Chapter 3

Approach to Assessment of Effects and Development of Conservation Measures to Avoid, Minimize, and Compensate for Effects

Environmental Baseline

The environmental baseline used to assess effects of implementing the Restoration Project on covered species and NCCP communities in this ASIP is defined as the existing, preproject, environmental conditions (existing conditions). Existing conditions are the existing extent of NCCP habitats and abundance and distribution of covered species and include the past and present effects of all actions and other human activities in the project area other than the Restoration Project–associated activities described in Chapter 2. Ongoing human activities that occur in the Battle Creek Watershed include ranching, logging practices, resort operations, fish stocking, and fish farming. The status of covered species and critical habitat is described in Appendix E. The existing extent and functions and values of NCCP communities in the project area are described in Chapter 5.

For flow-related resources, the current conditions include the Interim Flow Agreement between Reclamation and PG&E. This agreement is, as its title suggests, a temporary flow condition that does not accurately reflect the normal existing conditions along Battle Creek and, therefore, is not included in the environmental baseline. Habitat baseline conditions as related to flow are those flows produced under the existing FERC license, which requires a minimum flow of 3 cfs in North Fork Battle Creek and 5 cfs in South Fork Battle Creek.

Impact Mechanisms

Impact mechanisms are the specific activities and results of those activities that will be undertaken to implement the Restoration Project that could affect covered species and NCCP communities and include:

- excavation and vegetation removal;
- dewatering of waters of the United States;

- changing flows;
- alteration of instream flows as they relate to effects on aquatic organisms (other than fish) and riparian vegetation;
- temporary stockpiling and sidecasting of soil, construction materials, and/or other construction wastes;
- removal and redistribution of diversion dam materials;
- construction of temporary and permanent access roads;
- soil compaction, dust, and water runoff from the construction site;
- equipment accessing the sites through stream channels;
- construction-related noise from equipment and helicopters;
- construction of improvements to existing trails for construction access;
- site preparation for temporary water bypass structure;
- development of waste disposal areas to contain material from tunnel excavation and access road construction;
- decommissioning of open water diversion tunnels and conveyance canals;
- implementing mitigation measures identified in the Battle Creek Salmon and Steelhead Restoration Project EIS/EIR (Jones & Stokes 2003a); and
- effects from growth inducement.

Methods to Assess Project-Related Effects

Methods used to assess project-related effects on covered species, including fish and wildlife, and NCCP communities are described below.

Fish

Existing literature, discussions with fish biologists knowledgeable about the project area, and the findings of the BCWG Biological Technical Team (Kier 1999) provided information used to evaluate the environmental consequences of the Restoration Project on fishes and their habitats.

The assessment addresses construction-related effects and long-term effects. Construction-related effects are those effects that occur during or shortly after construction activities, including potential spill of contaminants and input of fine sediment, direct injury to individual organisms, temporary impedance of movement (i.e., migration habitat), and temporary disturbance of the channel bottom and bank. Construction-related effects are generally of relatively short duration and affect a restricted area, although effects may continue over many years and extend into downstream areas. Long-term effects include changes to key habitat quantity (as estimated by the Instream Flow Incremental Methodology [IFIM]), migration habitat, water temperature, entrainment in diversions, predation, and food. Long-term effects are associated with permanent and ongoing (e.g., hydropower operations) changes in environmental conditions. The project is not expected to substantially influence existing and ongoing harvest and hatchery effects, factors that currently affect the abundance of steelhead and Chinook salmon.

Monthly models were used to simulate the predicted habitat area and water temperature regime in the project area under the minimum flows for the No Action and Five Dam Removal Alternative. Two sets of minimum flow requirements and resultant temperature regimes are compared:

1. The No-Action minimum flow requirements represent the existing FERC license flow requirements and are 3 cfs below the North Fork Battle Creek diversion dams and 5 cfs below the South Fork Battle Creek diversion dams. Cold water from springs is captured by canals and does not enter adjacent stream reaches.
2. The 1999 MOU minimum flow requirements are substantially higher than the No Action flow requirements. Cold water from springs is allowed to flow into adjacent stream reaches. The flow prescription varies throughout the season by reach depending on the life history requirements of the three species prioritized for restoration and may be adjusted pursuant to an Adaptive Management Program as described in the MOU (Appendix A). The MOU flow prescriptions for the Restoration Project are those identified as the Five Dam Removal Alternative in the EIS/EIR.

Key Habitat Quantity

Methods for evaluating key habitat quantity rely on minimum flow requirements for each of the alternatives based on the assumption that the minimum flow at any time can limit the fish population. During the wet season the flow is above minimum values at unpredictable times in unpredictable amounts as influenced by runoff events. Streamflow directly influences the availability and function of important habitat elements, including water velocity, depth, wetted area, and cover. Flow-habitat relationships for Battle Creek are based on the IFIM and Physical Habitat Simulation (PHABSIM) system (Milhous et al. 1984, Thomas R. Payne and Associates 1998a). Streamflow and release of cold water from springs into adjacent stream reaches also influence the water temperature regime.

