley (*Hordeum marinum*

sp. *cussoneanum*), and foxtail fescue (*Festuca megalura*). Common forbs include broadleaf filaree (*Erodium moschatum*), redstem filaree (*Erodium cicutarium*), turkey mullein (*Eremocarpus setigerus*), clover (*Trifolium* sp.), and many others. California poppy (*Eschscholzia californica*) is often found in this habitat.

***Most of the project site consists of disturbed areas. About 79 classified acres of disturbed habitat occurs on both sides of the Sacramento River.***

Wildlife species that can occur in annual grasslands are the western fence lizard, common garter snake (*Thamnophis sirtalis*), western rattlesnake (*Crotalus viridis*), black-tailed jackrabbit (*Lepus californicus*), California ground squirrel, Botta's pocket gopher (*Thomomys bottae*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), badger (*Taxidea taxus*), and coyote (*Canis latrans*). Common birds that use grassland habitat include horned lark (*Eremophilia alpestris*), western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartus aura*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius),* white-tailed kite (*Elanus leucurus*), and prairie falcon (*Falco mexicanus*).

Annual grassland occurs on about 9.25 acres of the project area and is adjacent to the mixed woodland habitat (Figure 3.4-1). Star thistle (*Centaurea solstitialis*) and other exotic grasses have invaded the grassland and limit its value to wildlife. Three elderberry shrubs (one with a stem greater than 3 inches) occur in grassland habitat within the project area (Figure 3.4-2), but outside of the project footprint (Figure 3.4-2).

**Disturbed Habitat.** Most of the project site consists of disturbed areas. Disturbed habitat occurs on both sides of the Sacramento River (Figure 3.4-1). About 79 acres are classified as disturbed habitat. The disturbed areas were created as a result of activities associated with former agricultural use, the mitigation plantings (i.e., plowed fields), long-term disturbance related to maintenance of RBDD, pre-dam land uses, and long-term disturbance related to the Mill Site. Of the 79 acres, 51 acres are bare ground, 13 acres are dominated by star thistle, and 15 acres are dominated by blackberry bushes. Less than 1 acre is covered by a riprap pile, which is remnant dam-building material.

Habitat value of disturbed areas is very low. In areas where blackberries occur, the potential for providing habitat for small rodents and birds is greater. The riprap pile also could be used by small mammals and reptiles. Sites devoid of vegetation are little used by wildlife. The abandoned catchment basin on the west side Red Bank Creek, while dominated by ruderal species, does contain six elderberry shrubs that could provide habitat for VELB (Figure 3.4-2).

*Parkland comprises approximately 38 acres on the north side of the Sacramento River adjacent to RBDD.*

**Parkland Habitat.** Parkland comprises approximately 38 acres on the north side of the Sacramento River adjacent to RBDD (Figure 3.4-1). Ornamental shrubs and trees have been planted, including pines and native shrubs. A number of large, mature sycamore trees have been retained in the park, predominantly in and adjacent to the parking lots. Aside from a few ornamental shrubs, understory vegetation consists of a grassy lawn. Six elderberry shrubs or groups of elderberry shrubs occur in parkland habitat (Figure 3.4-2).

Habitat value of the park is low because of the high level of human use, low plant species diversity, and limited vegetation structural diversity. As a result, wildlife species using the park consist of those tolerant of human activity such as gray squirrels (*sciurus griseus*), scrub jays, and crows (*corvus* sp.). The borders of the park could provide habitat used by deer and a greater variety of rodent and bird species.

### Special-status Species

For the purposes of this evaluation, special-status species include species that are (1) listed as threatened or endangered by the state or federal governments, (2) proposed or petitioned for federal threatened or endangered status, (3) state or federal candidates for threatened or endangered status, (4) identified by USFWS as species of concern, or (5) identified by CDFG as Species of Special Concern. Special-status plant species are vascular plants that are (1) designated as rare, threatened, or endangered by the state or federal governments; (2) proposed for rare, threatened, or endangered status; (3) state or federal candidate species; (4) listed as species of concern by USFWS; or (5) included on the California Native Plant Society (CNPS) List 1A, 1B, or 2 (Skinner and Pavlik, 1994).

Special-status species potentially occurring in the project area were identified by querying the California Natural Diversity Database (CNDDB) and the CNPS Electronic Inventory, reviewing a USFWS species list for the project (USFWS, 2000; see Appendix C), discussing the subject with resource agency personnel, and performing field surveys. Table 3.4-1 lists the 58 special-status wildlife species and 15 special-status plant species that were identified as having the potential to occur in or near the project area, the status of each species, general habitat associations, and the habitat types in the project area where they have the potential to occur (all terms are defined at the bottom of the table). Appendix D provides additional information on the natural history and occurrence of special-status species potentially occurring in the project area.

**TABLE 3.4-1**
Special-status Species

| Species | Status | General Habitat Association | Project Habitat |
|---|---|---|---|
| Birds | | | |
| American Bittern<br>*Botaurus lentiginosus* | Federal – SC<br>State – none | Freshwater and brackish wetlands with dense vegetation | Freshwater Marsh |
| Black-crowned Night Heron<br>*Nycticorax nycticorax* | Federal – SC<br>State – none | Freshwater and brackish wetlands, occasionally rice fields | Freshwater Marsh |
| White-faced Ibis<br>*Plegadis chihi* | Federal – SC<br>State – CSC | Freshwater wetlands and irrigated fields | Freshwater Marsh |
| Aleutian Canada Goose<br>*Branta canadensis leucopareia* | Federal – D<br>State – none | Freshwater wetlands and agricultural fields | Freshwater Marsh |
| Cooper's Hawk<br>*Accipiter cooperii* | Federal – none<br>State – CSC | Woodlands, riparian forests, and agricultural fields | Mixed Woodland, Riparian, Restored |
| Sharp-shinned Hawk<br>*Accipiter striatus* | Federal – none<br>State – CSC | Woodlands, riparian forests, and shrub thickets | Mixed Woodland, Riparian, Restored |
| Northern Goshawk<br>*Accipter gentilis* | Federal – SC<br>State – CSC | Montane conifer forests and woodlands | Mixed Woodland, Restored |
| Golden Eagle<br>*Aquila chrysaetos* | Federal – none<br>State – CSC; FP | Grasslands, open woodland, chaparral, wetlands, and agricultural areas | Annual Grassland, Mixed Woodland, Riparian, Restored |
| Ferruginous Hawk<br>*Buteo regalis* | Federal – SC<br>State – CSC | Grasslands and agricultural fields | Annual Grassland |
| Swainson's Hawk<br>*Bueto swainsoni* | Federal – none<br>State – T | Mature riparian forests, oak groves, and agricultural fields | Riparian, Restored |
| Northern Harrier<br>*Circus cyaneus* | Federal – none<br>State – CSC | Marshes, grasslands, and agricultural fields | Freshwater Marsh, Annual Grassland |
| White-tailed Kite<br>*Elanus leucurus* | Federal – SC<br>State – CSC; FP | Grasslands, oak savannas and woodl-ands, and open riparian areas and agricultural fields | Annual Grassland, Mixed Woodland, Restored |
| Bald Eagle<br>*Haliaeetus leucocephalus* | Federal – T<br>State – E; FP | Open water habitats, lakes, rivers, and marshes | Freshwater Marsh, River |
| Osprey<br>*Pandion haliaetus* | Federal – none<br>State – CSC | Open water habitats, lakes, and rivers | River |
| Prairie Falcon<br>*Falco mexicanus* | Federal – none<br>State – CSC | Grasslands, agricultural fields, river embankment, and open savannas | Annual Grassland |
| Peregrine Falcon<br>*Falco peregrinus anatum* | Federal – D<br>State – E | Wetlands, lakes, rivers, grasslands, and agricultural fields | Freshwater Marsh, Annual Grassland, River |
| Black Tern<br>*Chlidonias niger* | Federal – SC<br>State – CSC | Freshwater lakes and wetlands | Freshwater Marsh |
| Western Yellow-billed Cuckoo<br>*Coccyzus americanus occidentalis* | Federal – FC<br>State – E | Riparian forests with abundant canopy cover of willow and cottonwood | Riparian |
| Short-eared Owl<br>*Asio flammeus* | Federal – SC<br>State – CSC | Wetlands, wet meadows, grasslands, open shrublands, savannas, and agricultural fields | Freshwater Marsh, Annual Grassland |
| Western Burrowing Owl<br>*Athene cunicularia hypougea* | Federal – SC<br>State – CSC | Grasslands, pastures, agricultural fields, road embankments, and near open urban areas | Annual Grassland, Disturbed |
| Vaux's Swift<br>*Chaetura vauxi* | Federal – SC<br>State – CSC | Mixed oak and conifer woodlands, forage over grasslands, lakes, and streams | Mixed Woodland, Restored, Annual Grassland |
| Black Swift<br>*Cypseloides niger* | Federal – SC<br>State – CSC | Coastal bluffs and mountain canyons | None |
| Rufus Hummingbird<br>*Selasphorus rutus* | Federal – SC<br>State – none | Riparian areas, open woodlands, chaparral, orchards, and gardens | Riparian, Mixed Woodland, Restored, Parkland |

**TABLE 3.4-1**
Special-status Species

| Species | Status | General Habitat Association | Project Habitat |
|---|---|---|---|
| Lewis' Woodpecker<br>*Melanerpes lewis* | Federal – SC<br>State – none | Open woodlands, savannas, and riparian areas | Mixed Woodland, Restored, Riparian |
| Olive-sided Flycatcher<br>*Contopus borealis* | Federal – SC<br>State – none | Montane conifer forests and woodlands | Mixed Woodland |
| Little Willow Flycatcher<br>*Empidonax traillii brewsteri* | Federal – none<br>State – E | Montane riparian areas and wet meadows, in dense willows | Riparian |
| California Horned Lark<br>*Eremophila alpestris actia* | Federal – none<br>State – CSC | Grasslands and open woodlands | Annual Grassland, Restored |
| Purple Martin<br>*Progne subis* | Federal – none<br>State – CSC | Grasslands, wet meadows, wetlands, woodlands, and riparian areas | Annual Grassland, Freshwater Marsh, Mixed Woodland, Riparian |
| Bank Swallow<br>*Riparia riparia* | Federal – none<br>State – T | Riparian areas, nest in friable soils of vertical streambanks | Riparian |
| Bewick's Wren<br>*Thryomanes bewickii* | Federal – SC<br>State – none | Chaparral, woodlands, conifer forests, and riparian areas | Mixed Woodland, Riparian, Restored |
| Loggerhead Shrike<br>*Lanius ludovicianus* | Federal – SC<br>State – CSC | Grasslands, savannas, and chaparral | Annual Grassland |
| Tri-colored Blackbird<br>*Agelaius tricolor* | Federal – SC<br>State – CSC | Wetlands in dense emergent vegetation | Freshwater Marsh |
| Grasshopper Sparrow<br>*Ammodramus savavvarum* | Federal – SC<br>State – none | Grasslands and hay fields | Annual Grassland |
| Lark Sparrow<br>*Chondestes grammacus* | Federal – SC<br>State – none | Savannas, chaparral, foothill woodlands, and conifer forests | Mixed Woodland, Restored |
| Hermit Warbler<br>*Dendroica occidentalis* | Federal – SC<br>State – none | Montane conifer forests, woodlands | Mixed Woodland |
| Yellow Warbler<br>*Dendroica petechia* | Federal – none<br>State – CSC | Riparian areas | Riparian |
| Yellow-breasted Chat<br>*Icteria virens* | Federal – none<br>State – CSC | Riparian areas | Riparian |
| Yellow-headed Black Bird<br>*Xanthocephalus xanthocephalus* | Federal – none<br>State – none | Wetlands in dense emergent vegetation | Freshwater Marsh |
| Lawrence's Goldfinch<br>*Carduelis lawrencei* | Federal – SC<br>State – none | Foothill woodlands | Mixed Woodland |
| Reptiles | | | |
| Western Pond Turtle<br>*Clemmys marmorata* | Federal – SC<br>State – CSC | Wetlands, ponds, irrigation ditches, rivers, and streams | Freshwater Marsh, Riparian, River |
| Giant Garter Snake<br>*Thamnophis gigas* | Federal – T<br>State – T | Wetlands, sloughs, irrigation ditches, rice fields | Freshwater Marsh |
| California Horned Lizard<br>*Phrynosoma coronatum frontale* | Federal – SC<br>State – CSC | Grasslands, chaparral, and riparian areas | Annual Grassland, Riparian |
| Amphibians | | | |
| Western Spadefoot Toad<br>*Scaphiopus hammodii* | Federal – SC<br>State – CSC | Quiet streams and pools in grasslands and woodlands | None |
| California Red-legged Frog<br>*Rana aurora draytonii* | Federal – T<br>State – CSC | Streams, ponds, marshes, and stock ponds | None |
| Foothill Yellow-legged Frog<br>*Rana boylii* | Federal – SC<br>State – CSC | Large streams with open gravel bars and rocks | None |
| Invertebrates | | | |
| Vernal Pool Fairy Shrimp<br>*Branchinecta lynchi* | Federal – T<br>State – none | Vernal pools | None |
| Leech's Skyline Diving Beetle<br>*Hydroporus leechi* | Federal – SC<br>State – none | Freshwater ponds, shallow water of streams, marshes, and lakes | None |

