Chapter 4

Assessment of Project Effects on Covered Species and Conservation Measures

This chapter describes the current status of each special-status species covered under this ASIP that could be affected by the Restoration Project (Table 1-3). The effects of the project on the species and conservation measures that will be implemented to avoid, minimize, and compensate for each effect are identified. Except where noted, assessment methods are described in Chapter 3. The expected outcomes of implementing the project and conservation measures and the CALFED contribution to recovery and conservation of the species are described.

Fish

The assessment of project-related effects on fish in this ASIP is consistent with the draft EIS/EIR (Jones & Stokes 2003a). The No Action Alternative in the EIS/EIR is identified as *baseline* in the assessment below and the Five Dam Removal Alternative is identified as the *Restoration Project*. Additional life history information pertaining to fish species within the project area is located in Appendix E.

Current Status of Chinook Salmon in the Project Area

The upper Sacramento River and its tributaries, including Battle Creek, provide habitat for adult holding and spawning, egg incubation, and juvenile rearing (Figure 4-1). Chinook salmon spend most of their lives in the Pacific Ocean (generally 3 years, but ranging from 1 to 5 years). Upon reaching sexual maturity, adults migrate to the Sacramento River and its tributaries. Chinook salmon home to the stream where they hatched, although some adults stray and spawn in streams other than the stream of their origin. Spawning requires cool water temperature, access to holding and resting pools, clean gravel for building nests, or redds, where eggs are deposited and fertilized, and suitable water velocity and depth.

Four runs of Chinook salmon occur in the upper Sacramento River and Battle Creek: fall/late fall, winter, and spring. One or more life stages of Chinook salmon are found in the upper Sacramento River throughout the year. Limited studies indicate that Chinook salmon in Battle Creek exhibit a life history pattern similar to that derived from the studies made at Red Bluff Diversion Dam (Comprehensive Assessment and Monitoring Program 2001). The actual timing of runs throughout the upper Sacramento River and its tributaries varies slightly from year to year as a function of weather, streamflow, and water temperature (Vogel and Marine 1991).

Identification of the runs is based on the time of year that the adults leave the Pacific Ocean and enter fresh water. Fall-run Chinook salmon migrate upstream during July through November. Late fall–run Chinook salmon migrate upstream during October through February. Fall- and late fall–run Chinook salmon spawn upon arrival on the spawning grounds.

Spring-run Chinook salmon migrate upstream in the spring and spend the summer in cool river and stream reaches where cover is provided by deep water or boulders. Adults spawn in August through October (Figure 4-1). The species is dependent on cold reservoir releases and cold spring–fed or high-elevation streams for holding and spawning habitat. The spring-run Chinook salmon population presently exists in the project area at low levels; probably between 50 and 100 adult spring-run Chinook salmon have used the Restoration Project area annually during the past several years, although these population estimates are not precise (U.S. Fish and Wildlife Service 2002). Current populations of spring-run Chinook salmon appear to be severely depressed when compared to populations that existed in the 1940s and 1950s.

Winter-run Chinook salmon migrate upstream in winter and hold in cool reaches during the spring and early summer (Figure 4-1). Adults spawn in the summer and are dependent on cool reservoir releases or streams dominated by cold spring water. The winter-run Chinook salmon population presently exists in the Restoration Project area at remnant levels; 0 to fewer than 10 adult winter-run Chinook salmon occurred in recent years (U.S. Fish and Wildlife Service 2002), although it is possible that some fish could enter the Restoration Project area uncounted. Remnant populations of winter-run Chinook salmon observed in 1998 and earlier included adults from hatchery-produced juveniles (Kier Associates 1999). Winter-run Chinook salmon are currently listed as endangered under both the CESA and the ESA.

Fall–run Chinook salmon comprise the largest population of Chinook salmon in Battle Creek. Fall-run Chinook salmon are intentionally restricted from entering the Restoration Project area because of concern about transmitting infectious hematopoietic necrosis (IHN) into the water supply for the Coleman National Fish Hatchery (U.S. Fish and Wildlife Service 1997) and potential problems that excessive numbers of fall-run pose to the small numbers of spring-run Chinook salmon. During the past 5 years of record, an average of about 95,000 adult fall–run Chinook salmon returned to Battle Creek, of which an average of nearly 34,000 are allowed to enter the Coleman National Fish Hatchery. The remaining

fall-run Chinook salmon are mostly confined downstream of the Coleman National Fish Hatchery barrier weir and outside the Restoration Project area (Comprehensive Assessment and Monitoring Program 1998, U.S. Fish and Wildlife Service 2001b). The abundance of fall–run Chinook salmon in the Battle Creek watershed has increased substantially since about 1980. Fishery managers have conventionally believed that most of these fall–run Chinook salmon are of Coleman National Fish Hatchery origin (Kier Associates 1999).

Late fall-run Chinook salmon in Battle Creek consist primarily of hatchery origin fish. Since 2001/2002, unmarked, natural origin late fall-run Chinook salmon have been released above the Coleman National Fish Hatchery's barrier weir to spawn naturally in Battle Creek.

Appendix E contains additional information regarding Chinook salmon distribution within the project area.

Current Status of Steelhead in the Project Area

Steelhead occur in the upper Sacramento River and its tributaries, which provide the main habitat for holding, spawning, egg incubation, and fry and juvenile rearing. The number of steelhead that actually spawn in the Sacramento River is presumed to be small. Spawning occurs primarily in cool reaches of tributaries.

The majority of adult steelhead migrate into the upper Sacramento River from July through March. Steelhead spawn in the upper Sacramento River and its tributaries, such as Battle Creek, from December through April and possibly May in most years (California Department of Fish and Game 1990, California Department of Fish and Game 1996, Hallock et al. 1961, Schafter 1980) (Figure 4-1). Steelhead home to the stream where they were hatched, although a portion of the population can be expected to stray and spawn in other streams.

Steelhead at various life stages inhabit the Battle Creek watershed year-round. Unlike Chinook salmon, steelhead typically rear in freshwater for at least 2 years before migrating to the Pacific Ocean. Steelhead may spawn more than once, returning to the Pacific Ocean between spawning runs. The percentage of the steelhead population that spawns more than once is small.

The existing population of steelhead in Battle Creek is comprised of a mixture of hatchery and natural origin adults. Over the past 10 years, the annual average population of adult steelhead in the Battle Creek watershed, including both hatchery and natural fish, has been about 2,400 fish. Since 2001, an annual average of about 300 natural origin steelhead have been documented in Battle Creek. In recent years, an average of about 1,000 adult steelhead have been released above the Coleman National Fish Hatchery barrier weir to spawn naturally in the Restoration Project area.

Appendix E contains additional information regarding steelhead distribution within the project area.

Effects of the Restoration Project

Construction-Related Effects

Short-term construction-related effects fall into four categories: key habitat quantity, migration habitat, contaminants, and direct injury.

Accidental Spill of Petroleum Products (Contaminants)

Accidental spills of petroleum products and other construction-related materials could cause mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek. Construction activities associated with removing the five dams would include dismantling and removing Wildcat, South, Coleman, Soap Creek Feeder, and Lower Ripley Creek Feeder Diversion Dams and their appurtenant facilities. Heavy equipment would be used in the creek channel to remove the concrete structures, gravel, rock, and other materials from the dam footprints. Construction of the fish screens and ladders would involve blasting and dismantling the existing structures and constructing new facilities. Construction of the Inskip Powerhouse bypass facility and the tailrace connectors at South and Inskip Powerhouses would involve the use of heavy equipment. The use of heavy equipment in and near the stream channel would increase the potential for an accidental spill of petroleum products, concrete wash, and other construction-related materials into the channel.

Accidental spill of petroleum products is likely to adversely affect steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall–run Chinook salmon. In addition, accidental spill of petroleum products would adversely affect Essential Fish Habitat (EFH) for Chinook salmon.

Adverse effects will be avoided or minimized with implementation of the spill prevention and countermeasure plan included in the environmental commitments described in Chapter 2, "Project Description," and with implementation of the following mitigation measure from the Restoration Project EIS/EIR:

> **EFISH1. Avoid or Minimize Accidental Spill of Petroleum Products.**[1] Contractors will be required to develop and implement toxic materials control and spill response plans. Toxic materials control and spill response plans will regulate the use of hazardous materials, such as petroleum-based products used as fuel and lubricants for equipment, and other potentially toxic materials associated with project construction. Reclamation, in consultation with NOAA Fisheries and DFG, will implement a construction-area fish management program to emphasize the importance of protecting Chinook salmon and steelhead

[1] Mitigation Measure EFISH1 is identified as "Mitigation Measure for Impact 4.1-1" in the draft EIS/EIR (Jones & Stokes 2003a).

and their habitat. The following measures will be implemented as part of the construction-area fish management program:

- A spill prevention control and countermeasures plan will be developed in coordination with the SWQCB through the Section 401, Clean Water Act permitting process in obtaining approval for the Restoration Project.
- Soils contaminated with fuels or chemicals will be disposed of in a suitable location to prevent discharge to surface waters.
- Temporary cofferdams will be used to separate construction areas from flowing waters.
- On-site fuels and toxic materials will be placed or contained in an area protected from direct runoff.
- If hazardous materials were released, the Coleman National Fish Hatchery would be immediately notified.
- Cement and concrete delivery and transfer equipment will be washed in contained areas protected from direct runoff until the material sets.