PHABSIM and SNTEMP temperature studies were applied to on-site studies on Battle Creek as part of the Upper Sacramento River Fisheries and Riparian Habitat Management Plan process (Resources Agency State of California 1989). A comprehensive study that predicted habitat quantity as a function of flow and temperature was conducted under the guidance of a technical committee that included biologists from the fisheries agencies and PG&E (Thomas R. Payne and Associates 1998a). The flow-habitat relationships that were identified by the study were integrated with the temperature model and analyzed by the Battle Creek Work Group Biological Technical Team in a public forum (Kier 1999, Battle Creek Work Group Presentation August 1998). The analysis identified:

1. priority species and life stages of focus for each reach of Battle Creek based on the usability of the reach determined from the predicted temperature regime and life history functions for five species of anadromous salmonids at a particular time of year,
3. flows to facilitate each species' upstream access over obstacles in the stream channel based on migration timing
4. rates of flow changes to avoid stranding and isolation of juveniles, and
5. water temperatures influenced both by increased flows and releases of cold spring–fed water to adjacent reaches of Battle Creek.

The instream flow releases at each of the dam sites developed through this process became the MOU flows, and the ramping rates used after power system outages are those identified in the MOU. In addition, the MOU also specifies a time of year for planned outages that is least likely to cause risks attributable to ramping operations.

Spawning and rearing habitat area was calculated for the FERC (i.e., No-Action Alternative) and MOU (i.e., Five Dam Removal Alternative) minimum flow requirements.

Water Temperature

As water temperature increases toward the extremes of the tolerance range of a fish, biological responses, such as impaired growth and risk of disease and predation, are more likely to occur (Myrick and Cech 2001; Sullivan et al. 2000). Once temperatures exceed the tolerance range for a species at a certain life stage, survival decreases depending on the magnitude and duration of elevated temperatures. Different life stages and species have different temperature responses, and the tolerance ranges that are identified in available literature are relatively broad (see the discussion under Section 4.1, "Fish" in the draft EIS/EIR [Jones & Stokes 2003a]). Conclusive studies of the thermal requirements completed for Chinook salmon and steelhead in Central Valley streams are limited (Myrick and Cech 2001), but for the purposes of this assessment of effects, survival estimates focus on the most temperature-sensitive life stages at the times of year when these life stages are both present and vulnerable because of climate conditions. Temperature response survival estimates are based on studies reported in the literature and impact analysis techniques used for the same assemblage of fish in the Sacramento River. The presence and absence of temperature-sensitive life stages are based on results of life history studies in the nearby Sacramento River and results of trapping and survey estimates on Battle Creek that have produced juvenile and adult abundance indices (U.S. Fish and Wildlife Service 2001a). Monthly average water temperature was simulated for the months of June through September under the minimum flow requirements in each reach of Battle Creek for each alternative using SNTEMP (PG&E 2001) (for details, see Appendix H of the ASIP, also included as Appendix G of the EIS/EIR). It should be noted that the daily temperatures will vary throughout the month, causing the actual mortality relationships to vary throughout the month as the fish respond to daily average temperatures; however, presenting the performance of the two alternatives on average over a month provides a suitable comparative analysis.

Temperature thresholds for survival and suitability for the different life stages of the priority species for the Restoration Project are presented in the ASIP as follows:

- Winter-run Chinook salmon embryos in June (Figure 4-15)and spring-run Chinook embryos in September (Figure 4-16) when the most temperature-sensitive pre-eyed life stage is at peak abundance and warm climate conditions occur. With respect to winter-run, mortality in July will also continue to be significant because of effects of elevated temperatures on this life stage; however, the relative differences between the No Action and the preferred alternative in July are considered to be similar to those in June. Temperature-survival relationships indicated on the figures are those developed for the same assemblage of Chinook in the nearby upper Sacramento River for use in a similar impact analysis for a temperature control project (U.S. Fish and Wildlife Service 1990,, Bureau of Reclamation 1991). These temperature-survival relationships were applied to Battle Creek in the Restoration Plan (Kier 1999) and confirmed for winter run in later studies by the USFWS.
- Spring-run Chinook adults over-summering in August (Figure. 4-17) when warm climate conditions occur and the adults are reaching the end of the pre-spawning holding period when energy reserves are low. The temperature response indicated on the figures includes the preferred temperature range (California Department of Water Resources 1988) and a range where the exposure represents stressful conditions. The relationships were presented in the Battle Creek Restoration Plan (Kier 1999).
- Winter-run Chinook salmon juvenile temperature tolerance in September (Figure 4-18) when this life stage is present and warm climate conditions occur. The temperature response indicated in the figures includes lethality (Brett 1952, Raleigh et al. 1984, Myrick and Cech 2001) and preferred temperature range (Groot and Margolis 1991). Literature covering the response for exposure to temperatures between lethal and preferred shows considerable variation; factors that increase the difficulty of replicating a response include available food availability (Bisson and Davis 1976) and acclimation temperature (Brett 1952).
- Spring-run Chinook salmon and steelhead smolt thermal tolerance in June (Figures 4-19 and 4-20) when the last of these smolt populations are present (U.S. Fish and Wildlife Service 2001a and Brown pers. comm.) and warm climate conditions occur. The temperature response indicated in the figures

refers to the advanced juvenile life stages of anadromous salmonids when the parr stage transforms to smolt (smoltification) during the spring. Changes in behavior and physiology prepare the smolts for survival in saltwater. Based primarily on controlled experiments, water temperatures high enough to interrupt the smoltification process vary by species (see reviews by Wedemeyer et al. 1980). From literature reviews, Zedonis and Newcomb (1997) identified three categories of thermal tolerance for salmonid smolts for the Trinity River. The three categories—optimal, marginal, and unsuitable—were defined by the relative likelihood that smolts would revert to parr or lose their ability to osmoregulate in seawater. Studies examining relationships between water temperature and smoltification for steelhead have observed a reduction in migratory tendencies in response to elevated temperatures (greater than 55.4ºF) (Zaugg 1981) and reduced physiological changes at higher temperatures (59ºF) that were inferred to be associated with a sharp decline in the number of outmigrating wild steelhead smolts captured in traps (Kerstetter and Keeler 1976).