**TABLE 3.4-1**
Special-status Species

| Species | Status | General Habitat Association | Project Habitat |
|---|---|---|---|
| Sacramento Anthicid Beetle *Anthicus sacramento* | Federal – SC<br>State – none | Sandbars and sandy riparian areas | River Banks |
| Valley Elderberry Longhorn Beetle *Desmocercus californicus dimorphus* | Federal – T<br>State – none | Valley elderberry shrubs in riparian areas, savannas, and woodlands | Riparian, Mixed Woodland |
| Mammals | | | |
| Pale Big-eared Bat *Corynorhinus townsendii palescens* | Federal – SC<br>State – CSC | Grasslands, chaparral, woodlands, and conifer forests | Annual Grassland, Mixed Woodland |
| Townsend's Western Big-eared Bat *Corynorhinus townsendii townsendii* | Federal – SC<br>State – CSC | Grasslands, chaparral, woodlands, and conifer forests | Annual Grassland, Mixed Woodland |
| Spotted Bat *Euderma maculatum* | Federal – SC<br>State – CSC | Grasslands and mixed conifer forests | Annual Grassland, Mixed Woodland |
| Small-footed Myotis *Myotis ciliolabrum* | Federal – SC<br>State – none | Open forests, woodlands, and chaparral | Mixed Woodland |
| Long-eared Myotis *Myotis evotis* | Federal – SC<br>State – none | Chaparral, woodlands, and conifer forests | Mixed Woodland |
| Fringed Myotis *Myotis thysanodes* | Federal – SC<br>State – none | Foothill woodlands and mixed conifer-hardwood forests | Mixed Woodland |
| Long-legged Myotis *Myotis volans* | Federal – SC<br>State – none | Chaparral, woodlands, and conifer forests | Mixed Woodland |
| Yuma Myotis *Myotis yumanensis* | Federal – SC<br>State – CSC | Open forests and woodlands, open waters | Mixed Woodland |
| San Joaquin Pocket Mouse *Perognathus inornatus inornatus* | Federal – SC<br>State – none | Grasslands and oak savannas | Annual Grassland, Restored |
| Plants | | | |
| Silky Cryptantha *Cryptantha crinita* | Federal – SC<br>State – none<br>CNPS – 1B | Riparian areas and gravelly streambeds | Riparian |
| Dwarf Downingia *Downingia pusilla* | Federal – none<br>State – none<br>CNPS – 2 | Vernal pools and wet meadows | Freshwater Marsh |
| Henderson's Bent Grass *Agrostis hendersonii* | Federal – SC<br>State – none<br>CNPS | Vernal pools and grasslands | Annual grassland |
| Scalloped Moonwort *Botrychium crenulatum* | Federal – SC<br>State – none<br>CNPS – 2 | Freshwater marshes and swamps | Freshwater marsh |
| Woolly Meadowfoam *Limnanthes floccosa* sp. *Floccosa* | Federal – none<br>State – none<br>CNPS – 2 | Vernal pools and wet meadows | Freshwater Marsh |
| Red Bluff Dwarf Rush *Juncus leiospermus* var. *Leiospermus* | Federal – SC<br>State – none<br>CNPS – 1B | Vernal pools and wet meadows, riparian areas, chaparral, and woodlands | Freshwater Marsh, Riparian, Mixed Woodland |
| Adobe Lily *Fritillaria pluriflora* | Federal – SC<br>State – none<br>CNPS – 1B | Grassland, chaparral, and woodlands | Annual Grassland, Mixed Woodland |
| Hairy Orcutt Grass *Orcuttia pilosa* | Federal – E<br>State – E<br>CNPS – 1B | Vernal pools | None |

**TABLE 3.4-1**
Special-status Species

| Species | Status | General Habitat Association | Project Habitat |
|---|---|---|---|
| Slender Orcutt Grass<br>*Orcuttia tenuis* | Federal – T<br>State – E<br>CNPS – 1B | Vernal pools | None |
| Green's Tuctoria<br>*Tuctoria greenei* | Federal – E<br>State – R<br>CNPS – 1B | Vernal pools | None |
| Hoover's Spurge<br>*Chamaesyce hooveri* | Federal – T<br>State – none<br>CNPS – 1B | Vernal pools | None |
| Indian Valley Brodiaea<br>*Brodiaea coronaria* sp.*rosea* | Federal – none<br>State – E<br>CNPS – 1B | Chaparral, woodlands, and conifer forests/serpentine | None |
| Oregon Fireweed<br>*Epilobium oreganum* | Federal – SC<br>State – none<br>CNPS – 1B | Wetlands and lower montane conifer forests/mesic | Freshwater Marsh, Mixed Woodland |
| Butte Fritillary<br>*Fritillaria eastwoodiae* | Federal – SC<br>State – none<br>CNPS – 1B | Chaparral, woodlands, open conifer forests | Mixed Woodland |
| Lengenere<br>*Lengenerre limosa* | Federal – SC<br>State – none<br>CNPS – 1B | Vernal Pools | None |
| Red-flowered Lotus<br>*Lotus rubriflorus* | Federal – SC<br>State – none<br>CNPS – 1B | Woodlands and grasslands | Mixed Woodland, Annual Grassland |
| Ahart's Paronychia<br>*Paronychia ahartii* | Federal – SC<br>State – none<br>CNPS – 1B | Woodlands, grasslands, and vernal pools | Mixed Woodland, Annual Grassland |
| Valley Sagittaria<br>S*agittataria sanfordii* | Federal – SC<br>State – none<br>CNPS – 1B | Wetlands | Freshwater Marsh |
| Tracy's Sanicle<br>*Sanicula tracyi* | Federal – SC<br>State – none<br>CNPS – 1B | Woodlands and open conifer forests | Mixed Woodland |
| Baker's Navarretia<br>*Navarretia leucocephala* sp.<br>*Bakerii* | Federal – SC<br>State – none<br>CNPS – 1B | Woodlands, open conifer forests, grasslands, and vernal pools | Mixed Woodland, Annual Grassland |

Status
Federal: E = Endangered
T = Threatened
SC = Species of Concern (Former Category 2 Candidates)
D = Delisted
PD = Proposed for Delisting
FC = Candidate for Federal Listing
State: E = Endangered
T = Threatened
R = Rare
CSC = California Species of Concern
FP = California Fully Protected

CNPS –1B = Rare or Endangered in California or elsewhere
CNPS – 2 = Rare or Endangered in California, more common elsewhere

Figure 3.4-3 shows the location of special-status species that were observed in the project vicinity in 2002 surveys or have been historically observed in the project area and have been recorded in CNDDB.

### Federal- and State-listed Species

As shown in Table 3.4-1, 14 species that are state or federal listed as threatened or endangered were identified as potentially occurring in the project area on the USFWS species list for the project area. The list includes species associated with the Red Bluff East Quadrangle and from Tehama County (USFWS, 2000 and updated in 2002 provided as Appendix B). Eight of these species (California red-legged frog [*Rana aurora draytonii*], giant garter snake [*Thamnophis gigas*], bank swallow, hairy orcutt grass [*Orcuttia pilosa*], slender orcutt grass [*Orcuttia tenuis*], Green's tuctoria [*Tuctoria greenei*], Hoover's spurge [*Chamaesyce hooveri*], and Indian Valley brodiaea [*Brodiaea coronaria* sp. *rosea*]) were determined not to have the potential to occur in the project area because the project area does not support suitable habitat, and/or the project area is outside the species' range. These eight species were not further evaluated. The potential for the remaining six species to occur in the project area is discussed below.

***The six species (out of 14 federal or state threatened or endangered species) with potential to occur in the project area are the little willow, flycatcher, western yellow-billed cuckoo, bald eagle, Swainson's hawk, peregrine falcon, and valley elderberry longhorn beetle.***

**Little Willow Flycatcher.** The little willow flycatcher (*Empidonax traillii brewsteri*) is a rare to uncommon summer resident in California from May through September. In California, it predominantly breeds in the Sierra Nevada mountains with more limited breeding in the Klamath and Siskiyou mountains in the northwestern portion of the state. Preferred breeding habitats include willow thickets along the margins of wet montane meadows, ponds and back waters, and riparian areas. During the spring (May through June) and fall (August through September) migrations, they are more common at lower elevations and less selective of habitat type. Habitats used during migration include narrow riparian corridors as well as shrubs and trees in parks and gardens. The little willow flycatcher is a state endangered species.

Little willow flycatchers would only be expected to occur in the project area during spring and fall migrations. If they migrate through the project area, they most likely use riparian habitat and potentially the mixed woodland habitat.

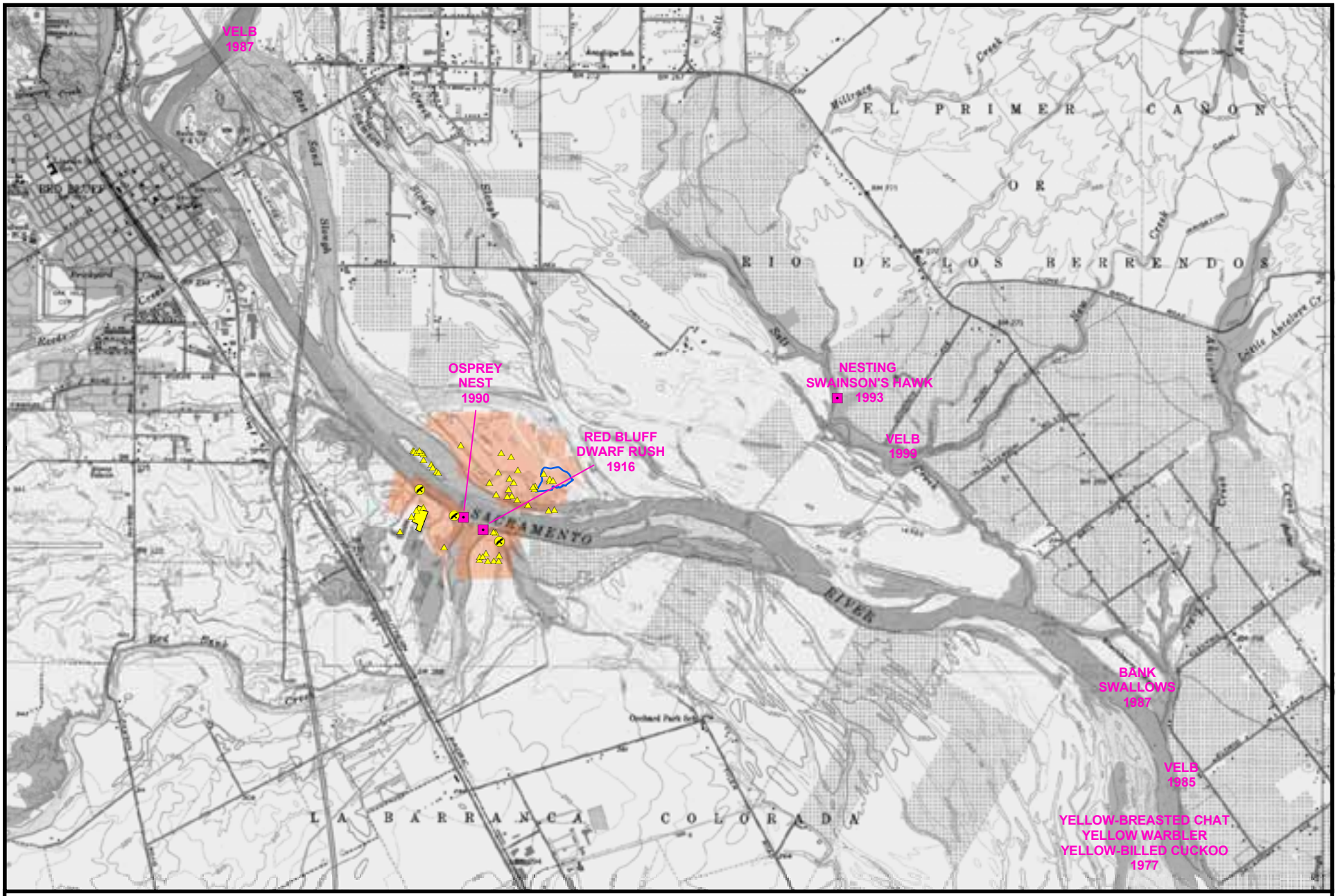
**Western Yellow-billed Cuckoo.** Historically, the western yellow-billed cuckoo was widespread throughout the western United States. However, the extensive loss of mature riparian forest has resulted in dramatic declines of this species. In California, it is now an uncommon to rare summer resident in scattered locations of its former range. The western yellow-billed cuckoo uses mature, dense cottonwood-willow stands for nesting sites. Cuckoos maintain large territories, and suitable habitat of at least 25 acres could be required for breeding. The western yellow-billed cuckoo is a California state endangered species.