Increased Sedimentation of North Fork and South Fork Battle Creek (Contaminants)

Increased sedimentation to North Fork and South Fork Battle Creek could cause mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species. Vegetation would be removed and the soil would be graded in order to construct staging areas and new roads and to expand existing roads in the project area. Construction and demolition activities adjacent to or in the flowing waters of Battle Creek and its tributaries would disturb soils and the streambed, potentially leading to erosion and input of fine sediment.

The input of fine sediment would increase turbidity and sedimentation of gravel substrates. Increased turbidity could adversely affect feeding efficiency of juvenile steelhead and Chinook salmon and other species dependent on sight to locate prey. Input of fine sediment to the stream could infiltrate gravel substrates and adversely affect the quality of spawning habitat for steelhead and Chinook salmon. The occurrence of fine sediment in spawning gravel in excess of 30% substantially increases the mortality of eggs and larvae of Chinook salmon and steelhead (Reiser and Bjornn 1979). Deposition of fine sediment on occupied redds would fill interstitial spaces between gravel and cobble substrates, inhibiting the flow of oxygen-rich water to the embryos and impeding the ability of larval fish to exit the redd after hatching. Infiltration of fine sediment into gravel would also adversely affect habitat for other aquatic species, such as aquatic insects, that live in gravel and that provide food for fish.

Erosion and input of fine sediment during Restoration Project construction is likely to adversely affect steelhead, spring-run Chinook salmon, winter-run

Chinook salmon, and fall/late fall–run Chinook salmon. In addition, input of fine sediment would adversely affect EFH for Chinook salmon.

Adverse effects associated with the release of fine sediment would be avoided or minimized with implementation of the SWPPP included in the environmental commitments described in Chapter 2, "Project Description," and with implementation of the following mitigation measure from the Restoration Project EIS/EIR:

> **EFISH2. Avoid or Minimize Erosion and Sedimentation.[2]**
> To avoid or minimize potential impacts related to erosion and subsequent discharge of settleable material and runoff, Reclamation and/or the construction contractor will develop an erosion and sediment control plan in coordination with the Central Valley Regional Water Quality Control Board (CVRWQCB) through the Sections 401 and 402, Clean Water Act permitting process in obtaining the storm water management approval for the Restoration Project. Reclamation and Reclamation's contractor will use this plan in developing the SWPPPs for the Restoration Project. The plan will contain the following BMPs for all areas disturbed by the Restoration Project:
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> - Monitoring of water turbidity will be conducted immediately above and 500 feet downstream of the construction site a minimum of two times each workday. If downstream turbidity levels are found to exceed a turbidity increase of 15 nephelometric turbidity units (NTUs) over background turbidity, construction activities will cease until turbidity decreases to acceptable levels.
> - During work in a flowing stream, the entire streamflow will be diverted around or under the work area by a barrier, culvert, channel, or berm constructed of clean gravel 1 to 6 inches in diameter (*clean* is defined as meeting the California Department of Transportation's cleanliness specification 85). The barrier and/or new channel will be constructed in a manner that will minimize sediment discharges and facilitate any necessary fish rescue operations and fish escape from the work area.
> - Small, temporary sediment traps will be installed as appropriate to prevent sediment from being transported away from development sites. These basins will be sized and sited to minimize any impacts on riparian areas and wetlands.
> - Temporary sediment control measures (e.g., fiber rolls or silt fences) will be located downslope of disturbed areas to prevent sediment from entering receiving waters. These measures will detain sediment-laden runoff until disturbed areas are stabilized.

[2] Mitigation Measure EFISH2 is identified as "Mitigation Measure for Impact 4.4-1" in the draft EIS/EIR (Jones & Stokes 2003a).

- Exposed soils will be sprayed with water to minimize wind erosion and dust during construction.
- The amount of vegetation removed and soil disturbed will be minimized to the extent practicable. Disturbing steep slopes will be avoided whenever feasible.
- If it is necessary to remove topsoil, the topsoil will be selectively removed, stockpiled, and replaced as a medium for revegetation (this measure should be implemented where more than 6 inches of topsoil is removed).
- Disturbed soils will be revegetated and stabilized. Reseeding, mulching, and erosion control blanket installation work will be completed by October 15 of the year following the completion of activities at each dam site. If erosion control practices are not installed by that date, exposed soils could require additional treatment following seasonal rains and subsequent erosion.
- Disturbed areas will be seeded with native plant species approved by a revegetation specialist or erosion control specialist. Special emphasis will be given to native plant assemblages that were characteristic of the site prior to construction.
- BMPs will be monitored and repairs will be made as required so that disturbed areas are adequately stabilized, as defined by the erosion and sediment control plans.

These erosion and sediment control measures will be completed in coordination with the revegetation activities needed to mitigate impacts on native vegetation, as discussed in Chapter 5 in this report. Reclamation will also implement a worker environmental education program as described in the environmental commitments listed in Chapter 2. The purpose of the environmental education program is to emphasize the importance of protecting Chinook salmon and steelhead and their habitat from construction-related impacts.

Release of Currently Stored Fine Sediment to the Stream Channel (Contaminants)

Removal of Wildcat, Coleman, and South Diversion Dams would release currently stored fine sediment to the stream channel, which could cause mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species. The volume and type of sediment stored behind the dams vary, with 30,000 yd^3 at South Diversion Dam and 28,000 yd^3 at Coleman Diversion Dam. Wildcat Diversion Dam is relatively small, and its removal would not release substantial sediment. Removal of diversion dams on Ripley and Soap Creeks would also release fine sediment, but the dams are small and would not release substantial sediment. Removal of the dams potentially increases the input of fine sediment to the stream channel. The input of fine sediment would increase

turbidity and sedimentation of gravel substrates. Increased turbidity could adversely affect feeding efficiency of juvenile steelhead and Chinook salmon, but the effect would be temporary.

Removal of diversion dams and mobilization of fine sediment are likely to adversely affect steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall–run Chinook salmon. In addition, mobilization of fine sediment would adversely affect EFH for Chinook salmon.

Adverse effects will be avoided or minimized at Coleman and South Diversion Dams with excavation of a pilot channel in the sediments behind the dams, as described under the project description for these sites presented in Chapter 2 of this report. The pilot channel would extend from the dam and upstream about 200 feet to facilitate sediment flushing and to ensure that fish passage is adequate. The pilot channel would have a bottom width of approximately 8 feet and side slopes of approximately 3:1. The bottom slope of the channel would range from 8:1 to 10:1. Material excavated for the pilot channel would be spread in the high flow channel in the vicinity of the dam.

Adverse effects of dam removal would also be minimized with implementation of the following mitigation measure from the Restoration Project EIS/EIR:

> **EFISH3. Minimize Release of Currently Stored Fine Sediment to the Stream Channel.**[3] Reclamation and/or the construction contractor will remove diversion dams during low-flow conditions (July–October) to minimize the downstream transport of fine sediment. Fine sediment would subsequently be mobilized and transported by higher flows during winter storms, minimizing deposition in gravel substrates and potential adverse effects on egg and larvae of Chinook salmon and steelhead and other aquatic organisms dependent on clean gravel. Reclamation and/or the construction contractor will also mitigate some of the potential sediment effects by constructing pilot channels to avoid fluvial erosion during the dry season and facilitate the downstream distribution of sediment from behind the dams during the high flow season.

In addition to the mitigation measure described above, a sediment monitoring plan, included as one of several focused studies in the adaptive management process, will document the response of the stream channel sediments following dam removal. The plan includes:

- channel planform and surface mapping,
- bed sediment volume and particle size surveys,
- channel elevation surveys, and
- sediment transport and model effectiveness evaluation.

[3] Mitigation Measure EFISH3 is identified as "Mitigation Measure for Impact 4.1-3" in the draft EIS/EIR (Jones & Stokes 2003a).

A more detailed description of the sediment monitoring plan is described in Section VI of the Adaptive Management Plan (Appendix C).

Disturbed Steelhead and Chinook Salmon Habitat (Key Habitat Quantity)

Construction activities could disturb steelhead and Chinook salmon habitat in the stream channel. Construction activities associated with removing the five dams would include dismantling and removing Wildcat, Coleman, Lower Ripley Creek Feeder, Soap Creek Feeder, and South Diversion Dams and their appurtenant facilities. Construction of the tailrace connectors between South Powerhouse and Inskip Canal and between Inskip Powerhouse and Coleman Canal also would include work in the stream channel. Heavy equipment would be used in the stream channel to remove the concrete structure, gravel, rock, and other materials from the dam footprint or to prepare the site for construction of facilities. To a lesser degree, construction of fish screens and fish ladders at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams would also disturb the channel bottom and bank.

The disturbance of the channel bottom and bank would alter the channel dimensions and form and the existing substrate. The affected spawning and rearing habitat area is small relative to total spawning and rearing habitat in Battle Creek. Existing channel structure and substrate at some locations do not currently provide spawning and rearing habitat. Some of the affected areas would provide spawning and rearing habitat after construction and dam removal are complete.

Construction activities in the stream channel are likely to adversely affect spawning, rearing, and migration habitat of steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall–run Chinook salmon. In addition, in-channel activities would adversely affect EFH for Chinook salmon.