It will not be possible to develop reliable production estimates for the target species until additional detailed temperature data are developed that provide daily average temperature over the year for the Battle Creek Watershed. In the meantime, critical factor analysis for temperature response examines the most temperature-sensitive life stages at the most vulnerable period of the year to compare alternatives. In addition, the analysis indicates the reaches of streams at various times of the year that the various life stages may be obligated to use in order to survive at reasonable levels in response to temperature.

Migration Habitat

Migration habitat includes the specific conditions that support migration of individuals to spawning and rearing habitat, in particular the upstream migration of adult Chinook salmon and steelhead. Delay and multiple attempts at passing the dams or natural barriers may reduce the survival of adults because of injury and exhaustion. After failed attempts at passing a dam, adults may spawn downstream of the dams or natural barriers, where survival of eggs may be reduced by warmer water temperature.

Methods for evaluation of migration habitat are qualitative. Minimum required flows under each alternative are used to assess the potential for impedance of migration

The effective flow range for fish ladders is used to determine the potential for passage impedance at all dams (Table 3-1). For natural barriers (Table 3-2), Thomas R. Payne and Associates (1998b) determined flows that would allow fish passage at all low-flow barriers. Flows less than the minimum passage flow are assumed to impede upstream migration. Although the minimum passage flows are based on field observation of potential barriers (Thomas R. Payne and Associates 1998b), the actual impedance of migration is uncertain, and adult

Table 3-1. Effective Flows at Fish Ladders under the Proposed Action

Name of Diversion Dam	Effective Flow Range (cfs)
North Battle Creek Feeder Diversion Dam	4 to 110[1]
Eagle Canyon Diversion Dam	20 to 71[1]
Wildcat Diversion Dam	Dam removed
South Diversion Dam	Dam removed
Inskip Diversion Dam[2]	35[3] to 170
Coleman Diversion Dam	Dam removed
Lower Ripley Creek Feeder Diversion Dam	Dam removed
Soap Creek Feeder Diversion Dam	Dam removed

[1] Kennedy, DWR (2001[rmi1]).

[2] Gravel may accumulate in the entrance pool to the fish ladder at Inskip Diversion Dam under the proposed design, leading to an ongoing operations impact between the dam and the ladder.

[3] The fish ladder at Inskip Diversion Dam could function at (as yet unspecified) lower flows if the orifices were blocked (Kennedy, DWR 2001[rmi2]).

Table 3-2. Distribution of Potential Natural Barriers and Diversion Dams That May Impede Upstream Fish Passage

Location (River Mile)	Type of Barrier/Name of Dam	Distance to Next Downstream Barrier (miles)
North Battle Creek		
13.48	Absolute Barrier	0
11.48	Falls/Cascade	2.00
11.46	Falls	2.02
11.45	Falls/Cascade	2.03
11.31	Cascade/Chute	2.17
11.10	Falls	2.38
10.79	Falls/Cascade	2.69
10.78	Falls/Cascade	2.70
10.72	Falls/Cascade	2.76
10.48	Rock Creek	–
9.92	Falls	3.56
9.35	North Battle Creek Feeder Diversion Dam	4.13
6.96	Falls	6.52
6.02	Falls	7.46
5.40	Falls/Cascade	8.08
5.29	Eagle Canyon Diversion Dam	8.19
4.50	Falls	8.98
2.48	Wildcat Diversion Dam	11.00
2.36	Falls	11.12
2.16	Subsurface Flow	11.32
South Battle Creek		
18.85	Absolute Barrier	0
14.35	South Diversion Dam	4.50
11.68	Cascade	7.17
7.96	Inskip Diversion Dam	10.89
3.81	Falls/Cascade/Chute	15.04
3.61	Falls/Cascade	15.24
3.40	Falls/Cascade/Chute	15.45
3.15	Falls	15.70
2.54	Coleman Diversion Dam	16.31

steelhead and Chinook salmon undoubtedly would pass many of the barriers at lower flows or take advantage of peaks in runoff.

In addition to flow barriers, mixing of North Fork Battle Creek flow with South Fork Battle Creek flow potentially results in false attraction of adult Chinook salmon and steelhead from their natal reaches in North Fork Battle Creek. Water temperature in North Fork Battle Creek is cooler than temperature in South Fork Battle Creek. Water temperatures required for spawning and rearing of steelhead and Chinook salmon are more likely to be adverse in South Fork Battle Creek, especially from April through October. Reproductive failure of adults that stray to South Fork Battle Creek may reduce the overall year class production for Battle Creek as a whole, depending on the level of habitat saturation in North Fork Battle Creek.