This species historically nested at Todd and Mooney islands, several miles to the southeast of the project area (CDFG, 2001), but there have been no recent observations in the vicinity of the project area. Riparian habitat in the project area provides poor habitat for the western yellow-billed cuckoo because it does not consist of mature and dense cottonwood-willow stands. Also, the riparian habitat occurs as narrow bands along the Sacramento River and Red Bank Creek that would not accommodate the species' breeding territory. Thus, western yellow-billed cuckoos are not likely to nest in the project area. Individuals could occur sporadically in the project area during spring and fall migrations.

**Bald Eagle.** In western North America, bald eagles are year-round resident species from northern California to Alaska. Breeding populations in California are restricted to the northeast part of the state, with half of the wintering population found in the Klamath Basin (Zeiner et al., 1990). Bald eagles predominantly prey on fish, although small mammals, waterfowl, reptiles, and carrion are also taken. For foraging, eagles require trees or snags near foraging sites. In the project area, bald eagles could use riparian trees as perch sites from which to forage for fish in the Sacramento River. The bald eagle is a federal threatened and California state endangered species.

Bald eagles are only rare breeders in Tehama County and are not known to nest in or near the project area. They are more common during the winter and were observed in Red Bluff during the 1999 Audubon Christmas bird counts.

**Swainson's Hawk.** Swainson's hawks are widespread throughout much of central and western North America. They are summer residents in the Central Valley, migrating to South America in winter. Although this species was historically widespread throughout California, most of the populations are now restricted to the Central Valley and Great Basin areas of the state. Nest sites occur in mature riparian forests, oak groves, or in large trees adjacent to grasslands or agricultural fields. Breeding season begins in late March, and fall migration begins in August. Insects are an important prey item, especially during the nonbreeding season, and large flocks of Swainson's hawks often congregate in fields to forage. During the breeding season, small mammals, birds, lizards, and amphibians are taken. Loss of nesting habitat throughout California and pesticide use throughout the wintering range are the two most significant factors affecting the decline of this species. Swainson's hawks are a state threatened species.




**LEGEND**

- CNDDB OCCURRENCES
- 2001 TO 2002 SURVEYS
  - OSPREY NEST
  - ELDERBERRY
  - BATS
- PROJECT SITE
- ELDERBERRY MITIGATION AREA

3,500 1,750 0 3,500 Feet

N

# FIGURE 3.4-3
# SPECIAL-STATUS SPECIES IN PROJECT VICINITY, 2001 TO 2002 SURVEYS AND CNDDB OCCURRENCES

FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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One nesting pair was observed approximately 1.5 miles northeast of the project site along Salt Creek in 1993 (CDFG, 2001) (see Figure 3.4-3). Some of the trees in riparian areas in the project area are large enough to support nesting by Swainson's hawks. However, their potential use by Swainson's hawks is probably low because of the high level of human activity and the lack of suitable foraging habitat in the immediate vicinity of potential nest sites.

**Peregrine Falcon.** The American peregrine falcon (*Falco peregrinus anatum*), which is the most southerly subspecies of peregrine falcon in North America, breeds south of the arctic tundra of Canada and from Alaska to Mexico. In the winter and during migration, the American peregrine falcon extends its range southward to the Caribbean and parts of South America. In California, it is a resident species throughout the Coast Range and Sierra Nevada, and a winter migrant throughout the Central Valley. Breeding season occurs between March and August. Nests are predominantly located on cliffs, rock ledges, bridges, and tall buildings; and trees, snags, or old raptor nests are used occasionally. Wetlands are habitat for this species as foraging areas (Zeiner et al., 1990). Peregrine falcons prey mostly on birds, but will also take small mammals, fish, and insects.

Pesticide use led to the earlier dramatic population decline of this species, but the population has made a significant recovery in recent decades and has been delisted by USFWS. Peregrine falcons remain listed as endangered by the State of California. This species is not known to nest in the vicinity of the project area but was observed in the Red Bluff area during the 1999 Audubon Christmas bird counts and has been observed on rare occasions during breeding bird surveys in the area.

**Valley Elderberry Longhorn Beetle.** VELB are entirely dependent on its host plant, elderberry, for food and reproduction. Mating occurs on the plants, and eggs are laid in the cracks and crevices of the bark. Upon emergence, the larva bore into the plant and remain in the spongy pith of the plant for the majority of their lifetime. The developing beetles remain inside the plant for up to two years after which time the adults emerge and reproduce. Adults emerge in March and feed on foliage and flowers until late June. The VELB is a federal threatened species.

There are several known occurrences of elderberry shrubs along the Sacramento River in the vicinity of the project area (CDFG, 2001). During 2002 surveys, shrubs and/or groups of shrubs were identified at 35 locations in the project area. Included in this count is an elderberry mitigation planting area that has been interplanted with other riparian tree species in an area located on the northeast side of the park (left bank). Some of these shrubs are within the project footprint and have the potential to be impacted; others are outside of the project footprint

*During 2002 surveys, two pair of osprey were observed to have active nests on the south side of the Sacramento River near RBDD. One other inactive osprey nest located on a constructed platform occurs west of both occupied nests.*

and would be avoided during construction activities. Additional plants were observed in the larger project vicinity, but outside the project footprint (Figure 3.4-2). The 35 elderberry shrubs or groups of shrubs all appeared in good condition, and stems ranged in size from less than 1 inch to over 20 inches at ground level. In some areas, the shrubs are relatively isolated; whereas, in other areas, they occur in dense clusters. A summary of stem counts for all shrubs. within the project area, temporary work areas, or in proximity to the work zones is provided in Table 3.4-2. Potential VELB exit holes were observed on five of the shrubs. For a detailed description of the survey, refer to Appendix E.

### Other Special-status Species

During the course of general biological surveys of the project area in May 2001, osprey *(Pandion haliaetus)* (state species of concern) and bats (possible federal or state species of concern) were observed.

**Osprey.** The osprey is a widespread species and has an extensive breeding range throughout northern California. During the winter, osprey migrate to more southern latitudes of California, the Gulf Coast, and Central and South America. Large trees, snags, and utility poles are used as nest sites. Osprey feed predominately on fish, and nest sites are generally located close to open water. The breeding season begins in late March and continues through April. Fall migration may begin as soon as September and continue through mid-November, but the peak migration period occurs between late September and early October. Osprey are a state species of concern.

Two pair of osprey have active nests on the south side of the Sacramento River near RBDD. The pairs were observed on the nests, as well as foraging and feeding along the Sacramento River during 2002 surveys. The nests are on platforms, erected specifically for osprey nesting, and are located on the south side of the river near the weir structure and just north of the old Mill Site. One other inactive osprey nest located on a constructed platform occurs west of both occupied nests (Figure 3.4-4).

*The presence of three bat species was visually confirmed, and a fourth species was acoustically detected. Roost locations were documented in the two abandoned storage buildings at the Mill Site.*

**Bats.** Bat species potentially occurring in the project area were identified by querying CNDDB, reviewing a USFWS list for the project, reviewing information from the USFS and Bureau of Land Management, and performing field surveys (Table 3.4-3). The presence of three species was visually confirmed, and a fourth species was acoustically detected. Numerous roost locations were documented in the two abandoned storage buildings at the Mill Site. Evidence was found that bats roost in some of the hydroelectric structures of RBDD in concrete weep holes and under metal overhangs. Several areas appeared to provide potential roosting and foraging habitat: the camping and recreational park area on the north side of the Sacramento River, the upland vegetation and open grasslands on the southwest

**TABLE 3.4-2**
Characteristics of Elderberry Shrubs Observed in the Project Area

| ID No. | Stems 1” | Stems >1” and <3” | Stems >3” and <5” | Stems >5” | No. VELB Exit Holes | Growth Form[a] | Habitat | Impact Area[b] | Notes |
|---|---|---|---|---|---|---|---|---|---|
| E1 | 1 | 1 | 0 | 2 | 0 | S, S | Parkland | O | Next to Discovery Center. |
| E2 | 0 | 1 | 0 | 0 | 0 | S, S | Riparian | O | Next to willows near old boat ramp. |
| E3 | 1 | 4 | 4 | 4 | 0 | S, C | Riparian | F | Cluster of several shrubs, abundant new growth, many stems <1 inch near proposed left fish ladder. |
| E4 | 1 | 1 | 0 | 2 | 1 (?)[c] | S, S | Parkland | F | Possible exit hole observed in dead stem. Near fish visitor center. |
| E5 | 1 | 0 | 2 | 0 | 0 | S, C | Ruderal | F | Shrubs within fenced area next to existing left fish ladder. Stem count is estimated. |
| E6 | 0 | 1 | 4 | 0 | 0 | S, C | Riparian | F | Shrubs within fenced area near existing left fish ladder. Stem count is estimated. |
| E7 | 1 | 0 | 0 | 0 | 0 | S, S | Riparian | F | On shoreline downstream of dam. |
| E8 | 5 | 15 | 0 | 0 | 0 | S, C | Riparian | O | Cluster of several shrubs outside of project area. |
| E9 | Several shrubs at east end of parking area, outside project boundary. | | | | | | Parkland | O | |
| E10 | 1 | 16 | 9 | 3 | 0 | S, C | Parkland | B | Several shrubs within campground clustered next to large oak tree. |
| E11 | All stems less than 1” diameter | | | | | S, S | Parkland | B | Within campground area. |
| E12 | 0 | 2 | 1 | 1 | 0 | S, S | Ruderal | B | Next to campground perimeter road. |
| E13 | 0 | 3 | 2 | 1 | 0 | S, C | Parkland | F | Next to pump house. |
| E14 | 0 | 0 | 9 | 3 | 0 | S, C | Parkland | F | Two shrubs next to pump house. |
| E15 | 2 | 12 | 2 | 4 | 1 | S, C | Parkland | F | Cluster of four shrubs next to pump house. |
| E16 | 0 | 4 | 0 | 0 | 0 | S, S | Mitigation Planting | O | Solitary shrub at south end of planting area. |
| E17 | 3 | 7 | 6 | 0 | 0 | S, C | Mitigation Planting | O | Cluster of three shrubs. |
| E18 | 0 | 6 | 4 | 1 | 0 | S, C | Mitigation Planting | O | Cluster of three shrubs. |
| E19 | 6 | 15 | 0 | 1 | 0 | S, C | Mitigation | B | Cluster of eight shrubs. |