Adverse effects will be avoided or minimized with construction of the pilot channel and implementation of mitigation measure EFISH3 described above and with the debris removal procedures described in Chapter 2, "Project Description." Debris will be removed to the extent that it will not affect conditions supporting upstream migration of juvenile and adult steelhead and Chinook salmon and will not adversely modify spawning (e.g., armoring) or rearing habitat. Environmental commitments include armoring spawning gravel with temporary mats or other armoring devices that will prevent spawning by Chinook salmon and steelhead, limiting activities to times of the year that are least detrimental, and implementing a fish rescue operation.

Direct effects on individual fish are discussed below under direct injury.

Dewatering Portions of the Stream Channel and Temporarily Removing Fish Ladders (Migration Habitat)

Dewatering portions of the stream channel and temporarily removing fish ladders during construction could disrupt movement and migration of fish species. Construction activities within the stream channel may include placement of cofferdams to isolate constructed elements from the streamflow and temporary removal of existing fish ladders. Depth and velocity conditions that support movement and migration of fish species may be interrupted temporarily and result in stranding. Although upstream passage of anadromous salmonids is currently blocked at Eagle Canyon and Coleman Diversion Dams, steelhead and Chinook salmon may occur upstream.

Dewatering the stream channel and temporarily removing the fish ladders are likely to adversely affect steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall–run Chinook salmon. In addition, the activities would adversely affect EFH for Chinook salmon.

Adverse effects will be avoided or minimized with implementation of environmental commitments described in Chapter 2, "Project Description." Environmental commitments include armoring spawning gravel with temporary mats or other armoring devices that will prevent spawning by Chinook salmon and steelhead, limiting activities to times of the year that are least detrimental, and implementing a fish rescue operation. An on-site fish biologist will implement the fish rescue operation in isolated pools that may harbor stranded fish. Fish will be removed from isolated pools by seining or electroshocking and released in the live channel upstream of the construction area.

Percussion-Related Energy Shock Waves, Operation of Equipment, and Becoming Trapped in Isolated Pockets of Water (Direct Injury)

Construction activities could cause injury or mortality of fish from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities. Physical injury and death of eggs, larvae, and juvenile fish could be caused by removal of the five diversion dams; construction of the Inskip Powerhouse bypass facility; construction of the tailrace connectors between South Powerhouse and Inskip Canal, and between Inskip Powerhouse and Coleman Canal; and construction of the fish screens and fish ladders at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams.

The construction of access roads, trenches, and foundations for fish facilities and demolition of water management facilities all may require blasting of the bedrock common throughout the project area. Percussion-related shock waves created during these construction and deconstruction activities could cause mortality of Chinook salmon and steelhead trout eggs incubating in the gravel. During

incubation, salmonid embryos are immobile and sensitive to percussion-related energy shock waves. Juvenile fish also may be affected.

Cofferdams would be installed to divert flow and isolate the in-channel construction area from the main streamflow. Placement of cofferdams in the stream channel could trap salmonids and other fish species. Fish that become trapped in isolated pockets of water could be killed during desiccation of the construction area and construction activities.

Field surveys in the project area have revealed that Chinook salmon and steelhead spawning and rearing habitat exists immediately below each diversion dam where construction activities are anticipated to occur. During construction of fish facilities and demolition of dams, equipment may be operated in the streambed, potentially crushing incubating eggs, larvae, and juvenile fish that may be present.

Percussion-related energy shock waves, operation of equipment, and entrapment of fish in isolated pools are likely to adversely affect steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall–run Chinook salmon. In addition, the activities would adversely affect EFH for Chinook salmon.

Adverse effects will be avoided or minimized with implementation of environmental commitments described in Chapter 2, "Project Description." Environmental commitments include armoring spawning gravel with temporary mats or other armoring devices that will prevent spawning by Chinook salmon and steelhead within the construction footprint, limiting construction activities to times of the year that are least detrimental, and implementing a fish rescue operation. An on-site fish biologist will implement the fish rescue operation in isolated pools that may harbor stranded fish. Fish will be removed from isolated pools by seining or electroshocking and released in the live channel upstream of the construction area.

Long-Term and Ongoing Effects

Long-term and ongoing effects fall into five categories: key habitat quantity; water temperature; migration habitat; entrainment in diversions; and predation, pathogens, and food.

Substantial Increase in Spawning and Rearing Habitat Area in Response to Increased Minimum Instream Flow Requirements

The Restoration Project will increase the minimum instream flow requirements in multiple reaches of Battle Creek (i.e., MOU minimum flow requirements) and is likely to have a substantial beneficial effect on steelhead and Chinook salmon

and on EFH for Chinook salmon. The increased flow will increase spawning and rearing habitat area for steelhead, spring-run Chinook salmon, winter-run Chinook salmon, and fall/late fall—run Chinook salmon (Tables 4-1 and 4-2, Figures 4-2 through 4-9). The total spawning and rearing habitat areas will be several times greater than the current area. The increased spawning and rearing habitat area would be expected to increase the abundance of steelhead and spring-, winter-, and fall/late fall–run Chinook salmon.

Total habitat area is an overestimate of actual spawning and rearing habitat available during the warm season (Tables 4-1 and 4-2, Figures 4-2 through 4-9). Water temperature conditions are too warm from June to September to support spawning in some of the downstream reaches (see the following effect, Substantial Increase in Survival during Spawning and Rearing Life Stages in Response to Cooler Water Temperatures). The relative increase in total spawning and rearing habitat area, however, reflects the expected magnitude of increase relative to baseline conditions.

Limited information is available for flow-habitat relationships on Soap, Ripley, and Baldwin Creeks. The removal of diversion dams on Soap and Ripley Creeks and the substantial increase in required minimum flow (i.e., greater than zero) would provide spawning and rearing habitat that would support additional steelhead and possibly Chinook salmon, contributing to the beneficial effects identified above. Although the contribution cannot be quantified, the increased flow would provide spawning and rearing habitat for salmonids that does not exist under baseline conditions, especially for steelhead (California Department of Fish and Game pers. comm. 1998, Kier 1999).

Soap Creek has a series of large cold springs that support a stable cold year-round flow. A self-sustaining rainbow trout population has been documented in a tributary to Soap Creek above the diversion dam (California Department of Fish and Game pers. comm. 1984). In addition to habitat upstream of the Soap Creek Feeder Diversion Dam, approximately ¾ mile of habitat would become accessible to steelhead from the confluence of Battle Creek to the existing dam.

A small spring maintains a flow of approximately 3 cfs upstream of the diversion dam on Ripley Creek. Within the upper Sacramento River basin, rainbow trout are known to use small tributaries like Ripley Creek in the wet season for rearing before the stream warms in the summer months. During the wet season, flow would provide habitat for spawning and rearing. With removal of Lower Ripley Creek Feeder Diversion Dam, more than a mile of stream would become accessible on Ripley Creek from the confluence of Battle Creek to the existing dam.

Baldwin Creek extends ¾ mile from Battle Creek to Asbury Dam. Flow released from Asbury Dam is contributed by Darrah Creek, a major cold spring–fed tributary. Flow below Asbury Dam in Baldwin Creek would provide spawning and rearing habitat for salmonids during the summer and during the wet season when spawning occurs.

Table 4-1. Calculated Spawning Area (acres) for Peak Months of Steelhead and Chinook Salmon Lifestage Occurrence For Minimum Flow Requirements

Reach of Battle Creek	Steelhead Spawning Area [a]	Spring-Run Chinook Spawning Area [b]	Winter-Run Chinook Spawning Area [c]	Late Fall–Run Chinook Spawning Area [d]
Baseline				
Keswick	0.06	–	–	–
North Battle Creek Feeder	0.01	0.04	0.04	0.04
Eagle Canyon	0.01	0.07	0.07	0.07
Wildcat	–	0.05	0.05	0.05
South	0.12	0.39	0.39	0.39
Inskip	–	0.2	0.2	0.2
Coleman	–	0.17	0.17	0.17
Main	0.27	0.55	0.55	0.55
Total	**0.47**	**1.47**	**1.47**	**1.47**
Restoration Project				
Keswick	0.06	–	–	–
NBC Feeder	0.89	0.69	0.69	0.63
Eagle Canyon	0.57	0.44	0.44	0.39
Wildcat	0.34	0.28	0.28	0.25
South	0.95	0.71	0.71	0.67
Inskip	2.08	1.62	1.62	1.47
Coleman	1.22	0.98	0.98	0.96
Main	1.36	1.96	1.96	1.67
Total	**7.47**	**6.68**	**6.68**	**6.04**

Note: If the removal of a dam under an alternative precludes the need for a minimum flow requirement, the minimum flow requirement for the adjacent upstream or downstream dam is applied.

[a] Values are for the month of February.

[b] Values are for the month of September.

[c] Values are for the month of June.

[d] Values are for the month of March.