The mechanisms that allow salmonids to home properly generally stem from their ability to recognize the olfactory characteristics of their home stream (Hasler and Scholz 1983). Juvenile salmonids remember, or “imprint on,” the smell of organic compounds that are uniquely characteristic of a given stream or stream reach. When returning to fresh water to spawn, adult salmonids use these odors to locate and return to the stream reach where they were hatched and reared. Homing may be influenced by such factors as flow, water temperature, presence of other salmon, and habitat quality (Pascual and Quinn 1994; Quinn 1984, 1997). For instance, the homing precision of salmon increases with the relative magnitude of streamflow present in the home stream (Hindar 1992).

Evaluation of the potential for false attraction is qualitative. The proportion of the flow in South Fork Battle Creek that comprises flow discharged from North Fork Battle Creek is assumed to indicate the potential for false attraction. False attraction is assumed to increase at higher proportions of North Fork Battle Creek flow in South Fork Battle Creek.

Entrainment in Diversions

Diversions entrain fish encountering the intake. Fish diverted into the hydropower canals are assumed to suffer total mortality and not contribute to annual production for the species populations in the stream. For reaches upstream of a diversion point, the proportion of production entrained is assumed equal to the proportion of streamflow diverted. Simulated flows and diversions under each alternative (for details, see Section 4.3, “Hydrology,” in the draft EIS/EIR [Jones & Stokes 2003a]) are used to assess the potential entrainment. Fish screens that function at design and performance criteria are expected to avoid most losses of juvenile Chinook salmon and steelhead attributable to entrainment and impingement.

Predation, Pathogens, and Food

Analysis of potential effects on predation and pathogens is qualitative. Dams and the associated fish ladders and other facilities are assumed to increase predation above natural levels, potentially increasing the abundance of predators and disorienting prey. Increased abundance of Chinook salmon and steelhead is assumed to increase the occurrence of salmonid pathogens in Battle Creek.

Analysis of food effects is similarly qualitative. Prey abundance affects growth rate and the survival of individual fish. Prey abundance may increase with increased stream surface area. The minimum required flows under each alternative (for details, see Section 4.3, “Hydrology,” in the draft EIS/EIR [Jones & Stokes 2003a]) are used to estimate stream surface area and assess relative differences in prey-species production.

Wildlife

Biological resource surveys for special-status wildlife species were performed in the Restoration Project area between 2000 and 2003. Detailed biological survey results are discussed in the following reports:

- *Site Assessment for the California Red-Legged Frog, Battle Creek Salmon and Steelhead Restoration Project, Shasta and Tehama Counties* (Jones & Stokes 2001a);
- *Biological Survey Summary Report for the Battle Creek Salmon and Steelhead Restoration Project, Volumes I and II* (Summary Report) (Jones & Stokes 2001b);
- *Site Assessment of the Battle Creek Salmon and Steelhead Restoration Project Area—Assessment of Bat Habitat in Water Diversion Tunnels* (Jones & Stokes 2002a);
- *California Spotted Owl Survey Results, Addendum to the Biological Survey Summary Report for the Battle Creek Salmon and Steelhead Restoration Project* (Jones & Stokes 2002b);
- *Site Assessment of the Battle Creek Salmon and Steelhead Restoration Area—Assessment of Wildlife Mitigation Measures*. (Jones & Stokes 2002c); and
- *Preliminary Delineation of Waters of the United States for the Battle Creek Salmon and Steelhead Restoration Project* (Jones & Stokes 2003b, 2004).

For the purpose of this document, the areas studied for special-status wildlife varied at each Restoration Project site and included a combination of diversion dams, flumes, pipelines, open canals, access roads, and staging areas. The study area for each site was based on the presence of suitable habitat for special-status wildlife, proposed construction methods, use of existing or new access roads, terrain constraints, private property boundaries, fence lines, and dense vegetation that would not be removed during construction.

The study areas for each Restoration Project site are shown on the maps presented in Volume II of the Summary Report (Jones & Stokes 2001b). Along existing access roads, the study area for valley elderberry longhorn beetle habitat surveys consisted of a 100-foot-wide corridor along both sides of the road (approximately 220 feet total). Raptor nest surveys included a ½- mile area around all Restoration Project features and access roads. Nighttime calling surveys for the California spotted owl were conducted around diversion dams in suitable foraging, nesting, or roosting habitat. These surveys would detect owls within ¼ mile.

Existing information was reviewed to determine the location and types of wildlife resources that could exist in the Restoration Project area. The sources of this information included:

- DFG’s CNDDB (California Natural Diversity Database 2000);
- Jones & Stokes file information;
- bird lists for Shasta County Wintu Audubon Society Checklist Committee 2001 and Tehama County (Laymon and Deuel 2003);
- Volumes I, II, and III of *California's Wildlife* (Zeiner et al. 1988, 1990a, 1990b); and
- Dr. Hartwell Welsh (pers. comm.).

Wildlife biologists conducted a reconnaissance-level field visit of the entire study area on March 24 and 25, 2000. The goals of this field visit were to evaluate existing conditions and to determine the approximate locations and extent of required future wildlife surveys. Protocol-level wildlife surveys were conducted at various times between March and August in 2000, 2001, 2002, and 2003 (Table 3-3). The overall objectives of the field surveys were to:

- identify and describe wildlife habitat uses associated with plant communities, and
- identify special-status wildlife occurrences and suitable habitats for special-status wildlife.