**TABLE 3.4-2**
Characteristics of Elderberry Shrubs Observed in the Project Area

| ID No. | Stems 1” | Stems >1” and <3” | Stems >3” and <5” | Stems >5” | No. VELB Exit Holes | Growth Form[a] | Habitat | Impact Area[b] | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Planting | | |
| E20 | 0 | 2 | 1 | 1 | 2 | S, S | Parkland | F | Next to log, north of campground area. |
| E21 | 2 | 5 | 0 | 0 | 0 | S, S | Grassland | F | Near dirt road on the north side of the park. |
| E22 | All stems less than 1” diameter. | | | | | S, S | Grassland | B | Near dirt road on the north side of the park. |
| E23 | 0 | 0 | 0 | 1 | 0 | S, S | Grassland | B | Along roadway entrance to campground. |
| E24 | 1 | 2 | 0 | 1 | 0 | S, S | Riparian | O | Pactiv property. |
| E25 | 0 | 3 | 0 | 1 | 0 | S, S | Ruderal | B | Pactiv property, next to building. |
| E26 | 3 | 3 | 0 | 0 | 0 | S, S | Ruderal | O | Along roadway next to large oak. |
| E27 | 3 | 7 | 1 | 0 | 0 | S, C | Ruderal | O | Cluster of four shrubs, along roadway next to large oak. |
| E28 | 0 | 8 | 4 | 0 | 0 | T, S | Ruderal | B | Sediment basin. |
| E29 | 0 | 0 | 0 | 1 | Multiple | T, S | Ruderal | B | Sediment basin. Estimated to be 20” diameter at ground surface. |
| E30 | 1 | 1 | 1 | 1 | 1 | T, S | Ruderal | B | Sediment basin. |
| E31 | | | | 1 (?) | ? | T, S | Ruderal | B | Sediment basin; tree was surrounded by very dense blackberry, could not get stem count. |
| E32 | | | | 1 (?) | ? | T, S | Ruderal | B | Sediment basin; tree was surrounded by very dense blackberry, could not get stem count. |
| E33 | | | | 1 | 2 | T, S | Ruderal | B | Sediment basin. Estimated to be 15” diameter at ground surface. |
| E34 | 0 | 5 | 1 | 0 | 0 | S, C | Riparian | B | Next to large sycamore tree. |
| E35 | All stems less than 1” diameter. | | | | | S, S | Riparian | B | Next to large sycamore tree. |

[a] Growth Form: S = Shrub.
T = Tree.
C = Cluster.

[b] Impact Area F = Within footprint of new facility.
B = Within 200-foot buffer area.
O = Outside of project area.

[c] ? = Exit hole of uncertain origin. Assumed to be VELB exit hole.

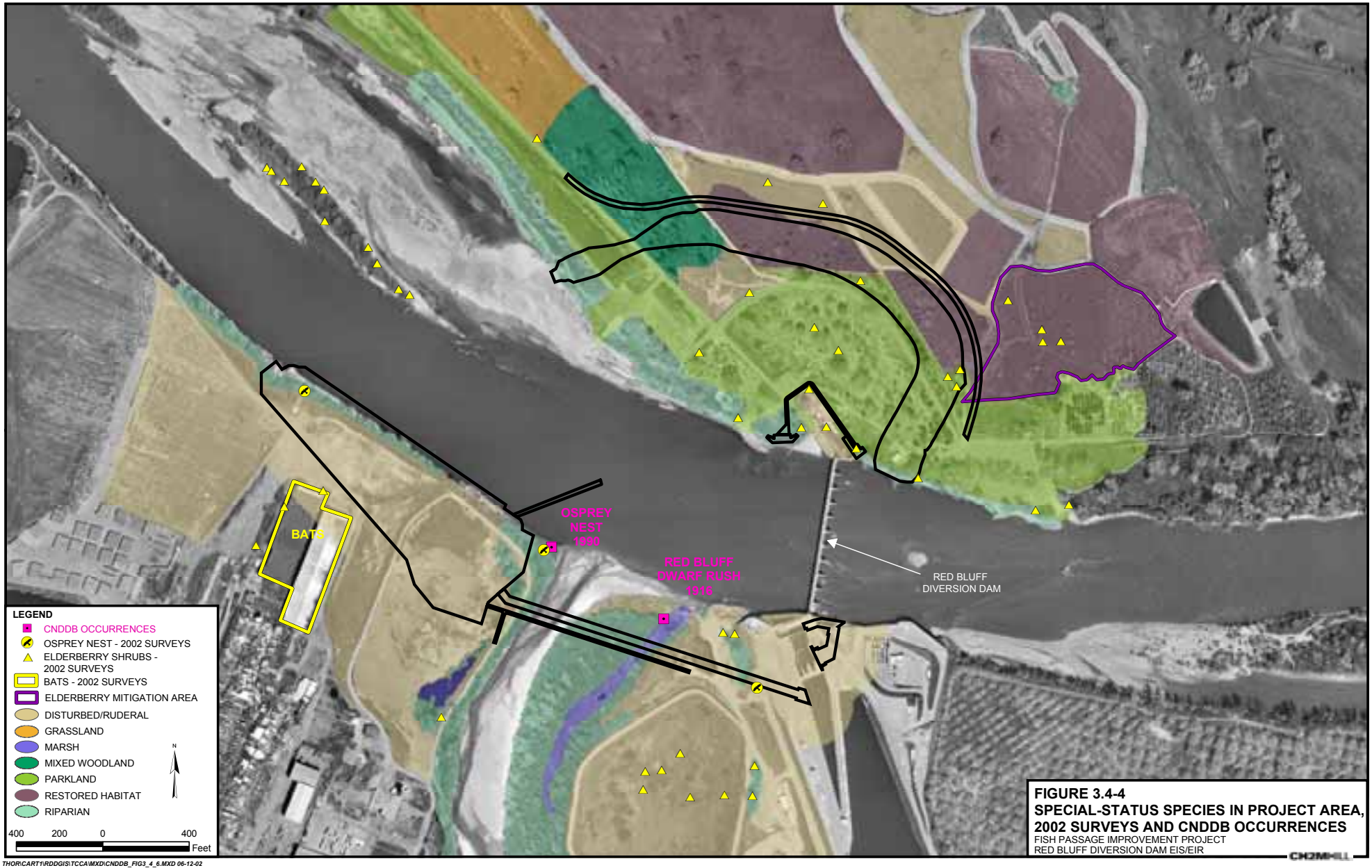


**FIGURE 3.4-4**
**SPECIAL-STATUS SPECIES IN PROJECT AREA, 2002 SURVEYS AND CNDDB OCCURRENCES**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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**TABLE 3.4-3**
Bat Species Potentially Occurring in the Project Area

| Species | Status | Habitat in Project Area | Comments |
|---|---|---|---|
| Mexican free-tailed bat *Tadarida brasiliensis* | NA | Oak woodland | Over 600 observed emerging after sunset, more are present |
| Townsend's big-eared bat *Corynorhinus townsendii* | CDFG – SC<br>USFWS – C<br>USFS – S<br>BLM – S | Oak woodland, riparian, active agricultural areas | Suitable habitat present, no evidence found |
| Spotted bat *Euderma maculatum* | CDFG – SC<br>USFWS – C | Mixed conifer forest | Not likely to be present, lack of suitable roosting habitat |
| Pallid bat *Antrozous pallidus* | CDFG – SC<br>USFS – S<br>BLM – S | Oak woodland, grasslands | Desiccated carcass found |
| Big brown bat *Eptesicus fuscus* | NA | Agricultural areas, oak woodland, pasture | Possible evidence of presence |
| Silver-haired bat *Lasionycteris noctivagans* | NA | Conifer/hardwood forests, drier habitats in winter and during seasonal migrations in low elevation | Possibly migrating along river |
| Red bat *Lasiurus blossevillii* | CDFG – SC<br>USFWS – C<br>USFS – S | Riparian and edge habitats adjacent to streams, open fields, or orchards | Potential habitat present |
| Hoary bat *Lasiurus cinereus* | NA | Forested habitats, oak woodland | Potential habitat present |
| Yuma myotis *Myotis yumanensis* | USFWS – C | Associated with rivers and streams, riparian, oak woodland, forests | *Myotis* sp. bats were observed, likely to be present |
| Little brown bat *Myotis lucifugus* | NA | Woodlands and conifer forests | Not likely to be present, more common at higher elevations |
| Long-legged myotis *Myotis volans* | USFWS – C | Woodlands and conifer forests | Not likely to be present, more common at higher elevations |
| Fringed myotis *Myotis thysanodes* | CDFG – SC<br>USFWS – C | Oak woodland | *Myotis* sp. bats were observed, potential evidence of presence |
| Long-eared myotis *Myotis evotis* | CDFG – SC<br>USFWS – C | Agricultural areas, conifer forests, oak woodland | *Myotis* sp. bats were observed, potentially present |
| California myotis *Myotis californicus* | NA | Conifer forests, oak woodland | *Myotis* sp. bats were observed, likely to be present |
| Small-footed myotis *Myotis ciliolabrum* | USFWS – C | Riparian, conifer forests, oak woodland | *Myotis* sp. bats were observed, possible evidence of presence |

CDFG – SC California Department of Fish and Game Species of Special Concern
USFWS – C U.S. Fish and Wildlife Service Species of Concern
USFS – S U.S. Forest Service Sensitive Species
BLM – S Bureau of Land Management Sensitive Species

side of the river, and riparian and wetlands areas. Figure 3.4-5 illustrates the location of potential bat foraging and roosting habitat in the project area.

***Abandoned Storage Buildings.*** One abandoned, enclosed storage building consisted of a row of 25 (numbered) large bays made of concrete blocks (Figure 3.4-6). Each bay provided a large, dark, cave-like environment, similar to a mine adit. Bats are roosting inside almost all of the bays during the day and at night, as revealed by guano (excrement) deposits on the floor. Day roost sites consisted of crevices and cavities formed by crumbling cement plaster on the interior walls. Often the crevices opened up into cavities within the walls (Figure 3.4-7). In two of the bays, bats roosted in large cracks in the cement frame of the bay openings. These day roosts were probably also occupied at night. In addition, guano deposits scattered along the floor and urine stains high on the walls indicated that bats night roost along the bay walls in the mid-section and in or on the rear wall.

Three guano types were distinguishable, that of myotis (*Myotis* sp.), Mexican free-tail bats (*Tadarida brasiliensis*), and a larger type, probably pallid bats (*Antrozous pallidus*) or big brown bats (*Eptesicus fuscus*). There was evidence that bats were also roosting in the corners at either side of the bay openings, and the guano type here was usually pallid bat, or possibly big brown bat since the guano did not have discarded prey remains, which is characteristic of pallid bat roosts.

The second abandoned storage building was a large, open, corrugated metal roof structure supported by a wooden frame (Figure 3.4-8). This open-roofed structure had some interior walls of plywood and corrugated plastic sheets, and one relatively short exterior wall that appeared to have been louvered windows that were backed by plywood squares. A few myotis and Mexican free-tail bats were observed roosting on the plywood behind the louvers and in the window frames. Greater numbers of bats were observed roosting here on May 11, 2001, and the guano deposits below suggested greater numbers. Also, myotis bats were roosting under a loose board on an upright pole. Video of the myotis bats under the board possibly revealed more than one species (based on morphology). Capture would be necessary for further identification.

***Behavior Observations.*** Over 600 Mexican free-tail bats were observed emerging from Bays 1 through 3. Up to 10 bats appeared to be a larger size than the rest, and the carcass discovery indicated they were pallid bats or possibly big brown bats. Bats flew in and out of adjacent bays. About 1.5 hours after sunset, myotis bats were seen flying in and out of Bay 8, which contained the rear wall roost site (evidence of night roosting).