Table 4-2. Calculated Rearing Area (acres) for Peak Months of Steelhead and Chinook Salmon Lifestage Occurrence for Minimum Flow Requirements

Reach of Battle Creek	Steelhead Rearing Area [a]	Spring-Run Chinook Rearing Area [b]	Winter-Run Chinook Rearing Area [c]	Late Fall–Run Chinook Rearing Area [d]
Baseline				
Keswick	1.92	–	–	–
North Battle Creek Feeder	1.62	0.62	0.62	0.62
Eagle Canyon	1.02	0.41	0.41	0.41
Wildcat	0.9	0.36	0.36	0.36
South	4.26	2.17	2.17	2.17
Inskip	2.3	0.53	0.53	0.53
Coleman	0.11	0.37	0.37	0.37
Main	13.18	4.39	4.39	4.39
Total	**25.31**	**8.85**	**8.85**	**8.85**
Restoration Project				
Keswick	1.92	–	–	–
NBC Feeder	6.06	4.14	4.68	4.68
Eagle Canyon	2.93	2.42	2.42	2.42
Wildcat	2.62	2.23	2.23	2.23
South	6.82	4.38	4.75	4.75
Inskip	7.37	5.72	5.85	5.85
Coleman	3.53	2.74	2.73	2.73
Main	12.3	16.15	17.14	17.14
Total	**43.55**	**37.78**	**39.8**	**39.8**

Note: If the removal of a dam under an alternative precludes the need for a minimum flow requirement, the minimum flow requirement for the adjacent upstream or downstream dam is applied.

[a] Values are for the month of July.

[b] Values are for the month of February.

[c] Values are for the month of October.

[d] Values are for the month of July.

Reestablishing higher streamflow under the Restoration Project benefits other species, including resident fish, aquatic invertebrates, amphibians, and stream-dependent wildlife. Greater stream area potentially provides greater habitat area for other fish and other aquatic species.

In addition to an increase in habitat area, the MOU minimum flow requirements have sufficient funding to support future adaptive management implementation of flow targets that incorporate new information and more efficiently use available flow relative to fish habitat needs.

Substantial Increase in Survival during Spawning and Rearing Life Stages in Response to Cooler Water Temperatures

As indicated previously, the minimum instream flow requirements and release of presently diverted spring water are increased over present FERC requirements (i.e., MOU minimum flow requirements) in the reaches downstream of the North Battle Creek Feeder Diversion Dam on North Fork Battle Creek and downstream of the South Diversion Dam on South Fork Battle Creek. The higher flows and cold spring waters will substantially cool water temperature at most locations, especially during the warmer months (Figures 4-10 through 4-20) and Appendix H) and are likely to have a substantial beneficial effect on steelhead and Chinook salmon and on EFH for Chinook salmon.

Potential beneficial effects provided by cooler water temperatures in each reach from June through September are estimated using the SNTEMP model described in the EIS/EIR and used by the BCWG Biological Team (Figures 4-15 through 4-20) and Appendix H). A general indication of the magnitude of beneficial water temperature effects over all months of the year is presented using the Warming Model for unspecified runoff and climate conditions described in the EIS/EIR (Figures 4-10 through 4-14). Both approaches illustrate that during summer months higher flows associated with the Restoration Project substantially increase the extent of usable spawning and rearing habitat.

There are two short segments in South Fork Battle Creek where baseline conditions provide cooler summertime temperatures than that of the Restoration Project. This condition occurs when Inskip and South Powerhouses inject cooler North Fork water into South Fork Battle Creek. However, the powerhouses do not reliably inject cooler water under baseline conditions; canal and turbine outages occur at unpredictable times, producing substantial temperature fluctuations that reduce habitat value compared to the stabilized conditions under the Restoration Project.

Exceptions that occur in short stream segments immediately below Inskip Diversion Dam and Coleman Diversion Dam are displayed as point estimates in July (Figure 4-10) and as temperatures change over distance by examining the Coleman and Inskip reach in June (Figure 4-14), August (Figure 4-17), and September (Figure 4-16).

During the summer months, Inskip Powerhouse discharges North Fork Battle Creek water under the baseline conditions. This discharge can result in an 8°F cooling of the water temperature immediately upstream of the Coleman Diversion Dam and downstream into the Coleman Reach. Inversely, when an outage is needed to repair the turbine or canal, the cool water shuts off at the intake, causing the temperature below the powerhouse to suddenly warm 8°F. The warming will affect several miles of stream downstream of the discharge points.

Under the Restoration Project, the cooler powerhouse flow will bypass South Fork Battle Creek via connectors, which can result in temperatures as much as 8°F warmer in the 1-mile stream segment below Coleman Dam (cooled under baseline conditions). Although the Restoration Project will not provide the cooler discharges noted as part of the baseline conditions, it will not result in a significant reduction of habitat because it will stabilize the overall temperature regime by eliminating fluctuations associated with outages. The downstream segment of the Coleman reach is cooler under the Restoration Project because of the higher minimum flows compared to baseline conditions (see the longitudinal profiles for the Coleman and Inskip reaches in Appendix H and Figures 4-15 through 4-17).

Under baseline conditions, South Powerhouse discharges cool water from Upper South and North Fork Battle Creek during the summer months, resulting in a 6°F cooling of the water temperature immediately downstream of the powerhouse to Inskip Diversion Dam and into the upstream segment of the Inskip Reach. Inversely, when an outage is needed to repair the turbine or canal, the cool water shuts off at the intake causing the temperature below the powerhouse to suddenly warm 6°F.

Under the Restoration Project, the cooler powerhouse flow will bypass South Fork Battle Creek via connectors, resulting in temperatures as much as 4°F warmer in the 1-mile stream segment below Inskip Diversion Dam. The Restoration Project will not result in a significant reduction of habitat because it will stabilize the overall temperature regime by eliminating fluctuations associated with outages. Water temperatures are cooler in the downstream segment of the Inskip Reach under the Restoration Project because of the higher minimum flows. Overall, the Restoration Project creates a temperature regime in which temperature warms as the stream drops in elevation, providing the salmon with the environmental cue to continue their upstream migration to the reaches that have the most reliable cold water environment in the South Fork (see the longitudinal profiles for the Inskip and South Fork Battle Creek reaches in Appendix H and Figures 4-15 through 4-17).

The extension of cooler water temperatures into downstream reaches under the higher instream flow requirements for the Restoration Project occurs during warmer months (Figures 4-13 through 4-20 and Appendix H). Cooler temperatures are especially apparent in North Fork Battle Creek and South Fork above Inskip Dam (Figure 4-13 and Appendix H). Cooler water temperature under higher instream flow and the addition of cold water to the North and South

Forks from the Eagle Canyon Spring and Bluff Spring Complexes substantially increases habitat suitable for survival of all Chinook salmon and steelhead temperature sensitive life stages during June through September (Figures 4-15 through 4-20 and Appendix H). Water temperatures during October through May are cool and generally have minimal effect on survival.

The comparative analyses of the biological consequences displayed in Figures 4-15 through 4-20 compare the estimated survival rates as predicted by SNTEMP for the months of June though September. This analysis focuses on stream reaches that are functional for various life stages of the priority species during vulnerable times. This approach, described in Chapter 3, is similar to that developed by the BCWG Technical Team (Kier 1999). In addition to survival estimates during the warm season, point estimates are provided at the start and terminus of the reach for the entire year (Tables 4-3 through 4-6). This year round analysis approach applied in the EIS/EIR predicts temperatures using the "warming model" (Appendix M of the EIS/EIR) and determines survival assumptions that in some cases are much more conservative than what is routinely applied to Sacramento River populations (U.S. Fish and Wildlife Service 1990, Kier 1999, and Bureau of Reclamation 1991). It should be noted that there are significant differences in the results of the two comparative analysis methods that predict water temperature and characterize survival rates (e.g., there is a 50% difference in survival rates in one case). The Adaptive Management Plan for the Restoration Project (Appendix C) recognizes the uncertainty associated with prediction of water temperature regimes and survival rates for different life stages under various environmental conditions. The Adaptive Management Plan includes measures to improve modeling efforts during the postproject period, ways to apply those improvements to real time temperature management in the project area, and measures to provide necessary improvements though the Water Acquisition Fund.

The SNTEMP model examined the expected survival for critical salmonid life stages, including spring-run and winter-run Chinook salmon embryos, steelhead and spring-run Chinook salmon smolts, juvenile Chinook salmon, and prespawning adult spring-run Chinook salmon (Figures 4-15 through 4-20).

Winter-run Chinook salmon embryo survival rates (Figure 4-15) at locations where the estimated survival rates exceed 50%, reveal that the Restoration Project substantially improves temperature conditions over baseline conditions in the South Diversion reach, but not in the North Battle Creek Feeder or Eagle Canyon reach. Winter-run Chinook salmon embryo survival rates throughout the year as listed in Table 4-3 generally indicate the Restoration Project improves conditions in the Eagle Canyon reach but not elsewhere compared to baseline conditions.

The portions of the project area shown in the longitudinal profile for September where survival of spring-run Chinook salmon embryos exceed 50% (Figure 4-16) show that the Restoration Project substantially improves temperature conditions. The Restoration Project provides cooler, more stable habitat in the reaches below South Diversion, Eagle Canyon, and Wildcat Diversion Dams, and a portion of

the reach below Inskip Dam, but not below North Battle Creek Feeder, compared to baseline conditions. In addition, the Restoration Project provides substantial improvements over baseline conditions in the reaches with estimated survival rates above 90%, including Eagle Canyon and South Diversion reaches.