Special-Status Wildlife Surveys

Wildlife surveys were used to locate special-status wildlife and to identify sensitive habitats in the Restoration Project area. To account for different seasonal occurrences of special-status wildlife, several series of field surveys were conducted between 2000 and 2003 (Table 3-3). These field surveys included the following elements:

Table 3-3. Wildlife Survey Dates

Restoration Project Site	Survey Dates	Survey Purpose
North Fork Battle Creek		
North Battle Creek Feeder Diversion Dam	April 20, 2000 June 16, 2000	Raptor nests; special-status birds; breeding birds; California spotted owl; red-legged frog; valley elderberry longhorn beetle habitat
	April 13, 2001 May 28, 2001 August 26, 2001	Raptor nests; California spotted owl
	March 19, 2002 March 29, 2002 April 5, 2002 June 8, 2002	Raptor nests; California spotted owl
Eagle Canyon Diversion Dam	April 20, 2000 June 16, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; bats; red-legged frog; valley elderberry longhorn beetle habitat
	May 29, 2001 June 25, 2001 August 25, 2001	Raptor nests; California spotted owl
	March 19, 2002 March 30, 2002 April 6, 2002 June 7, 2002	Raptor nests; California spotted owl
	April 17, 2003	Valley elderberry longhorn beetle habitat (follow-up surveys)
Eagle Canyon Canal (tunnels)	January 29, 2002	Bats
Wildcat Diversion Dam	April 20, 2000 June 16, 2000	Raptor nests; special-status birds; breeding birds; red-legged frog; valley elderberry longhorn beetle habitat
	April 12, 2001 May 28, 2001 August 25, 2001	Raptor nests; California spotted owl
	March 19, 2002 March 30 , 2002 April 5, 2002 June 8, 2002	Raptor nests; California spotted owl
South Fork Battle Creek		
Coleman Diversion Dam/ Inskip Powerhouse	April 17, 2000 June 13, 2000 June 15, 2000 July 25, 2000	Raptor nests; special-status birds; breeding birds; bats; red-legged frog; valley elderberry longhorn beetle habitat
	April 12, 2001 May 28, 2001 August 26, 2001	Raptor nests; California spotted owl

Table 3-3. Continued

Restoration Project Site	Survey Dates	Survey Purpose
	March 18, 2002 March 30 , 2002 April 6, 2002 June 7, 2002	Raptor nests; California spotted owl
	April 17, 2003	Valley elderberry longhorn beetle habitat (follow-up surveys)
Inskip Canal (tunnels)	January 28, 2003	Bats
Lower Ripley Creek Feeder	April 17, 2000 June 15, 2000 July 7 and 25, 2000	Raptor nests; special-status birds; breeding birds; willow flycatcher; red-legged frog; valley elderberry longhorn beetle habitat
	April 17, 2003	Valley elderberry longhorn beetle habitat (follow-up surveys)
Inskip Diversion Dam/ South Powerhouse	April 17, 2000 June 13 and 14, 2000 June 15, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; bats; red-legged frog; valley elderberry longhorn beetle habitat
	May 29, 2001 June 25, 2001 August 25, 2001	Raptor nests; California spotted owl
	March 18, 2002 March 29 , 2002 April 5, 2002 June 7, 2002	Raptor nests; California spotted owl
	April 17 , 2003	Valley elderberry longhorn beetle habitat (follow-up surveys)
Soap Creek Feeder	April 17, 2000 June 14, 2000 June 16, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; red-legged frog; tailed frogs and general amphibians; valley elderberry longhorn beetle habitat
South Diversion Dam/South Canal	April 17, 2000 June 12 and 14, 2000 June 16, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; bats; red-legged frog; tailed frogs and general amphibians; valley elderberry longhorn beetle habitat
	April 13, 2001 May 28, 2001 August 26, 2001	Raptor nests; California spotted owl
	March 19, 2002 March 29 , 2002 April 5, 2002 June 8, 2002	Raptor nests; California spotted owl
	April 17, 2003	Valley elderberry longhorn beetle habitat (follow-up surveys)
South Canal (tunnels)	January 28 and 29, 2002	Bats

Table 3-3. Continued

Restoration Project Site	Survey Dates	Survey Purpose
Access Roads		
Eagle Canyon Access Road	April 20, 2000 June 16, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
Wildcat Dam Access Road	April 20, 2000 June 16, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
Lower Ripley Creek Feeder Access Road	April 17, 2000 June 14, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
South Powerhouse Road to Inskip Dam/South Powerhouse Access Road	April 17, 2000 June 14, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
East of Bar Ranch and South Powerhouse Access Road	April 17, 2000 June 14, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
Bluff Springs to South Powerhouse Access Road	April 17, 2000 June 14, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
Soap Creek Feeder Access Road	April 17, 2000 June 14, 2000 July 24, 2000	Raptor nests; special-status birds; breeding birds; valley elderberry longhorn beetle habitat
South Diversion Dam/South Canal Access Road	April 17, 2000 June 14, 2000	Raptor nests; special-status birds; breeding birds
	April 17, 2003	valley elderberry longhorn beetle habitat (follow-up surveys)