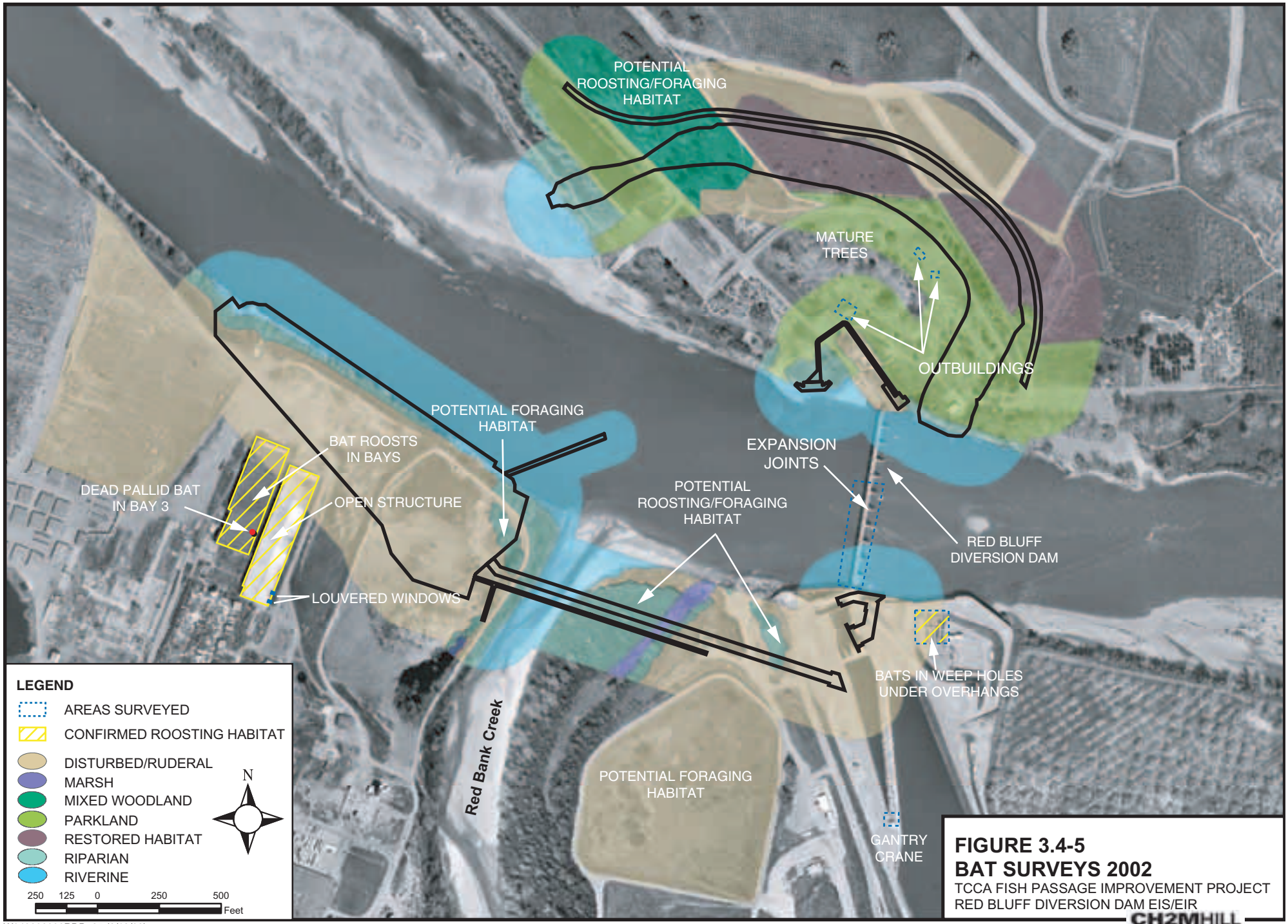


**FIGURE 3.4-5**
**BAT SURVEYS 2002**
TCCA FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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**FIGURE 3.4-6**
**BAT HABITAT—ABANDONED COVERED STORAGE BUILDING**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_88

CH2MHILL

**FIGURE 3.4-7**
**MEXICAN FREE-TAIL BATS**
**INSIDE CEMENT WALL CAVITY ROOST**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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CH2MHILL

**FIGURE 3.4-8**
**BAT HABITAT—OPEN-WALLED ABANDONED STORAGE BUILDING**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

W042002002RDD_86

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***Acoustic Monitoring.*** Four types of echolocation calls were recorded. Echolocation calls of the Mexican free-tail were distinctive in this case. A second call type could have been pallid bat or big brown bat; either species (or both) are likely.

The final two call types were myotis, which are often reported as phonic types based on the characteristic frequency of the sonagrams (40 kilohertz and 50 kilohertz). The echolocation calls of many species of bats are indistinguishable by acoustic means alone (especially when recorded near roosts), and capture is required to confirm identification. However, the Yuma myotis (*Myotis yumanensis*) is a 50-kilohertz phonic type and would be expected to occur in buildings along the Sacramento River. The 40-kilohertz calls may have been attributable to the small-footed myotis (*Myotis ciliolabrum*).

For a complete description of the bat survey, refer to Appendix F.

### Federal Jurisdictional Waters

USACE has jurisdictional authority to regulate discharge of dredging material and fill into "waters of the United States (including wetlands)" under Section 404 of the Clean Water Act. The Code of Federal Regulations (33 CFR Section 328.3) defines waters of the United States as all navigable waters, including: (1) all tidal waters; (2) all interstate waters and wetlands; (3) all other waters such as lakes, rivers, streams (perennial or intermittent), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds – the use, degradation or destruction of which could affect interstate commerce; (4) all impoundments of water mentioned above; (5) all tributaries to waters mentioned above; (6) territorial seas; and (7) all wetlands adjacent to waters mentioned above.

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration (wetland hydrology) sufficient to support, and that under normal circumstances do support, a prevalence of wetlands vegetation (hydrophytic vegetation) typically adapted for life in saturated soil conditions (hydric soils). Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 230.3 and 33 CFR 328). Any actions that involve the placement of fill material into jurisdictional waters and wetlands, including such activities as sidecasting material during ditch excavation or temporary fills to provide equipment access during construction must comply with Section 4040 of the Clean Water Act.

Under Section 10 of the Rivers and Harbors Act of 1899, USACE also regulates the obstruction or alteration of navigable waters (including tidal waters) of the United States. It is important to note that Section 10 jurisdiction includes navigable waters within the mean high water line that have been diked or filled.

*A comprehensive delineation of jurisdictional waters, including pre-jurisdictional waters and wetlands, will be conducted within 1 year prior to the beginning of project construction activities.*

The 1987 Wetland Delineation Manual requires an examination for the presence of indicators of three mandatory diagnostic characteristics. These characteristics, or wetland parameters, are hydrophytic vegetation, wetlands hydrology, and hydric soils. Except in limited instances, the 1987 Wetland Delineation Manual requires evidence of a minimum of one positive indicator from each of the three mandatory wetlands parameters for an area to be called a "wetland" under Section 404 jurisdiction. A comprehensive delineation of jurisdictional waters, including pre-jurisdictional waters and wetlands, will be conducted within 1 year prior to the beginning of project construction activities.

## 3.4.2 Environmental Consequences

This section provides a discussion of the consequences of the project alternatives on biological resources as compared to the No Action Alternative. Each project alternative impacts a different amount of wildlife habitat, and, in turn, wildlife communities and/or special-status species. Table 3.4-4 lists the acreage of each habitat type that would be affected by each alternative. Acreage is broken down into temporary and permanent impacts for each alternative. A discussion of the impacts on habitats and special-status species follows the table. For a complete description of the project alternatives, refer to Chapter 2 of this document.

**TABLE 3.4-4**
Acreage of Habitat Impacts for Project Alternatives

| | Alternatives | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1A: 4-month Improved Ladder | | 1B: 4-month Bypass | | 2A: 2-month Improved Ladder | | 2-month with Existing Ladders | | 3: Gates-out | |
| Vegetation Habitat | No Action | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact | Permanent Impact | Temporary Impact |
| Riparian | 0 | 2.18 | 5.56 | 2.60 | 6.30 | 2.18 | 5.56 | 2.05 | 4.76 | 2.05 | 4.76 |
| Freshwater marsh | 0 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 | 0.05 | 0.71 |
| Mixed woodland | 0 | 0 | 0 | 1.37 | 4.30 | 0 | 0 | 0 | 0 | 0 | 0 |
| Restored habitat | 0 | 0 | 0 | 4.96 | 4.80 | 0 | 0 | 0 | 0 | 0 | 0 |
| Annual grassland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Disturbed | 0 | 11.75 | 44.12 | 12.90 | 51.70 | 11.75 | 44.12 | 11.36 | 41.35 | 11.36 | 41.3 |
| Parkland | 0 | 0.19 | 4.86 | 4.19 | 12.32 | 0.19 | 4.86 | 0 | 0 | 0 | 0 |

### Methodology

Potential impacts to biological resources were assessed through mapping habitat in the project area onto aerial photographs, converting the mapped habitats to a Geographic Information Systems database, calculating acreage of each type of habitat from the database, and then overlaying the project features onto the Geographic Information Systems database to determine acres of each habitat that would be impacted by the project features. A 200-foot buffer zone around all project components was considered to encompass the entire area potentially impacted during construction activities. Habitat where project components would be located was considered permanently lost. Habitat within the buffer zone was assumed to be removed during construction of the project components but could be restored following completion of the project. These impacts were considered temporary.

Impacts to wildlife, including special-status species, were determined according to changes in the amount and/or quality of habitat in the project area. Impacts to federal- and state-listed species with the potential to occur in the project area were individually evaluated on the basis of changes in the amount and quality of habitat and the use of the project area by each species.

### Significance Criteria

The following criteria were used to evaluate the significance of effects on wildlife. These criteria are based on the *CEQA Guidelines* and NEPA regulations. Construction and operation impacts on wildlife resources were considered significant if they would result in any of the following:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS.
- Have a substantial adverse effect on any riparian habitat, or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFG or USFWS.
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, and coastal) through direct removal, filling, hydrological interruption, or other means.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

### No Action Alternative

No changes to hydrology or surface-water management would occur. Gates would be operated during the current 4-month gates-in period. Construction activity would be limited to the installation of the fourth pump at RPP. No other construction activity would occur as a result of the No Action Alternative.

### 1A: 4-month Improved Ladder Alternative

#### Impacts on Wildlife Habitat and Wildlife.

***Impact 1A–BR1: Riparian Habitat.*** Up to 7.74 acres of riparian habitat would be impacted under this alternative (Figure 3.4-9). The permanent loss of 2.18 acres of riparian habitat would occur with the permanent land conversion resulting from installation of the access bridge, the conveyance pipeline, left fish ladder, and the fish screen and forebay. Up to an additional 5.56 acres of riparian habitat could be removed to accommodate construction activities required for the forebay/ conveyance and left fish ladder. Following completion of construction, temporarily impacted areas of riparian habitat would be planted with native riparian trees and shrubs to restore the habitat.

Under this alternative, the gates would be in the river for the same duration (4 months) during the same time period (May 15 through September 15) as under current operation. Therefore, there would be no change in the extent or frequency of inundation of Lake Red Bluff and no change in the nature or extent of riparian vegetation adjacent to the lake.

Riparian habitat that would be impacted under this alternative is predominantly located along Red Bank Creek, with small amounts on the north and south sides of the Sacramento River. A small patch of riparian habitat with limited plant species and structural diversity would be impacted on the north side of the river. The habitat quality of this area is very low because of this low level of diversity and the high levels of human activity resulting from the adjacent park. The riparian habitat on the south side of the river that would be removed for construction of the screen and forebay consists of a narrow band of scattered oak trees, shrubs, and non-native plants. This riparian habitat provides very limited habitat for wildlife. Riparian habitat on both sides of Red Bank Creek would be impacted by construction of the access bridge, the conveyance facility, and the screen and forebay. The larger