Prior to spring-run Chinook salmon spawning activity in the late summer and fall, the adults and unfertilized ova can be vulnerable to adverse affects of elevated temperatures (Kier 1999). The August longitudinal temperature regime displayed in Figure 4-17 shows that the Restoration Project provides substantially more habitat in the temperature range preferred for adult holding in both the Eagle Canyon and the South Diversion reaches. The Restoration Project also improves adult holding areas in the Wildcat and Inskip reaches. For the Restoration Project, the temperature range is categorized as stressful compared to an unsuitable classification under baseline conditions.

For steelhead, spawning begins in December and ends in April, with incubation extending through May (Table 4-4 in this report and Table 4.1-1 in the EIS/EIR). Spawning is supported under baseline conditions and with implementation of the Restoration Project. Cool temperatures, however, extend farther downstream and through May under the Restoration Project. The cooler water temperatures in April and May generally indicate higher embryo survival in the forks and in the mainstem of Battle Creek.

Juvenile spring-run Chinook salmon benefit from cooler water temperatures that would support rearing through June (Figure 4-18 and Table 4-5) with substantial improvement tending near the preferred temperature range in the South Diversion reach (Figure 4-18). Spring-run smolts outmigrate through June (Brown 2004 pers. comm.), and the Restoration Project results in substantial cooling to optimum temperatures in the reaches below South Diversion and Wildcat Diversion Dams. The Restoration Project also cools the temperatures considered unsuitable for the Inskip, Coleman, and mainstem reaches under baseline conditions (Figure 4-19).

Juvenile winter-run Chinook salmon benefit from the cooler temperatures that extend to the lower elevation reaches during juvenile emigration periods under the Restoration Project. The emigration of winter-run Chinook salmon juveniles from the spawning areas is highly dependent on streamflow conditions and water year type. Emigration past Red Bluff Diversion Dam generally peaks in September (National Marine Fisheries Service 1997). During September of normal years, the Restoration Project temperature is 65°F or less, which is more than 10°F less than the temperature resulting in lethal response during a short exposure (Appendix H). Substantial improvements in the temperature regime in September are provided under the Restoration Project in the Inskip, Coleman, Wildcat, and mainstem reaches (Appendix H and Table 4-5).

For steelhead, juvenile rearing occurs year-round (Table 4-6). The last smolts of the emigration period are present in June (Brown 2004 pers. comm.) when the lower elevation reaches of the project area become unsuitable for smolts (Figure 4-20). The Restoration Project temperatures in June are marginally suitable for

Table 4-3. Estimated Survival of Chinook Salmon Eggs in Response to Water Temperature during Incubation at Various Locations in Battle Creek under Baseline Conditions and the Restoration Project

Potential Occurrence of Spawning and Incubation for Spring-, Winter-, Fall-, and Late Fall–Run Chinook Salmon

Location	Estimated Incubation Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
North Battle Creek Feeder Diversion Dam												
Baseline	100%	100%	100%	100%	99%	96%	87%	96%	99%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	99%	96%	87%	96%	99%	100%	100%	100%
Eagle Canyon Diversion Dam												
Baseline	100%	100%	100%	100%	81%	49%	0%	24%	67%	98%	100%	100%
Restoration Project	100%	100%	100%	100%	97%	90%	72%	88%	96%	100%	100%	100%
Wildcat Diversion Dam												
Baseline	100%	100%	100%	79%	0%	0%	0%	0%	0%	25%	97%	100%
Restoration Project	100%	100%	100%	100%	87%	66%	15%	52%	79%	99%	100%	100%
Mouth of North Fork Battle Creek												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	54%	100%
Restoration Project	100%	100%	100%	99%	63%	5%	0%	0%	33%	91%	100%	100%
South Diversion Dam												
Baseline	100%	100%	100%	100%	99%	52%	0%	0%	52%	99%	100%	100%
Restoration Project	100%	100%	100%	100%	99%	52%	0%	0%	52%	99%	100%	100%
South Powerhouse												
Baseline	100%	100%	100%	100%	79%	0%	0%	0%	0%	79%	100%	100%
Restoration Project	100%	100%	100%	100%	96%	21%	0%	0%	21%	96%	100%	100%

Table 4-3. Continued

	Potential Occurrence of Spawning and Incubation for Spring-, Winter-, Fall-, and Late Fall–Run Chinook Salmon
Spring-Run	
Winter-Run	
Fall-Run	
Late Fall–Run	

Location	Estimated Incubation Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Inskip Diversion Dam												
Baseline	100%	100%	100%	100%	96%	78%	27%	53%	81%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	96%	21%	0%	0%	21%	96%	100%	100%
Inskip Powerhouse												
Baseline	100%	100%	100%	59%	0%	0%	0%	0%	0%	0%	81%	100%
Restoration Project	100%	100%	100%	100%	57%	0%	0%	0%	0%	57%	100%	100%
Coleman Diversion Dam												
Baseline	100%	100%	100%	100%	75%	0%	0%	0%	60%	97%	100%	100%
Restoration Project	100%	100%	100%	100%	57%	0%	0%	0%	0%	57%	100%	100%
Mouth of South Fork Battle Creek												
Baseline	100%	100%	100%	77%	0%	0%	0%	0%	0%	0%	96%	100%
Restoration Project	100%	100%	100%	100%	18%	0%	0%	0%	0%	0%	100%	100%
Below the Confluence of North and South Fork Battle Creek												
Baseline	100%	100%	100%	53%	0%	0%	0%	0%	0%	0%	87%	100%
Restoration Project	100%	100%	100%	100%	33%	0%	0%	0%	0%	56%	100%	100%
Battle Creek at Coleman Powerhouse												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Restoration Project	100%	100%	100%	98%	0%	0%	0%	0%	0%	0%	96%	100%

Table 4-4. Estimated Survival of Steelhead Eggs in Response to Water Temperature during Incubation at Various Locations in Battle Creek under Baseline Conditions and the Restoration Project

	Potential Occurrence of Spawning and Incubation for Steelhead											
Steelhead Occurrence												
Location	Estimated Incubation Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Battle Creek Feeder Diversion Dam												
Baseline	100%	100%	100%	100%	91%	80%	51%	80%	91%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	91%	80%	51%	80%	91%	100%	100%	100%
Eagle Canyon Diversion Dam												
Baseline	100%	100%	100%	95%	33%	0%	0%	0%	0%	85%	100%	100%
Restoration Project	100%	100%	100%	100%	83%	62%	8%	55%	80%	100%	100%	100%
Wildcat Diversion Dam												
Baseline	100%	100%	100%	28%	0%	0%	0%	0%	0%	0%	83%	100%
Restoration Project	100%	100%	100%	98%	53%	0%	0%	0%	30%	92%	100%	100%
Mouth of North Fork Battle Creek												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Restoration Project	100%	100%	100%	91%	0%	0%	0%	0%	0%	65%	100%	100%
South Diversion Dam												
Baseline	100%	100%	100%	100%	91%	0%	0%	0%	0%	91%	100%	100%
Restoration Project	100%	100%	100%	100%	91%	0%	0%	0%	0%	91%	100%	100%
South Powerhouse												
Baseline	100%	100%	100%	100%	30%	0%	0%	0%	0%	30%	100%	100%
Restoration Project	100%	100%	100%	100%	81%	0%	0%	0%	0%	81%	100%	100%
Inskip Diversion Dam												
Baseline	100%	100%	100%	100%	81%	25%	0%	0%	33%	94%	100%	100%
Restoration Project	100%	100%	100%	100%	81%	0%	0%	0%	0%	81%	100%	100%

Table 4-4. Continued

	Potential Occurrence of Spawning and Incubation for Steelhead											
Steelhead Occurrence												
Location	Estimated Incubation Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inskip Powerhouse												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	34%	100%
Restoration Project	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	100%	100%
Coleman Diversion Dam												
Baseline	100%	100%	100%	97%	15%	0%	0%	0%	0%	84%	100%	100%
Restoration Project	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	100%	100%
Mouth of South Fork Battle Creek												
Baseline	100%	100%	100%	21%	0%	0%	0%	0%	0%	0%	81%	100%
Restoration Project	100%	100%	100%	99%	0%	0%	0%	0%	0%	0%	93%	100%
Below the Confluence of North and South Fork Battle Creek												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	52%	100%
Restoration Project	100%	100%	100%	97%	0%	0%	0%	0%	0%	0%	98%	100%
Battle Creek at Coleman Powerhouse												
Baseline	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Restoration Project	100%	100%	100%	86%	0%	0%	0%	0%	0%	0%	81%	100%

Table 4-5. Estimated Survival of Juvenile Chinook Salmon in Response to Water Temperature during Rearing at Various Locations in Battle Creek under Baseline Conditions and the Restoration Project

Potential Occurrence of Juvenile Spring-, Winter-, Fall-, and Late Fall–Run Chinook salmon

Location	Estimated Juvenile Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Battle Creek Feeder Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Eagle Canyon Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Wildcat Diversion Dam												
Baseline	100%	100%	100%	100%	100%	90%	28%	58%	95%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Mouth of North Fork Battle Creek												
Baseline	100%	100%	100%	100%	66%	0%	0%	0%	0%	91%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
South Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
South Powerhouse												
Baseline	100%	100%	100%	100%	100%	100%	88%	88%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 4-5. Continued