- In 2000, two biologists performed two series of field surveys to identify birds that breed either in the early spring or in the late spring or early summer. The surveys consisted of visual and aural detections at all Restoration Project sites and habitats. Suitable breeding habitat was surveyed for evidence of breeding at the appropriate time of year for each species. All evidence of breeding, such as singing male birds, territorial behavior, and courtship behavior, was recorded. All plant communities were surveyed, and all wildlife species detected were noted.
- With the exception of bats, biologists identified all vertebrates encountered during field surveys performed between 2000 and 2002 to the level necessary to determine whether they qualified as special-status species, unique occurrences, or extensions of species' documented ranges.
- In 2000, biologists visually surveyed for bats at dusk at each of the canal tunnel openings, but the species were not identified. In January 2002, biologists conducted walk-through surveys in Tunnels 1, 2, and 3 along Inskip Canal and Tunnels 1, 2, 3, 4, and 5 along Eagle Canyon Canal (the canals were not diverting water at the time so that PG&E could perform annual maintenance on the canals). During this same field visit, biologists performed a visual assessment of habitat conditions at the entrance and exit portals of Tunnels 1 through 10 along the South Canal. Using high-powered spotting scopes and binoculars, biologists visually surveyed for raptor nests in 2000, 2001, and 2002, on all suitable trees and cliff sites within ½ mile of Restoration Project sites and access roads.
- In 2000, using USFWS protocols, biologists assessed the Restoration Project area for red-legged frog habitat. Protocol-level surveys were not conducted because of the lack of suitable habitat as established in the reconnaissance-level surveys and site assessments.
- Biologists conducted tailed frog surveys in 2000 at two Restoration Project sites with the highest potential for occurrence: Soap Creek Feeder and South Diversion Dam. Survey methods followed methods developed by Dr. Hartwell Welsh, Redwood Sciences Laboratory, Pacific Southwest Research Station, U.S. Forest Service (Welsh pers. comm.).
- Biologists conducted area-constrained surveys in 2000 for other amphibian species following methods proposed by Welsh (1987).
- In 2000, elderberry bushes, which provide habitat for the listed valley elderberry longhorn beetle, were surveyed and plotted on U.S. Geological Survey (USGS) 7.5-minute topographic maps and aerial photographs of the Restoration Project area and recorded in field notes. The gathering of data for each occurrence followed USFWS protocols. The survey included a search for exit holes on living stems, counts of stems in three size classes, and a physical description of the location.
- In 2003, biologists performed surveys on all elderberry shrubs located within 100 feet of proposed construction activities. Data gathered at each shrub location followed USFWS protocols. Only previously mapped shrubs in the project area were surveyed during the 2003 field visit.

- In 2000, biologists surveyed for California spotted owls in potential habitats near North Battle Creek Feeder Diversion Dam. Both visual and daytime calling surveys were conducted.
- In 2001, biologists began a 2-year survey at five additional sites: Eagle Canyon Diversion Dam, Wildcat Diversion Dam, Coleman Diversion Dam/Inskip Powerhouse, Inskip Diversion Dam/South Powerhouse, and South Diversion Dam. California spotted owl survey methods followed the USFWS–endorsed *Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls* (U.S. Fish and Wildlife Service 1992). According to USFWS representatives, the survey protocol for the California spotted owl will be similar to the survey protocol for the northern spotted owl. The 2-year survey ended in 2002. However, because the USFWS recently determined that listing of this subspecies is not warranted, updated protocol-level surveys for purposes of ESA are not necessary for the project.

Plants and NCCP Communities

Biological resource surveys for habitat communities were performed in the Restoration Project area in 2000, 2001, and 2003. Detailed biological survey results are discussed in the following reports:

- *Biological Survey Summary Report for the Battle Creek Salmon and Steelhead Restoration Project, Volumes I and II* (Summary Report) (Jones & Stokes 2001b);
- *Preliminary Delineation of Waters of the United States for the Battle Creek Salmon and Steelhead Restoration Project* (Jones & Stokes 2003b, 2004).

The areas studied for botanical and wetland resources varied at each Restoration Project site and include a combination of diversion dams, flumes, pipelines, open canals, access roads, and potential staging areas. The study area for each Restoration Project site was based on proposed construction methods, use of existing or new access roads, terrain constraints, private property boundaries, fence lines, and dense vegetation that would not be removed during construction. The study areas for the Restoration Project sites are shown on the maps in Volume II of the Summary Report (Jones & Stokes 2001b). Along existing access roads, the study area consisted of a 20-foot corridor on each side of the road edge (approximately 60 feet total).

Information reviewed to determine the location and types of vegetation that could exist in the Restoration Project area included:

- the DFG's CNDDB (California Natural Diversity Database 2000);
- the California Native Plant Society's (CNPS's) Inventory of Rare and Endangered Vascular Plants of California, sixth edition (California Native Plant Society 2000); and

- previously prepared environmental documents (Jones & Stokes file information; Oswald and Ahart 1994).

When appropriate, state and federal resource specialists were asked to provide information on special-status plants, noxious weeds, and local ordinances (e.g., oak tree ordinances or policies).