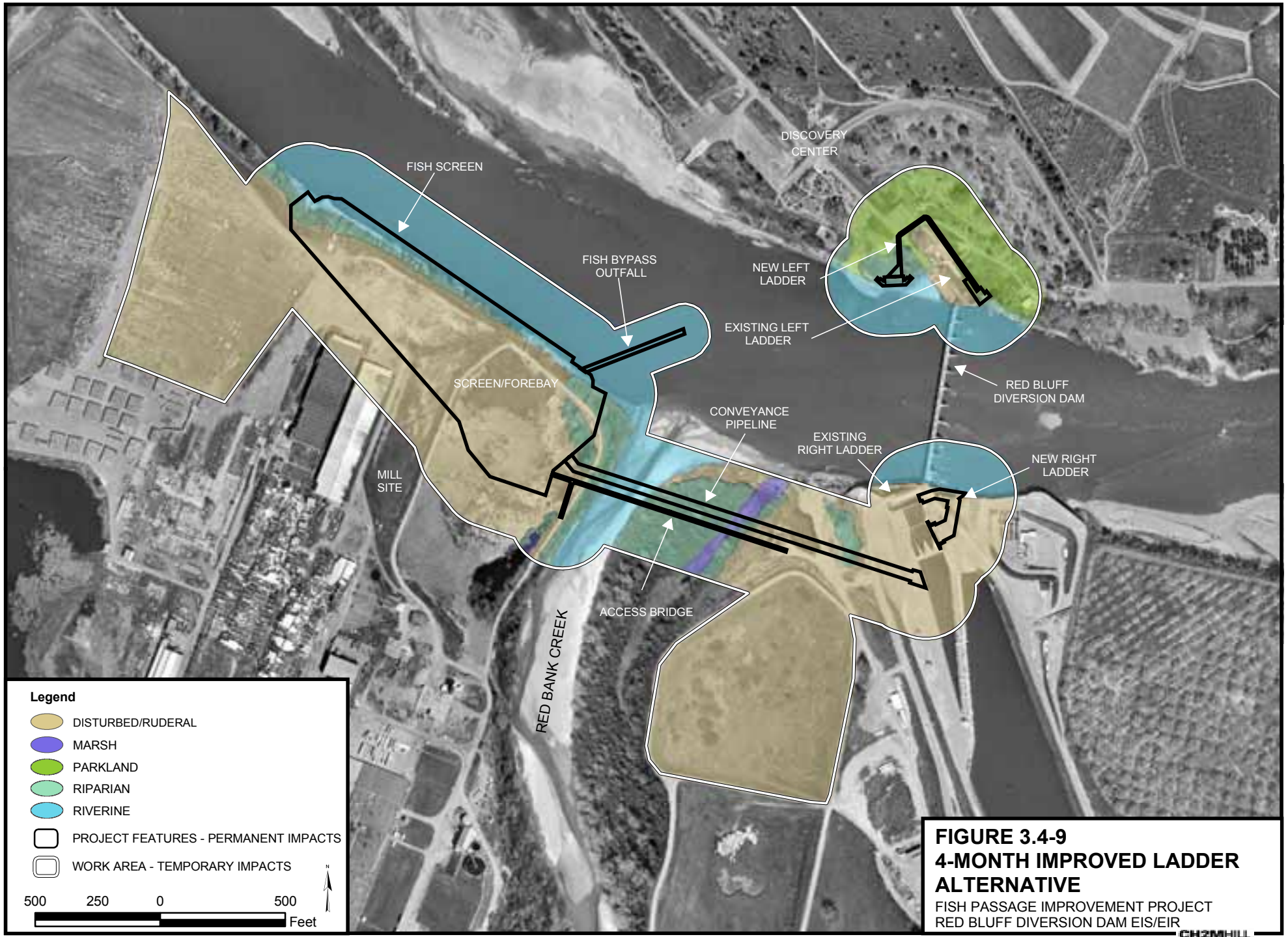


**FIGURE 3.4-9**
**4-MONTH IMPROVED LADDER ALTERNATIVE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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area and greater plant and structural diversity of this riparian habitat provides moderate habitat value for riparian-associated wildlife.

In total, this alternative would permanently or temporarily remove up to 7.74 acres of riparian habitat. This loss of riparian habitat under this alternative would constitute a significant impact because riparian habitat is considered a sensitive natural community. For riparian-associated wildlife, the habitat that would be impacted provides low- to moderate-quality habitat. Because of the small amount of habitat that would be lost and its modest habitat value, the loss of the riparian habitat under this alternative would not significantly impact wildlife populations, migratory corridors, or nursery sites.

***There would be no significant impacts on wildlife under Alternative 1A; however, under the criterion used, construction and operations of Alternative 1A would result in a significant impact to riparian habitat.***

***Impact 1A–BR2: Freshwater Marsh Habitat.*** At least 0.05 acre of freshwater marsh would be permanently lost with construction of the conveyance pipeline and access bridge. An additional 0.71 acre of freshwater marsh is within the 200-foot construction area around the conveyance pipeline and access bridge and could be impacted during construction. For this analysis, it is assumed that all of the 0.71 acre of freshwater marsh within the construction area would be permanently lost, for a total of 0.76 acre.

The marsh habitat that would be impacted consists of two areas: a narrow strip on the south bank of the Sacramento River, which is surrounded by riparian habitat on the east side of Red Bank Creek; and a smaller area on the west side of Red Bank Creek. This is an artificially created marsh, established from the drainage area of the current Pactiv plant. The total acreage of freshwater marsh in the project area is 2.01 acres; the freshwater marsh acreage that would be impacted by this alternative constitutes about one-third of the total marsh acreage. The habitat is of low value to wildlife species because the areas are small, isolated patches with high levels of human disturbance. Although loss of this small amount of freshwater marsh would not significantly impact wildlife populations, migratory corridors, or nursery sites, at least one of the two freshwater marsh areas is probably a federal-protected wetlands under Section 404 of the Clean Water Act. Assuming that the impacted freshwater marsh is protected under Section 404, its loss under this alternative is considered a significant impact.

***The impacts from construction and operations on freshwater marsh habit would be significant.***

***Impact 1A–BR3: Disturbed Habitat.*** Under this alternative, 56 acres of disturbed habitat would be impacted by the project activities. Of this acreage, approximately 12 acres would be permanently converted to

new facilities. The remaining 44 acres would be temporarily disturbed during construction. Following construction, temporarily disturbed areas would be naturally colonized by plants and remain as disturbed habitat. Disturbed areas support very little vegetation – predominantly blackberry and star thistle – and are of very low habitat value for wildlife. Most of this habitat is bare ground. Because of its very low value as wildlife habitat, and because it consists predominantly of non-native plant species, loss of this disturbed habitat would not result in significant biological impacts.

***The impacts from construction and operations on disturbed habitat would be less than significant; therefore, no mitigation is required.***

***Impact 1A–BR4: Parkland Habitat.*** Under this alternative, a total of 5.05 acres of parkland would be impacted. Of this acreage, 0.19 acre would be permanently converted to new facilities. The remaining 4.86 acres would be temporarily disturbed during construction. Following construction, temporarily disturbed areas would be replanted to grow back into their pre-construction condition. The habitat value of the park is low because of the high level of human use, low plant species diversity, and limited vegetation structural diversity. As a result, wildlife species using the park consist of those tolerant of human activity such as gray squirrels, scrub jays, and crows. The borders of the park could also provide habitat used by deer and a greater variety of rodent and bird species. Because of its low value as wildlife habitat, loss of parkland habitat would not result in significant biological impacts.

***The impacts from construction and operations on parkland habitat would be less than significant; therefore, no mitigation is required.***

**Impacts on Special-status Species.** As described above, this alternative would result in only minor reductions in riparian and freshwater marsh habitat. Special-status species associated with riparian and freshwater marsh habitat and with the potential to occur in the project area are listed in Table 3.4-1. Because of the low quality and small amount of the habitats that would be impacted, the only significant impacts to special-status species from changes in habitat quality or amount would be to VELB, osprey, and special-status bats. The following information further describes the potential for impacts to federal- and state-listed species and evaluates other potential impacts to special-status species not captured by consideration of vegetation changes alone.

***Impact 1A–BR5: Little Willow Flycatcher.*** Little willow flycatchers would only be expected to occur in the project area during spring and fall migrations. If they migrate through the project area, they would most likely use riparian habitat and potentially the mixed woodland habitat. Under this alternative, a small amount of riparian habitat would be impacted (2.74 acres permanently lost and 5.41 acres temporarily affected). Because of the small amount of riparian habitat that would be

affected, its low quality for little willow flycatchers, and the low potential for project area use by little willow flycatchers, no significant impacts to little willow flycatchers would occur under this alternative.

***The impacts from construction and operations on little willow flycatchers would be less than significant; therefore, no mitigation is required.***

***Impact 1A–BR6: Western Yellow-billed Cuckoo.*** Under this alternative, a small amount of riparian habitat would be impacted (2.74 acres permanently lost and 5.41 acres temporarily affected). This habitat is not suitable for nesting by western yellow-billed cuckoos but could be used sporadically by cuckoos during spring and fall migrations. Because of the small amount of riparian habitat that would be affected, its low quality for western yellow-billed cuckoos, and the low potential for project area use by western yellow-billed cuckoos, no significant impacts to western yellow-billed cuckoos would occur under this alternative.

***The impacts from construction and operations on western yellow-billed cuckoos would be less than significant; therefore, no mitigation is required.***

***Impact 1A–BR7: Bald Eagle.*** Bald eagles do not nest in the project area but occasionally occur in the project area during the winter. Bald eagles require perch sites such as trees near water bodies where they forage. In the project area, bald eagles could use riparian trees as perch sites from which to forage for fish in the Sacramento River. Although this alternative would remove some riparian habitat, large trees would remain available in riparian areas not affected by construction. Considering the low level of use of this area by bald eagles, the small reduction in riparian habitat under this alternative would not significantly impact foraging opportunities for bald eagles in the project area.

***The impacts from construction and operations on bald eagles would be less than significant; therefore, no mitigation is required.***


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***Impact 1A–BR8: Swainson's Hawk.*** Swainson's hawks are not known to occur in the project area, and their potential to use riparian habitat in the project area appears low. As a result, the small loss of riparian habitat under this alternative would not significantly impact Swainson's hawks.

***The impacts from constructionand operations on Swainson's hawks would be less than significant; therefore, no mitigation is required.***

***Impact 1A–BR9: Valley Elderberry Longhorn Beetle.*** VELB are entirely dependent on the elderberry shrub. Vegetation surveys conducted in 2002 reported six elderberry shrubs and/or groups of shrubs that occur in riparian habitat and eight shrubs that occur in ruderal habitat within

the construction footprint of this alternative. In riparian habitat, Elderberry Shrub Nos. 2, 3, 6, and 7 (Shrubs E2, E3, E6, and E7) are on the left bank (north side) of the Sacramento River within the 200-foot construction buffer zone of the proposed new left fish ladder. Shrubs E34 and E35 occur on the right bank (south side) of the Sacramento River within the 200-foot construction buffer zone of the proposed conveyance pipeline and the access bridge. In ruderal habitat, Shrub E5 occurs within the 200-foot construction buffer zone of the left fish ladder. Shrubs E25, E28, E29, E30, E31, E32, and E33 occur on the right side of the river. Shrub E25 occurs in the 200-foot construction buffer zone of the proposed screen/forebay. No exit holes were observed in the shrub. Shrubs E28 through E33 occur in the staging area south of the proposed conveyance pipeline. Multiple exit holes were observed in the shrubs in this area (refer to Table 3.4-2 and Figure 3.4-2). The elderberry shrubs identified under this alternative are within the 200-foot buffer area considered to be temporarily impacted in this analysis. Because the shrubs do not occur in the footprint of the new facility, it could be possible to avoid them during construction activities. However, for this analysis, the worst-case scenario that the shrubs could not be avoided is assumed. Removal of the elderberry shrubs under this alternative has the potential to adversely affect the federal-listed VELB and is therefore, considered a significant impact.

***The impacts from construction and operations on VELB would be significant.***

***Impact 1A–BR10: Peregrine Falcon.*** This species is not known to nest in the vicinity of the project area but has been observed in the Red Bluff area during the 1999 Audubon Christmas bird counts and observed on rare occasions during breeding bird surveys in the area. The project area provides minimal foraging habitat for peregrine falcons, which more typically prey on waterfowl attracted to Sacramento Valley wildlife refuges. Because of the low quality and small amount of habitat that would be impacted under this alternative, no significant impacts to the peregrine falcon would occur under this alternative.

***The impacts from construction and on peregrine falcons would be less than significant; therefore, no mitigation is required.***

**Impacts on Other Special-status Species.**

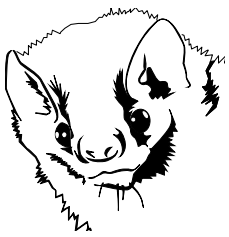
***Impact 1A–BR11: Osprey.*** Two of the three osprey nests on the south side of the Sacramento River area are occupied and are within the area that would be temporarily impacted under this alternative (Figure 3.4-9) during construction of the conveyance pipeline, access bridge, and fish screen. It is anticipated that both of the nesting platforms would need to be removed during construction. The removal of these nest sites constitutes a significant impact.