	Potential Occurrence of Juvenile Spring-, Winter-, Fall-, and Late Fall–Run Chinook salmon
Spring-Run	
Winter-Run	
Fall-Run	
Late Fall–Run	

Location	Estimated Juvenile Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inskip Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inskip Powerhouse												
Baseline	100%	100%	100%	100%	95%	9%	0%	0%	16%	99%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	96%	58%	58%	96%	100%	100%	100%
Coleman Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	96%	58%	58%	96%	100%	100%	100%
Mouth of South Fork Battle Creek												
Baseline	100%	100%	100%	100%	99%	55%	0%	5%	85%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	74%	0%	0%	72%	100%	100%	100%
Below the Confluence of North and South Fork Battle Creek												
Baseline	100%	100%	100%	100%	94%	12%	0%	0%	54%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	97%	68%	77%	98%	100%	100%	100%
Battle Creek at Coleman Powerhouse												
Baseline	100%	100%	100%	98%	0%	0%	0%	0%	0%	0%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	62%	0%	0%	68%	100%	100%	100%

Table 4-6. Estimated Survival of Juvenile Steelhead in Response to Water Temperature during Rearing at Various Locations in Battle Creek under the Baseline Conditions and the Restoration Project

	Potential Occurrence of Juvenile Steelhead											
Steelhead												
Location	Estimated Juvenile Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Battle Creek Feeder Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Eagle Canyon Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Wildcat Diversion Dam												
Baseline	100%	100%	100%	100%	100%	96%	62%	79%	99%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Mouth of North Fork Battle Creek												
Baseline	100%	100%	100%	100%	84%	0%	0%	0%	4%	97%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
South Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
South Powerhouse												
Baseline	100%	100%	100%	100%	100%	100%	95%	95%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inskip Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 4-6. Continued

	Potential Occurrence of Juvenile Steelhead											
Steelhead												
Location	Estimated Juvenile Survival by Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inskip Powerhouse												
Baseline	100%	100%	100%	100%	99%	50%	0%	0%	54%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	99%	79%	79%	99%	100%	100%	100%
Coleman Diversion Dam												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	99%	79%	79%	99%	100%	100%	100%
Mouth of South Fork Battle Creek												
Baseline	100%	100%	100%	100%	100%	77%	16%	48%	94%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	88%	2%	2%	87%	100%	100%	100%
Below the Confluence of North and South Fork Battle Creek												
Baseline	100%	100%	100%	100%	98%	52%	0%	0%	77%	100%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	100%	85%	90%	100%	100%	100%	100%
Battle Creek at Coleman Powerhouse												
Baseline	100%	100%	100%	100%	0%	0%	0%	0%	0%	44%	100%	100%
Restoration Project	100%	100%	100%	100%	100%	81%	0%	14%	85%	100%	100%	100%

maintaining smolts in good condition in the North Battle Creek Feeder and South Diversion reaches, representing a substantial improvement over baseline conditions in the South Diversion reach (Figure 4-20). There is a general indication that steelhead juveniles residing in the summer benefit from the Restoration Projects cooler temperatures in the lowest elevation reaches, except for the terminus of the South Forks and terminus of the mainstem (Table 4-6).

Additional water temperature benefits related to coldwater refugia are not fully captured by the simulated water temperature analysis. The importance of coldwater refugia for the overall performance of the project is recognized in the Adaptive Management Plan (Appendix C). Under baseline conditions, cool springs are diverted into canals that convey flow from Eagle Canyon Diversion Dam and Soap Creek Feeder Diversion Dam. At Eagle Canyon Diversion Dam, the spring flow is approximately 12 cfs, and the temperature of the spring flow is near 52°F year-round. Under the Restoration Project, the spring flow would discharge to North Fork Battle Creek and would cool streamflow during the warmer months (Figure 4-21). The cooling would provide temperatures more conducive to support of spawning and rearing, especially benefiting winter- and spring-run Chinook salmon and steelhead.

Soap Creek inflow to South Fork Battle Creek would also increase under the Restoration Project. Flow in Soap Creek originates from Bluff Springs and would contribute cool water to South Fork Battle Creek. Under baseline conditions, flow in Soap Creek is diverted and does not contribute to cooling of South Fork Battle Creek. The approximate effect of Soap Creek flow, based on 15 cfs at a minimum water temperature of 52°F to 54°F, is shown in Figure 4-22. Coldwater refugia can develop in the bottom of pools provided that stratification is allowed to occur through flow management. Development of coldwater refugia will be substantially beneficial, providing temperatures more conducive to support of adult holding, spawning, smolting, and rearing, especially benefiting early spawning winter- and spring-run Chinook salmon and steelhead.

Stream reaches receiving cool spring flow are expected to provide cool water refugia that will better support spawning and rearing of Chinook salmon and steelhead, benefits not fully reflected by the simulated water temperature. The longitudinal temperature profiles for the driest months (Appendix H) show regions with potential to develop coldwater refugia (outside of the powerhouse cooling zones). Specifically there are inputs visible in the profiles at the following reaches at the indicated mileage upstream of Coleman Powerhouse: (1) mainstem at 8.5 miles, (2) Inskip at 13 miles, (3) South Diversion at 21 miles, and (4) Eagle Canyon at 14.5 miles. The minimum flow requirements under the Restoration Project support future adaptive management of water temperature to realize benefits from spring-flow refugia to meet the adult holding, rearing, and spawning life stage needs of Chinook salmon and steelhead.

Fall/late fall–run Chinook salmon survival is less affected by water temperature than the other Chinook salmon runs because spawning occurs in the winter. Winter- and spring-run Chinook salmon and steelhead juveniles and smolts would receive the most temperature benefits from increased flows and cool water

accretions because embryos and smolts generally occur during warmer months. Fall/late fall–run juveniles would benefit from cooler water temperatures through the summer (Table 4-5).

Higher Instream Flows (Migration Habitat)

Higher instream flows would improve conditions that facilitate passage over natural barriers and are likely to benefit steelhead and winter-, spring-, and fall/late fall–run Chinook salmon and improve EFH for Chinook salmon. The Restoration Project would increase the minimum flows (MOU minimum flow requirements) in multiple reaches of Battle Creek relative to baseline conditions (FERC minimum flow requirements). The Restoration Project does not elevate the flow to levels that can impair passage over natural obstacles. In addition, the MOU minimum flow requirements support future adaptive management of passage conditions that may incorporate new information on flow-passage relationships.

The maintenance of MOU flows would improve passage conditions compared to present FERC requirements, substantially increasing unimpeded access to upstream spawning habitat (Table 4-7). Although the precise benefit of higher flows may not be illustrated by the required minimum flow, survival of adult Chinook salmon and steelhead would increase because of reduced potential for injury and exhaustion related to multiple attempts at passing partial barriers during minimum flow conditions. Improved passage would also facilitate distribution of adults to available upstream spawning habitat that could increase survival of eggs and production of fry. The Biological Committee of the BCWG adjusted MOU flows through application of the Integrated Instream Flow Methodology, where necessary, to meet the lowest flow expected to provide passage over natural barriers.

Removal of Five Dams and Construction of More-Reliable, Effective Fish Ladders (Migration Habitat)

The removal of five dams and the construction of more-reliable, effective fish ladders would facilitate passage and are likely to benefit steelhead and winter, spring, and fall/late fall–run Chinook salmon and improve EFH for Chinook salmon. Removal of Wildcat, Coleman, Soap Creek Feeder, Lower Ripley Creek Feeder, and South Diversion Dams under the Restoration Project and construction of improved fish ladders on North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams would provide significantly greater upstream passage efficiency relative to passage conditions provided by existing ladders. The removal of dams and construction of new ladders would substantially increase unimpeded access to upstream spawning habitat. Survival of adult Chinook salmon and steelhead would increase because of reduced potential for injury, delay, and exhaustion related to multiple attempts at passing the dams without effective fish ladders meeting current design standards. Improved passage would also facilitate distribution of adults to available

Table 4-7. Potential Steelhead and Chinook Salmon Passage over Natural Barriers in Battle Creek for Minimum Required Instream Flows[1] under Baseline Conditions and the Restoration Project

Stream Reach	Barrier Location[2] (river mile)	Minimum Passage Flow[3] (cfs)	Potential Passage by Species for Each Alternative	
			Baseline	Restoration Project
North Fork Battle Creek				
Keswick	11.48	All flows	None[4,5]	None[4,5]
	11.46	90*	None[5]	None[5]
	11.45	90*	None[5]	None[5]
	11.31	90*	None[5]	None[5]
	11.10	7	None[5]	None[5]
	10.79	7	None[5]	None[5]
	10.78	20	None[5]	None[5]
	10.72	90*	None[5]	None[5]
	9.92	90*	None[5]	None[5]
North Battle Feeder	6.96	30*	None[5]	Steelhead, spring- and winter-run Chinook salmon (all months)
	6.02	30*	None[5]	
	5.40	35	None[5]	
Eagle Canyon	4.50	30*	None[5]	
Wildcat	2.36	20	None[5]	
	2.16	20	None[5]	
South Fork Battle Creek				
South	11.68	50	None[5]	Steelhead, spring- and winter-run Chinook salmon (all months)
Inskip	3.81	30*	None[5]	
	3.61	40	None[5]	
	3.40	<5	None[4,5]	
	3.15	20	None[5]	

* The exact flow need is unknown and could be lower or higher than indicated.