Botanists conducted a reconnaissance-level field visit on March 24 and 25, 2000, to evaluate existing conditions and to determine the extent of detailed botanical and wetland surveys. Protocol-level botanical surveys and wetland delineations were conducted at various times between April and August 2000 (Table 3-4). The purposes of the field surveys were to:

- characterize plant communities and unique plant assemblages,
- identify special-status plant occurrences or suitable habitat for special-status plants,
- delineate waters of the United States (including wetlands) using the *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987),
- map noxious weed infestations (see the definition below for species considered noxious weeds in this analysis), and
- coordinate with state and federal resource agencies to develop measures that avoid or minimize effects on vegetation and wetland resources.

Special-Status Plant Surveys

Information on occurrences of special-status plants in the Restoration Project area was obtained initially from the CNDDB (California Natural Diversity Database 2000), the USFWS, and reconnaissance-level surveys. Additional information on species' habitat requirements, blooming periods, and field-identifying characteristics was obtained from state lists of flora (Munz and Keck 1968; Hickman 1993) and the CNPS fifth-edition (Skinner and Pavlik 1994) and sixth-edition inventories. This information was used to develop a list of special-status plants that have the potential to occur in the Battle Creek region. This table was used to identify habitats that have the highest potential to support special-status plants and to develop survey dates.

The floristic survey methods used to locate special-status plants in the Restoration Project area are based on guidelines recommended by the DFG and involve identifying all species to the level necessary to determine whether they qualify as a special-status plant or are plant species with unusual or significant range extensions (Nelson 1987). To account for different special-status plant identification periods, biologists conducted several series of field surveys between April and August 2000 (refer to Table 3-4 for survey dates).

Table 3-4. Botanical Survey and Wetland Delineation Dates

Restoration Project Area	Survey Dates	Survey Purpose
North Fork Battle Creek		
North Battle Creek Feeder Diversion Dam	April 13, 2000 August 4, 2000	Botanical surveys and wetland delineation
Eagle Canyon Diversion Dam	April 20, 2000 May 26, 2000	Botanical surveys and wetland delineation
	March 19, 2001	Butte County fritillary surveys
Wildcat Diversion Dam	April 25, 2000 August 4 and 11, 2000	Botanical surveys and wetland delineation
	March 19, 2001	Butte County fritillary surveys
South Fork Battle Creek		
Coleman Diversion Dam/Inskip Powerhouse	April 4 and 5, 2000 June 15, 2000 August 11, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Penstock Junction Box	April 4 and 5, 2000 August 11, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Lower Ripley Creek Feeder	April 12, 2000 August 8, 2000	Botanical surveys and wetland delineation
Inskip Diversion Dam/South Powerhouse	April 6, 2000 June 13 and 14, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Soap Creek Feeder	April 12, 2000 August 8, 2000	Botanical surveys and wetland delineation
South Diversion Dam	April 7 and 25, 2000 August 11, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Access Roads		
Eagle Canyon Access Road	April 20, 2000	Botanical surveys and wetland delineation
	March 19, 2001	Butte County fritillary surveys
Wildcat Dam Access Road	April 13 and 25, 2000 August 4 and 11, 2000	Botanical surveys and wetland delineation
	March 19, 2001	Butte County fritillary surveys
Lower Ripley Creek Feeder Access Road	April 12 and 24, 2000 August 8, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys

Table 3-4. Continued

Restoration Project Area	Survey Dates	Survey Purpose
South Powerhouse Road to Inskip Diversion Dam/South Powerhouse Access Road	April 6 and 21, 2000 August 8, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
East of Bar Ranch and South Powerhouse Access Road	April 20, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Bluff Springs to South Powerhouse Access Road	April 19, 2000 August 13 and 14, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys
Soap Creek Feeder Access Road	April 12, 2000 August 8, 2000	Botanical surveys and wetland delineation
South Diversion Dam Access Road	April 7, 14, and 25, 2000 August 11, 2000	Botanical surveys and wetland delineation
	March 20, 2001	Butte County fritillary surveys

Depending on the terrain, various survey patterns were used, including meandering and intuitive-controlled transects (i.e., transects that rely on the location and quality of habitat in the study area and focus efforts on those areas) in areas that contained suitable habitat for special-status plants. Survey intensity varied depending on species richness, habitat type and quality, and the probability of special-status species occurring in a particular habitat type.

NCCP Community Characterization and Mapping

NCCP communities at each Restoration Project site were mapped in the field on aerial photographs (1 inch equals approximately 250 feet). The plant communities identified in the project area are subtypes of the NCCP communities described in Table 1-4. Descriptions and names of plant communities were based on field surveys and on descriptions from the list of California terrestrial natural communities recognized by the CNDDB (2000), Holland (1986), and Sawyer and Keeler-Wolf (1995). Although the classification system of Sawyer and Keeler-Wolf represents the most recent treatment and includes greater community detail than the CNDDB list, it is incomplete for many geographical areas in California. Additionally, some of the plant communities described in this report do not fit well into the communities that were defined by either Holland or Sawyer and Keeler-Wolf. Therefore, some community-type names have been modified based on field observations.

Wetland Delineation

The term *waters of the United States* is used by the U.S. Army Corps of Engineers (Corps) to include areas that would qualify for federal regulation under Section 404 of the Clean Water Act (33 USC 1251–1376). For the purpose of this document, waters of the United States are separated into wetlands and other waters of the United States.