***The impacts from construction and operations on osprey would be significant.***

***Impact 1A–BR12: Bats.*** The presence of three bat species was visually confirmed, and a fourth species was acoustically detected. The species visually confirmed were myotis (*Myotis* sp.), Mexican free-tail bats (*Tarida brasilensis*), and either pallid bats (*Antrozous pallidus*) or big brown bats (*Eptesicus fuscus*). A pallid bat carcass was found at the site, but guano associated with pallid bats was not found and guano associated with big brown bats was found. Numerous roost locations were documented in the two abandoned storage buildings at the Mill Site. Evidence was found that bats roost in some of the hydroelectric structures of RBDD in concrete weep holes and under metal overhangs. Several areas appeared to provide potential roosting and foraging habitat: the camping and recreational park area on the north side of the Sacramento River, the upland vegetation and open grasslands on the southwest side of the river, and riparian and wetlands areas (Figure 3.4-5).

The two abandoned buildings used as bat roosts are within the 200-foot buffer area considered to be temporarily impacted by all project alternatives. However, there are no plans to remove these buildings. Therefore, no significant impacts to bats would occur. If at the time of project construction a decision is made to permanently impact the roosting habitat by removing the buildings, bats would be significantly impacted, and appropriate mitigation for exclusion of bats from the habitat would be prescribed. For detailed mitigation measures refer to Appendix F.

To further ensure that there would be no significant impact, a 25-foot buffer area will be demarcated and flagged around the buildings. No construction activities would occur within this area. Construction materials will not be stored in the buildings occupied by bats, nor would workers enter the buildings. If these avoidance measures are not possible, TCCA would work with CDFG to coordinate an appropriate avoidance measure.



***The impacts from construction and operations on bats would be less than significant; therefore, no mitigation is required.***

### 1B: 4-month Bypass Alternative

#### Impacts on Wildlife Habitat and Wildlife.

***Impact 1B–BR1: Riparian Habitat.*** This alternative (Figure 3.4-10) would permanently or temporarily remove 8.9 acres of riparian habitat. This includes the permanent loss of 2.6 acres of riparian habitat with land conversion resulting from installation of the bypass, access bridge, conveyance pipeline, and the fish screen and forebay. Up to an additional 6.3 acres of riparian habitat could be removed to

accommodate construction activities required for the bypass work area and the forebay/conveyance and right fish ladder work areas. These impacts would constitute a temporary impact. Following completion of construction, temporarily impacted areas of riparian habitat would be planted with native riparian trees and shrubs to restore the habitat.

Riparian habitat that would be impacted under this alternative is predominantly located along Red Bank Creek and the north side of the Sacramento River, with small amounts also on the south side of the river. The riparian habitat on the north side of the river that would be impacted is of low quality because of the low level of diversity and the high levels of human activity in this area. This area is adjacent to a boat launch in a heavily used recreational area that is adjacent to a campground. In addition, a public footpath winds through the riparian area. The riparian habitat on the south side of the river that would be removed for construction of the screen and forebay consists of a narrow band of scattered oak trees, shrubs, and non-native plants. This riparian habitat provides very limited habitat for wildlife. Riparian habitat on both sides of Red Bank Creek would be impacted by construction of the access bridge, the conveyance facility, and the screen and forebay. The larger area and greater plant and structural diversity of this riparian habitat provide moderate habitat value for riparian-associated wildlife.

Under this alternative, the gates would be in the river for the same duration (4 months) during the same time period (May 15 through September 15) as under current operation. Therefore, there would be no change in the extent or frequency of inundation of Lake Red Bluff and no change in the nature or extent of riparian vegetation adjacent to the lake.

In total, this alternative would permanently or temporarily remove about 8.9 acres of riparian habitat. The loss of riparian habitat under this alternative would constitute a significant impact because riparian habitat is considered a sensitive natural community. For riparian-associated wildlife, the habitat that would be impacted provides low- to moderate-quality habitat. Because of the small amount of habitat that would be lost and its modest habitat value, the loss of the riparian habitat under this alternative would not significantly impact wildlife populations, migratory corridors, or nursery sites.

***There would be no significant impacts on wildlife under Alternative 1B; however, under the criterion used, construction and operations of Alternative 1B would result in a significant impact to riparian habitat.***

***Impact 1B–BR2: Freshwater Marsh Habitat.*** Impacts on freshwater marsh habitat under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A-BR2).

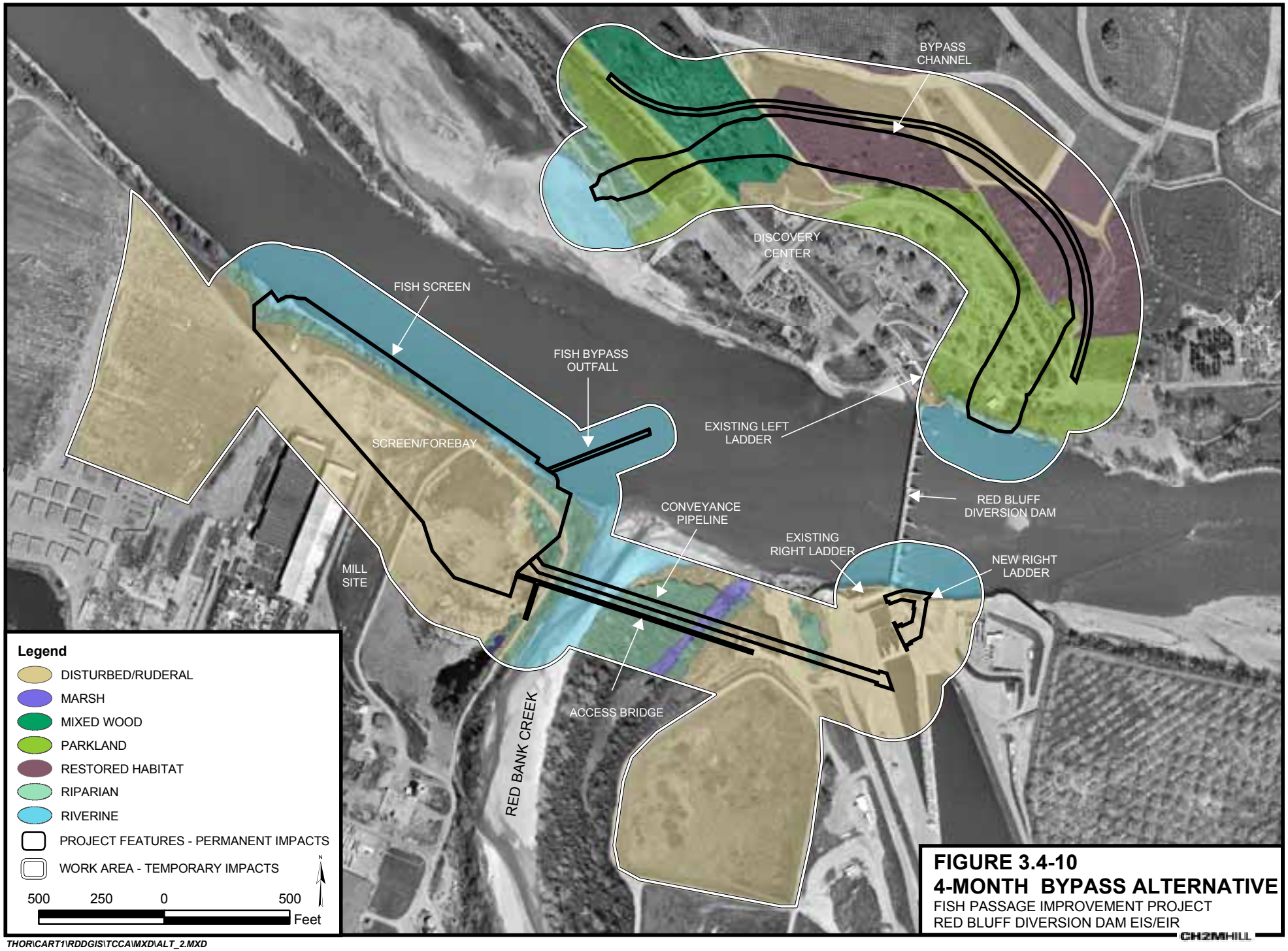



**FIGURE 3.4-10**
**4-MONTH BYPASS ALTERNATIVE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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***The impacts from construction and operations on freshwater marsh habit would be significant.***

***Impact 1B–BR3: Mixed Woodland Habitat.*** A total of 5.67 acres of mixed woodland habitat would be impacted. Of this acreage, about 1.37 acres would be permanently converted into the bypass facility. The remaining 4.30 acres would be temporarily disturbed during construction of the bypass facility. This area is an isolated block adjacent to the road entering the campground on the north side of the Sacramento River. Larger trees are clustered in two general areas, and shrubs and grasses cover the remaining area. Although the large trees and structural complexity added by shrubs and smaller trees make this area attractive to wildlife, its small size, current isolation, and proximity to human activity reduces its wildlife habitat value. Because of its relatively low value as wildlife habitat and the small amount impacted, loss of mixed woodland habitat would not result in significant biological impacts.

***The impacts from construction and operations on mixed woodland habitat would be less than significant; therefore, no mitigation is required.***

***Impact 1B–BR4: Restored Habitat.*** Under this alternative, 9.76 acres of restored habitat would be impacted. The restored habitat is a mitigation area that has been planted at various times during the last 5 to 10 years. This habitat takes on an orchard-like appearance and has little under-story cover for wildlife species, though it is filling in over time. While the area provides cover and some foraging habitat for bird species and smaller mammals, it provides limited habitat value because of its young age. However, because the restored habitat was created as mitigation for removal of riparian habitat and/or oak woodland elsewhere, its removal would result in inadequate mitigation for the previous impact. Therefore, removal of restored habitat under this alternative is a significant impact.

***The impacts from construction and operations on restored habitat would be significant.***

***Impact 1B–BR5: Disturbed Habitat.*** Under this alternative, 64.60 acres of disturbed habitat would be impacted. This land is of low habitat value and supports very little vegetation except for blackberry and star thistle. Most of this habitat is bare ground, with less than an acre covered in rock remnants from dam construction. Because of its very low value as wildlife habitat and because it consists predominantly of non-native plant species, loss of disturbed habitat would not result in significant biological impacts.

***The impacts from construction and operations on disturbed habitat would be less than significant; therefore, no mitigation is required.***

***Impact 1B–BR6: Parkland Habitat.*** A total of 16.51 acres of parkland habitat would be impacted under this alternative. Of this acreage, 4.19 acres would be permanently converted to new facilities, and temporary impacts from construction would impact 12.32 acres of land This parkland is a managed campground and is of low wildlife value, because of the presence of high human activity and relatively small amount of continuous habitat. Because of its low value as wildlife habitat, loss of parkland habitat would not result in significant biological impacts.

***The impacts from construction and operations on parkland habitat would be less than significant; therefore, no mitigation is required.***

**Impacts on Special-status Species.** As described above, this alternative would result in only minor reductions in riparian and freshwater marsh habitat. Special-status species associated with riparian and freshwater marsh habitat and with the potential to occur in the project area are listed in Table 3.4-1. Because of the low quality and small amount of the habitats that would be impacted, the only significant impacts to special-status species from changes in habitat quality or amount would be to VELB, osprey, and special-status bats. The following information further describes the potential for impacts to federal- and state-listed species and evaluates other potential impacts to special-status species not captured by consideration of vegetation changes alone.

***Impact 1B–BR7: Little Willow Flycatcher.*** Little willow flycatchers would only be expected to occur in the project area during spring and fall migrations. If they migrate through the project area, they would most likely use riparian habitat and potentially the mixed woodland habitat. Under this alternative, a small amount of riparian and mixed woodland habitat would be impacted (2.60 acres permanently lost and 6.30 acres temporarily affected for riparian, and 1.37 acres permanently lost and 4.30 acres temporarily affected for mixed woodland). Because of the small amount of riparian habitat that would be affected, its low quality for little willow flycatchers, and the low potential for use of the project area by little willow flycatchers, no significant impacts to little willow flycatchers would occur under this alternative.

***The impacts from construction and operations on little willow flycatchers would be less than significant; therefore, no mitigation is required.***

***Impact 1B–BR8: Western Yellow-billed Cuckoo.*** Under this alternative, a small amount of riparian habitat would be impacted (2.60 acres permanently lost and 6.30 acres temporarily affected). This habitat is not suitable for nesting by western yellow-billed cuckoos but could be used sporadically by cuckoos during spring and fall migrations. Because of the small amount of riparian habitat that would be affected, its low quality for western yellow-billed cuckoos, and the low potential for use

of the project area by western yellow-billed cuckoos, no significant impacts to western yellow-billed cuckoos would occur under this alternative.