1 The minimum required instream flows are discussed in Appendix J.

2 Location is the distance upstream from the confluence of the North and South Forks of Battle Creek

3 Minimum passage flow is from the analysis by Thomas R. Payne and Associates (1998)

4 Although Chinook salmon or steelhead could pass this barrier, downstream barriers prevent access.

5 The conclusion does not consider that high flows of short duration in response to storms would occur and provide passage during wetter months and years.

upstream spawning habitat, which could increase survival of eggs and production of smolts.

The removal of dams and construction of more effective fish ladders under the Restoration Project would improve passage conditions for adult Chinook salmon and steelhead. The proposed ladder capacity would be at least 10 times the capacity of existing ladders (Table 4-8). The ladders would be designed to convey 10% of the streamflow at average spill conditions for each diversion dam and facilitate undelayed adult passage under all but extreme high-flow conditions (1-in-10-year recurrence when conditions allow fish movement [Department of Water Resources 2000]). Where necessary, additional flow would be directed to facilitate attraction of adult salmonids into the ladder, minimizing delay associated with flow spilling over the dam. Delays of less than 3 days are not considered harmful to migrating salmon (Katopodis 1992). The new fish ladders would be designed to automatically clear debris and include safe maintenance access under all streamflow conditions. Detailed monitoring and operation and maintenance plans for the proposed ladders under the Restoration Project are included in the draft Facility Monitoring Plan (Appendix B).

Separation of the Powerhouse Water Discharge from the Natural Stream Channel (Migration and Habitat Stability)

Ceasing the discharge of North Fork Battle Creek water to South Fork Battle Creek would guard against the potential for false attraction to South Fork Battle Creek that exists under baseline conditions. This could potentially increase spawning success and fry production because it would facilitate the return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek and stabilize the temperature regime in the South Fork. The species response to false attraction is uncertain because adult Chinook salmon and steelhead may be able to distinguish the correct pathway. False attraction of winter-run Chinook salmon to the South Fork may have been indicated by observation of spawning below Coleman Diversion Dam (California Department of Fish and Game 1996). Winter-run Chinook salmon eggs would not survive the warm summer water temperatures in this reach. Water temperature is warmer in South Fork Battle Creek, and optimal spawning and rearing habitat is less available for Chinook salmon and steelhead than in North Fork Battle Creek, especially during extremely dry years (PG&E 2001). False attraction could result in lower overall production for the Battle Creek watershed. Removing two powerhouse tailraces from the migratory corridor eliminates false attraction to the actual powerhouse tailrace where adults face potential injury from the Francis turbine and waste energy swimming against large powerhouse discharge that would distract them from their migration. Additional benefits include eliminating the need to rescreen hundreds of cubic feet per second of water discharged from the powerhouse system, which are diverted a short way downstream.

With cessation of the discharge of North Fork Battle Creek water into the South Fork Battle Creek at Inskip and Coleman Diversion Dams, the gradient of warm

to cool water temperatures from downstream to upstream would be restored. The restoration of the gradient may help ensure movement of adult winter- and spring-run Chinook salmon to cool reaches upstream of South Diversion Dam. Flow and water temperature fluctuations that may occur during powerhouse outages would be minimized, and warming of Inskip and Coleman reaches during the outages would no longer occur. Successful adult holding and egg survival may be more consistently supported upstream of South Diversion Dam.

Under the Restoration Project, tailrace connectors would be constructed between South Powerhouse and Inskip Canal and between Inskip Powerhouse and Coleman Canal. Water delivered to South and Inskip Powerhouses originates from three locations in the North Fork Battle Creek watershed (i.e., Volta 2 Powerhouse, North Battle Creek Feeder Diversion Dam, and Eagle Canyon Diversion Dam). Flow diverted from these sources would no longer be discharged into South Fork Battle Creek at South and Inskip Powerhouses. The absence of significant North Fork Battle Creek water in South Fork Battle Creek would facilitate return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek.

Under baseline conditions, powerhouse outages result in canal flow spilling down natural pathways to enter South Fork Battle Creek near the existing powerhouses or gates at the head of the canal if workers need to enter water conveyance facilities associated with the powerhouse. Outages in canals result in release of power system waters to adjacent stream reaches. The outage and subsequent canal spill cause short-term fluctuations of flow to short segments of stream channel between the powerhouses and the canal intakes.

Under the Restoration Project, tailrace connectors constructed between South Powerhouse and Inskip Canal and between Inskip Powerhouse and Coleman Canal and the Inskip bypass facility (designed to return bypass flow to the Coleman Canal) would minimize flow and water temperature fluctuations that may occur during outages. The connectors and the bypass facility would provide benefits during outages. The level of benefit would depend on the extent of stream affected by the outages and the frequency and duration of the outages. Historical outages have varied in frequency and duration (Table 4-9). The connectors would reduce the influence of outages on fish habitat in the South Fork.

Based on the discussion above, separation of the powerhouse discharge from the natural stream channel of South Fork Battle Creek is likely to benefit steelhead and Chinook salmon. However, continued variation in flows attributable to powerhouse outages is likely to adversely affect steelhead and winter- and spring-run Chinook salmon and EFH for all Chinook salmon runs. Adverse effects may include stranding of individual fish. Ramping rates will be implemented to minimize the adverse effect. High flows after outages as the power plants and canals come back on line would gradually be reduced (Chapter 2, “Project Description”). In addition, the MOU specifies that planned outages will occur during the wet season when spill conditions will maintain full channel flows after the outage, making the need for ramping operations is less likely. The

Table 4-8. Effective Flows at Fish Ladders for the Restoration Project

Name of Dam	Effective Flow Range for the Restoration Project (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).

[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).

Table 4-9. Number of Days of Powerhouse Outages on Battle Creek, 1983–2001

	Year											
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1983 South	-	-	-	-	3	-	-	-	-	-	-	-
Inskip	-	-	-	-	-	3	-	-	-	-	-	-
Coleman	-	-	-	-	-	-	-	-	-	-	5	-
1984 South	-	-	-	-	-	-	-	-	-	13	-	-
Inskip	-	-	-	-	-	-	-	-	-	-	-	12
Coleman	-	-	-	-	-	-	-	-	-	-	7	-
1985 South	1	4	-	-	-	-	-	-	7	6	-	-
Inskip	-	-	-	-	-	-	-	-	-	-	17	-
Coleman	-	-	-	-	-	-	-	-	-	7	-	-
1986 South	-	-	-	-	-	-	-	-	-	9	-	-
Inskip	-	-	-	-	-	-	-	-	-	11	13	-
Coleman	-	-	-	2	9	-	-	-	-	-	-	-
1987 South	-	-	-	-	-	-	-	-	-	15	-	-
Inskip	-	-	-	-	-	-	-	21	23	-	-	-
Coleman	-	-	-	-	3	-	-	-	-	-	-	-
1988 South	-	-	-	-	-	-	-	-	-	3	-	-
Inskip	-	-	-	-	-	-	-	-	-	20	21	-
Coleman	-	-	-	-	-	-	-	-	9	-	-	-
1989 South	-	-	-	-	-	-	-	-	-	4	-	-
Inskip	-	-	-	-	-	-	-	-	-	7	-	-
Coleman	-	-	-	-	-	-	-	-	23	-	-	-
1990 South	-	-	-	-	-	-	-	-	-	8	-	-
Inskip	-	-	-	-	-	-	-	-	6	10	-	-
Coleman	-	-	-	-	-	1	-	3	7	-	-	-
1991 South	-	-	-	-	-	-	-	-	-	6	-	-
Inskip	-	-	-	-	-	-	-	2	-	-	-	-
Coleman	-	-	-	-	-	-	-	-	11	-	-	-
1992 South	-	-	-	-	-	-	-	-	-	9	-	-
Inskip	-	-	-	-	-	-	-	-	-	7	-	-
Coleman	-	-	-	-	-	-	-	14	28	-	-	-
1993 South	-	-	-	-	-	-	-	-	-	2	-	-
Inskip	-	-	-	-	-	-	-	1	2	-	-	-
Coleman	6	1	-	-	-	-	-	-	2	-	-	-

Table 4-9. Continued

Site	Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994 South	-	-	-	-	-	-	-	-	-	1	-	-
Inskip	-	-	-	-	-	-	-	-	8	-	-	-
Coleman	-	-	-	-	-	-	-	1	-	-	-	-
1995 South	-	-	-	-	-	-	-	-	-	1	-	-
Inskip	-	-	-	-	-	-	-	-	-	2	-	-
Coleman	-	-	-	-	14	-	-	-	1	-	-	4
1996 South	-	-	-	-	-	-	-	-	1	-	-	-
Inskip	-	-	-	-	-	-	-	2	-	-	-	-
Coleman	-	-	-	-	-	-	-	3	1	-	-	-
1997 South	-	-	1	-	-	-	-	-	2	-	-	-
Inskip	28	24	-	-	-	-	-	-	-	-	-	-
Coleman	1	-	-	-	-	-	-	6	30	3	-	-
1998 South	-	-	22	8	-	-	-	-	-	-	-	-
Inskip	-	-	-	1	-	-	-	-	-	-	-	-
Coleman	-	-	-	-	-	9	-	-	-	-	7	6
1999 South	0	0	2	-	-	-	-	-	-	-	-	-
Inskip	-	-	3	-	-	-	-	-	-	-	-	-
Coleman	-	-	-	2	-	-	-	-	-	-	-	-
2000 South	-	-	-	2	-	-	-	-	-	-	-	-
Inskip	-	-	3	-	-	-	-	-	-	-	-	-
Coleman	-	-	20	-	-	9	-	-	-	-	-	-
2001 South	-	-	1	-	-	-	-	-	-	-	-	-
Inskip	-	-	1	-	-	-	-	-	-	-	-	-
Coleman	-	-	1	-	30	30	9	-	-	-	-	-

ramping rates are designed to minimize stranding losses as flows are returned to normal following outages. In addition, planned maintenance would be scheduled during the period of February 1 through April 30, as specified in the MOU and Adaptive Management Plan, to guard against stranding and false attraction. The construction of connectors and the bypass, and subsequent minimization (through ramping rates) and avoidance of flow fluctuation attributable to spill, would avoid short-term fluctuation in habitat availability and the potential for stranding losses.