Wetlands are defined as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that, under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3[b]; 40 CFR 230.3). For a wetland to qualify as jurisdictional by the Corps and, therefore, subject to regulation under Section 404 of the Clean Water Act (33 USC 1251–1376), the site must support a prevalence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Wetlands were identified in the field based on the Corps's definition. Wetlands were delineated using the methods outlined in the *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987).

Other waters of the United States are waters that typically lack one or more of the three indicators identified above. For the purpose of this document, drainages include all streams, creeks, rivers, and other surface features with defined beds and banks. The jurisdictional boundary for other waters of the United States was determined during the wetland delineation using the estimated ordinary high-water mark (based on an estimated 2-year flood event).

Waters of the United States (including wetlands) at each Restoration Project site were mapped in the field on aerial photographs (1 inch equals approximately 250 feet). A detailed description of the methods used to delineate waters of the United States is provided in a separate wetland delineation report.

Noxious Weed Surveys

Noxious weeds were documented as part of the special-status plant surveys. For the purpose of this document, a *noxious weed* is defined as a plant that has the potential to displace native plants and natural habitats, affect the quality of forage on range lands, or affect cropland productivity (California Natural Diversity Database 2000). High-priority noxious weeds include all California Department of Food and Agriculture “A”-rated species. Some “B”- and “C”-rated species were included in this analysis if the county agricultural commissioners identified them as target noxious weeds. Additional weeds were included if they were considered to have great potential for displacing native plants and damaging natural habitats and were not considered too widespread to be effectively controlled.

Noxious weed infestation and dispersal have been identified by federal, state, and county agencies as issues of concern and, therefore, are addressed in this document. Two federal acts and one executive order direct weed control: the Carlson-Foley Act of 1968 (42 USC 1241–1243), the Federal Noxious Weed Act of 1974 (7 USC 2814), and Executive Order 13112, Invasive Species (64 FR 6183, February 8, 1999). Local counties are also concerned about noxious weed infestation and dispersal on private and public lands. To identify noxious weed species of concern in the Restoration Project area, the following sources were consulted:

- a list of species designated as federal noxious weeds by the U.S. Department of Agriculture;
- Shasta and Tehama Counties’ agricultural commissioners;
- the California Department of Food and Agriculture’s “A,” “B,” and “C” lists of noxious weeds; and
- the California Exotic Pest Plant Council’s list of pest plants of ecological concern.

Development of Conservation Measures

The conservation measures identified in this ASIP generally tier from the programmatic-level conservation measures identified in the MSCS and were developed in coordination with USFWS, NOAA Fisheries, and DFG ASIP team representatives. Additionally, conservation measures are consistent with the EIS/EIR. Initially, MSCS programmatic conservation measures for each covered species and NCCP communities were reviewed and project-level conservation measures were developed from those MSCS conservation measures that were applicable to the project. In some instances, additional conservation measures were developed to adequately avoid, minimize, and compensate for effects on covered species and NCCP communities. The use of a CALFED–funded conservation easement located in the project area along the mainstem of Battle Creek is proposed to offset permanent Restoration Project effects on riparian and upland habitats that cannot be fully compensated on site (for more information, see the habitat compensation approach presented in Appendix F of this document). Temporary effects on all species and habitats would be restored on site with additional compensation on the easement.

Conservation measures to avoid, minimize, and compensate for effects on covered species and NCCP communities of implementing the Restoration Project are described in Chapters 4 and 5, respectively.

CALFED Contribution to Species and Habitat Conservation

The programmatic NCCP Determination requires that CALFED projects evaluated in the MSCS must collectively demonstrate a benefit to NCCP covered species and communities. As described in Chapter 2, the Restoration Project is specifically designed to help achieve MSCS goals for three anadromous fish species: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead). The Restoration Project, however, has established a goal to fully mitigate effects on the remaining covered species and, with the exception of montane riverine aquatic habitat, NCCP communities. The Restoration Project goal for montane riverine aquatic habitat is to help achieve the MSCS goal of substantially increasing the extent and quality of this habitat type. This assessment links the Restoration Project to other CALFED projects and fulfills NCCP requirements for contribution to conservation of covered species and NCCP communities both through its own anadromous fish restoration goals and through its association with other CALFED projects that will collectively benefit all NCCP covered species and communities.

The CALFED contribution to conservation is described for each covered species and NCCP community in Chapters 4 and 5, respectively. CALFED’s contribution to conservation was determined by reviewing available CBDA documentation of projects that have been or are being implemented that will benefit each covered species and NCCP community. CBDA has developed a draft database of CALFED ecosystem restoration projects that have been or are being implemented or that have been funded for implementation. This database was searched in August 2003 for other CALFED projects in the Sacramento River Basin that are contributing to conservation of the seven species and eight NCCP communities analyzed in this ASIP. Appendix I lists the species and NCCP communities analyzed in this ASIP and describes how additional CALFED projects in the Sacramento River Basin are contributing to their conservation.

In addition, the Programmatic BOs and NCCP Determination identify ecosystem milestones that must be attained within the first 7 years of CALFED implementation. Because attainment of these ecosystem milestones is a condition of the Programmatic BOs and NCCP Determination, it is reasonable to assume that ecosystem restoration actions to help attain these near-term milestones will be implemented. Consequently, the ecosystem milestones that, when attained, will benefit each of the covered species and NCCP communities are also identified. The ecosystem milestones identified by the Programmatic BOs and NCCP Determination are shown in Appendix J.