***The impacts from construction and operations on western yellow-billed cuckoos would be less than significant; therefore, no mitigation is required.***

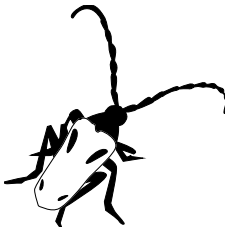
***Impact 1B–BR9: Bald Eagle.*** The impacts on bald eagles under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–BR7).

***The impacts from construction and operations on bald eagles would be less than significant; therefore, no mitigation is required.***

***Impact 1B–BR10: Swainson's Hawk.*** The impacts on Swainson's hawk under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–BR8).

***The impacts from construction and operations on Swainson's hawks would be less than significant; therefore, no mitigation is required.***

***Impact 1B–BR11: Valley Elderberry Longhorn Beetle.*** VELB are entirely dependent on the elderberry shrub. Under this alternative, the same elderberry shrubs that would be affected by the 4-month Improved Ladder Alternative would also be affected here. An additional 10 shrubs located in the bypass footprint on the north side of the river also have the potential to be impacted. Shrubs E21 and E22 are located in grassland habitat; Shrubs E11, E13, E14, E15, and E20 occur in parkland habitat; Shrub E19 occurs in restored habitat; Shrub E7 occurs in riparian habitat; and Shrub E12 occurs in disturbed habitat. Shrub stems range from less than 1 inch to greater than 5 inches in diameter, and exit holes have been observed in two of the shrubs (E15 and E20) (refer to Table 3.4-2 and Figure 3.4-2).



The elderberry shrubs identified in the project area are within the 200-foot buffer area considered to be temporarily impacted and the facility footprint that would be permanently impacted. Because some of the shrubs do not occur in the footprint of the new facility, it could be possible to avoid them during construction activities. However, for this analysis, the worst-case scenario that the shrubs could not be avoided is assumed for all shrubs. Removal of the elderberry shrubs under this alternative has the potential to adversely affect the federal-listed VELB and is therefore, considered a significant impact.

***The impacts from construction and operations on VELB would be significant.***

***Impact 1B–BR12: Peregrine Falcon.*** The impacts on peregrine falcon under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–BR10).

***The impacts from construction and operations on peregrine falcons would be less than significant; therefore, no mitigation is required.***

#### Impacts on Other Special-status Species.

***Impact 1B–BR13: Osprey.*** The impacts on osprey under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–BR11 and Figures 3.4-4 and 3.4-10).

***The impacts from construction and operations on osprey would be significant.***

***Impact 1B–BR14: Bats.*** The impacts on bats under Alternative 1B would be the same as those identified for Alternative 1A (see Impact 1A–BR12).

***The impacts from construction and operations on bats would be less than significant; therefore, no mitigation is required.***

### 2A: 2-month Improved Ladder Alternative

#### Impacts on Wildlife Habitat and Wildlife.

***Impact 2A–BR1: Riparian Habitat.*** Up to 7.74 acres of riparian habitat would be impacted under this alternative (Figure 3.4-11). The permanent loss of 2.18 acres of riparian habitat would occur with the permanent land conversion from installation of the access bridge, the conveyance pipeline, left fish ladder, and the fish screen and forebay. Up to an additional 5.56 acres of riparian habitat could be removed to accommodate construction activities required for the forebay/ conveyance and left fish ladder. Following completion of construction, temporarily impacted areas of riparian habitat would be planted with native riparian trees and shrubs to restore the habitat.

Under this alternative, the gates would be in the river for the reduced period of time (2 months) relative to the No Action Alternative. The gates would be in during July and August of each year. The areal extent of inundation by Lake Red Bluff would be the same as under the No Action Alternative. Because of the annual inundation, vegetation would not become established, and the inundation area would remain devoid of vegetation. Cottonwoods along the margins of Lake Red Bluff likely are tapped into groundwater and therefore not dependent on water from the lake. Therefore, no change in the extent of riparian habitat would be expected with gates in for 2 months.

Riparian habitat that would be impacted under this alternative is predominantly located along Red Bank Creek, with small amounts on the north and south side of the Sacramento River. The riparian habitat on the north side of the river that would be impacted is a small patch with limited plant species and structural diversity. The habitat quality of this area is very low because of the low level of diversity and the high

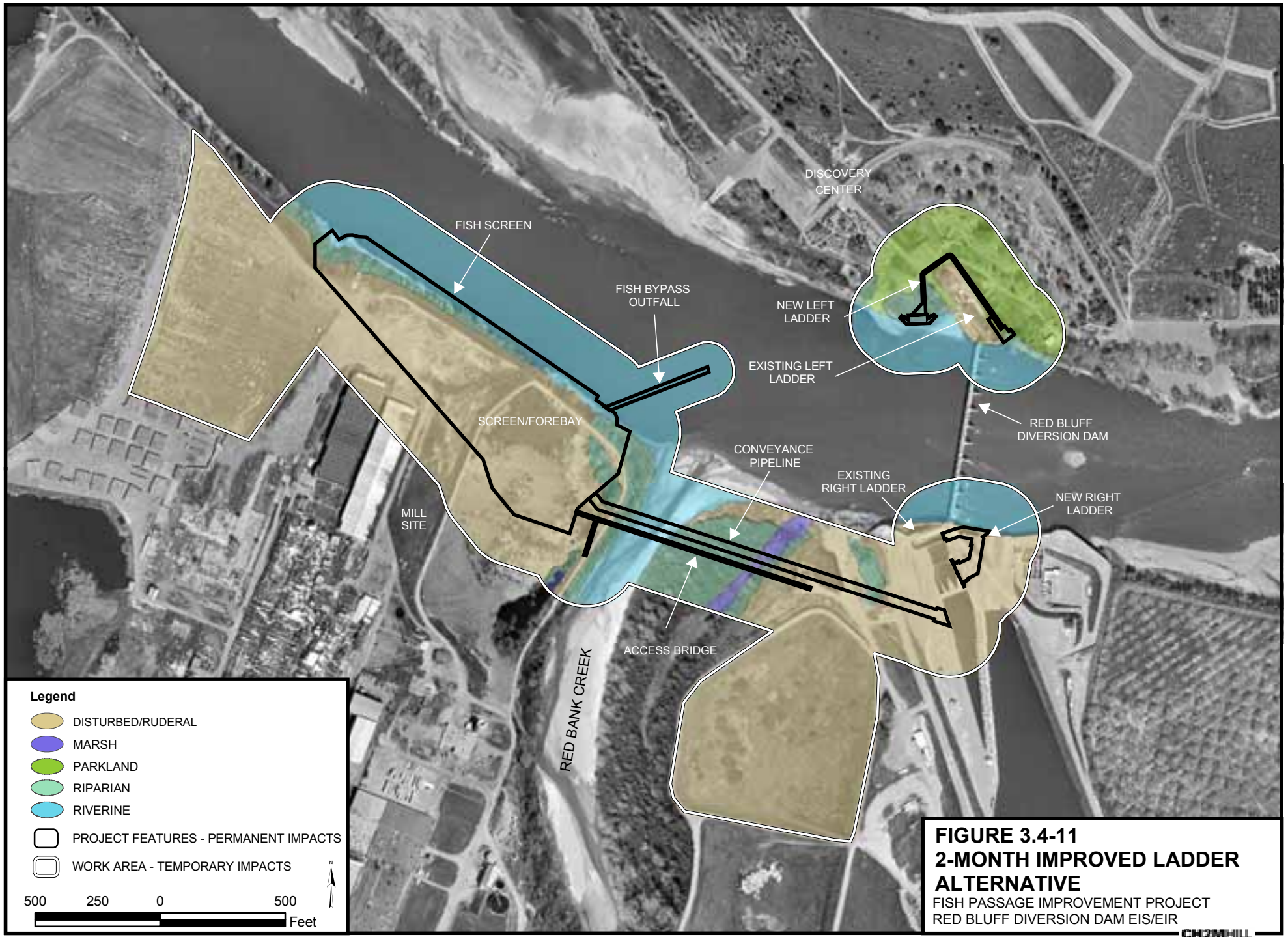



**FIGURE 3.4-11**
**2-MONTH IMPROVED LADDER ALTERNATIVE**
FISH PASSAGE IMPROVEMENT PROJECT
RED BLUFF DIVERSION DAM EIS/EIR

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levels of human activity resulting from the adjacent park. The riparian habitat on the south side of the river that would be removed for construction of the screen and forebay consists of a narrow band of scattered oak trees, shrubs and non-native plants. This riparian habitat provides very limited habitat for wildlife. Riparian habitat on both sides of Red Bank Creek would be impacted by construction of the access bridge, the conveyance facility, and the screen and forebay. The larger area and greater plant and structural diversity of this riparian habitat provides moderate habitat value for riparian-associated wildlife.

In total, this alternative would permanently or temporarily remove about 7.74 acres of riparian habitat. The loss of riparian habitat under this alternative would constitute a significant impact because riparian habitat is considered a sensitive natural community. For riparian-associated wildlife, the habitat that would be impacted provides low- to moderate-quality habitat. Because of the small amount of habitat that would be lost and its modest habitat value, the loss of the riparian habitat under this alternative would not significantly impact wildlife populations, migratory corridors, or nursery sites.

***There would be no significant impacts on wildlife under Alternative 2A; however, under the criterion used, construction and operations of Alternative 2A would result in a significant impact to riparian habitat.***

***Impact 2A–BR2: Freshwater Marsh Habitat.*** The impacts on freshwater marsh habitat under Alternative 2A would be the same as Alternative 1A (see Impact 1A–BR2).

***The impacts from construction and operations on freshwater marsh habit would be significant.***

***Impact 2A–BR3: Disturbed Habitat.*** The impacts on disturbed habitat under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–BR3).

***The impacts from construction and operations on disturbed habitat would be less than significant; therefore, no mitigation is required.***

***Impact 2A–BR4: Parkland Habitat.*** The impacts on parkland habitat under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–BR4).

***The impacts from construction and operations on parkland habitat would be less than significant; therefore, no mitigation is required.***

**Impacts on Special-status Species.** As described above, this alternative would result in only minor reductions in riparian and freshwater marsh habitat. Special-status species associated with riparian and freshwater marsh habitat having the potential to occur in the project area are listed in Table 3.4-1. Because of the low quality and small amount of the habitat that would be impacted, the only significant impacts to special-

status species from changes in habitat quality or amount would be to VELB, osprey, and special-status bats. The following information further describes the potential for impacts to federal- and state-listed species and evaluates other potential impacts to special-status species not captured by consideration of vegetation changes alone.

***Impact 2A–BR5: Little Willow Flycatcher.*** Little willow flycatchers would only be expected to occur in the project area during spring and fall migrations. If they migrate through the project area, they would most likely use riparian habitat and potentially the mixed woodland habitat. Under this alternative a small amount of riparian habitat would be impacted (2.18 acres permanently lost and 5.56 acres temporarily affected). Because of the small amount of riparian habitat that would be affected, its low quality for little willow flycatchers, and the low potential for use of the project area by little willow flycatchers, no significant impacts to little willow flycatchers would occur under this alternative.

***The impacts from construction and operations on little willow flycatchers would be less than significant; therefore, no mitigation is required.***

***Impact 2A–BR6: Western Yellow-billed Cuckoo.*** Under this alternative, a small amount of riparian habitat would be impacted (2.18 acres permanently lost and 5.56 acres temporarily affected). This habitat is not suitable for nesting by western yellow-billed cuckoos but could be used sporadically by cuckoos during spring and fall migrations. Because of the small amount of riparian habitat that would be affected, its low quality for western yellow-billed cuckoos and the low potential for use of the project area by western yellow-billed cuckoos, no significant impacts to western yellow-billed cuckoos would occur under this alternative.

***The impacts from construction and operations on western yellow-billed cuckoos would be less than significant; therefore, no mitigation is required.***

***Impact 2A–BR7: Bald Eagle.*** The impacts on bald eagles under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–BR7).

***The impacts from construction and operations on bald eagles would be less than significant; therefore, no mitigation is required.***

***Impact 2A–BR8: Swainson's Hawk.*** The impact on Swainson's hawk under Alternative 2A would be the same as those identified for Alternative 1A (see Impact 1A–BR8).

***The impacts from construction and operations on Swainson's hawks would be less than significant; therefore, no mitigation is required.***