Elimination of Some Diversions and Construction of Fish Screens at the Remaining Diversions (Entrainment)

The elimination of some diversions and construction of fish screens at the remaining diversions could substantially increase survival of juvenile steelhead and Chinook salmon during downstream movement and migration. Under the Restoration Project, diversions would no longer occur at South, Coleman, and Wildcat Diversion Dams (Table 4-10). Fish screens would be constructed on all remaining diversions at Inskip, North Battle Creek Feeder, and Eagle Canyon Diversion Dams from North Fork and South Fork Battle Creek. Elimination of some diversions and construction of fish screens is likely to benefit steelhead and Chinook salmon. However, continued diversion of streamflow is likely to adversely affect steelhead and winter- and spring-run Chinook salmon and EFH for all Chinook salmon runs. Adverse effects may include entrainment and impingement of individual fish relating to a mechanical breakdown of screen facilities. The new failsafe fish screens would be expected to virtually eliminate entrainment losses of juvenile Chinook salmon and steelhead at the remaining diversions by automatically shutting down diversion during mechanical breakdowns of the screen. The addition of tailrace connectors will also be a reliable way to avoid loss attributable to entrainment and impingement while reliably conveying the large quantities of power system water.

Baseline conditions result in very high diversion fractions at each of the six North Fork and South Fork diversion dams within the salmon and steelhead restoration area (Table 4-11). Under baseline conditions, diversions occur at North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams. The proportion of flow diverted under baseline conditions is as high as 97% (Table 4-11). The diversion fractions will decrease dramatically under the Restoration Project because the MOU minimum flow requirements below each diversion dam are substantially greater than the FERC minimum flow requirements under baseline conditions. For those dams that are removed, the diversion fraction becomes zero.

Diversions would be screened using designs that meet or exceed criteria established by NOAA Fisheries and DFG. Proposed fish screens would include features that continuously monitor screen performance and, in the case of a malfunction, automatically stop the diversion. Detailed monitoring and operation and maintenance plans have been developed for the proposed fish screens and bypass facilities (Appendix B).

Under the Restoration Project, entrainment losses would be reduced and the increased survival of the juvenile life stages would be expected to increase the abundance of steelhead and Chinook salmon. Removal of diversions at South, Coleman, and Wildcat Diversion Dams would eliminate entrainment of juvenile Chinook salmon, juvenile steelhead, and other fish species produced in the upstream segments of North Fork and South Fork Battle Creek. Effective fish screens at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams would be expected to virtually eliminate entrainment-related mortality of fish moving downstream past the diversion intakes.

Removing Dams and Improving Fish Ladders (Predation, Pathogens, and Food)

Reduction of predation-related mortality could occur as a result of removing dams and improving fish ladders. Reduced predation mortality is likely to benefit steelhead and winter- and spring-run Chinook salmon and EFH for all Chinook salmon runs. The dams and associated fish ladders that would be present under baseline conditions are assumed to maintain predation above levels that would occur in the absence of dams. The existing dams may stop the upstream migration of predatory species such as pikeminnow; juveniles passing over the dams, likely disoriented by turbulent flow conditions, are vulnerable to predation. Concentration of pikeminnow below the diversion dams coincident with the downstream migration of juvenile salmonids could increase predation losses.

Removal of Wildcat, South, Soap Creek Feeder, Lower Ripley Creek Feeder, and Coleman Diversion Dams under the Restoration Project would remove any potential effects of the existing dams on predation. The improved fish ladders at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams would minimize disorientation of juveniles and improve conditions for downstream movement of Chinook salmon and steelhead. The vulnerability to predation would be reduced.

Although predation-related mortality may be reduced by removal of dams and fish ladder improvements, the overall benefit to fish species is unknown and may be minor given the area of stream affected. A localized reduction of predator-related mortality will likely be more significant in reaches where predation is more prevalent, specifically downstream of Wildcat and Coleman Diversion Dams. Fish species that prey on juvenile Chinook salmon and steelhead would continue to occur throughout Battle Creek, especially in the mainstem where warmer water temperatures support known predators, including smallmouth bass, green sunfish, and Sacramento pikeminnow. Most salmonid predators occur below the Restoration Project area, and those populations may be reduced only if there is an increase in coldwater habitat below the Restoration Project.

Table 4-10. Summary of Facility and Instream Flow Modifications for Baseline Conditions and the Restoration Project

Component	Baseline	Restoration Project
Remove Wildcat Diversion Dam and appurtenant facilities		T
Remove South Diversion Dam and appurtenant facilities		T
Remove Soap Creek Feeder Diversion Dam and appurtenant facilities		T
Increase releases at all Battle Creek dams not removed to levels per MOU		T
Remove Lower Ripley Creek Feeder Diversion Dam and facilities		T
Remove Coleman Diversion Dam and appurtenant facilities		T
Provide water below dam sites on Soap and Lower Ripley Creeks		T
Reoperate and gage Asbury Dam		T
Provide water below Asbury Diversion Dam		T
Redirect cold water from spring complexes from canals to adjacent creek reaches		T
Maintain and replace, as needed, all fish ladders on dams	T	T
Construct North Battle Creek Feeder Diversion Dam fish screen and fish ladder		T
Construct Eagle Canyon Diversion Dam fish screen and fish ladder		T
Construct Inskip Diversion Dam fish screen and fish ladder		T
Screen and ladder designs meet failsafe definition in MOU		T
Construct tailrace connector between South Powerhouse and Inskip Canal		T
Construct tailrace connector between Inskip Powerhouse and Coleman Canal		T
Construct Inskip Powerhouse bypass facility		T
Provide ramping rate during operations reducing flows below dams		T

Table 4-11. Proportion of Flow Diverted at Each Diversion Dam for Baseline Conditions and the Restoration Project, Median Value for All Months and All Years

Diversion Dam	Baseline	Restoration Project *
North Battle Creek Feeder	89%	0%[1]
Eagle Canyon	89%	45%
Wildcat	79%	R
South	85%	R
Inskip	96%	36%
Coleman	97%	R

* Fish screens constructed under the Restoration Project would minimize entrainment loss of fish.

R indicates the dam has been removed and diversion no longer occurs.

[1] Wet season months are the only period flows available for diversion.

Increased Minimum Instream Flows (Predation, Pathogens, and Food)

Increased minimum instream flows could result in substantially increased production of food for fish and are likely to benefit steelhead and winter- and spring-run Chinook salmon and EFH for all Chinook salmon runs. Prey abundance affects growth rate and the survival of individual fish. The quantity of habitat available for the production of periphyton and aquatic macroinvertebrates is at least partially dependent on the stream surface area. Periphyton is a key component of the aquatic food web and aquatic macroinvertebrates are a primary food for fish, especially juvenile Chinook salmon and steelhead. Prey abundance may increase in response to increased stream surface area and subsequent increase in primary productivity. Minimum instream flows would increase under the Restoration Project (see Section 4.3, "Hydrology" in the EIS/EIR [Jones & Stokes 2003a]), potentially increasing the abundance of food for fish. In addition, increasing the minimum instream flow and decreasing the temperature in typical salmonid holding habitats will decrease the adverse affects of pathogens.

Under baseline conditions, the summer stream surface area is approximately 108.9 acres (Table 4-12). In response to increased minimum instream flow requirements, the summer stream surface area would increase by approximately 66 acres (60%) under the Restoration Project. The increase in surface area may increase food availability for fish species, including juvenile Chinook salmon and steelhead. This benefit is partially captured under key habitat quantity (described above), reflecting the effects of increased minimum flow requirements on habitat area and potential production of Chinook salmon and steelhead. This benefit would be most apparent in future years when population size increases along with competition for food.

Although the additional stream surface area provided by increased minimum flows in Soap, Ripley, and Baldwin Creeks is not simulated, the additional surface area in those streams would also increase production of food for fish in the Battle Creek watershed. The stream surface area in Soap, Lower Ripley, and Baldwin Creeks would increase dramatically compared to the surface area at a minimum instream flow of 0 cfs under baseline conditions.

ASIP Conservation Measures

Several of the programmatic conservation measures listed in the MSCS for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley fall/late fall–run Chinook salmon, and Central Valley steelhead are already incorporated as part of the Restoration Project and the environmental commitments (see Chapter 2). In addition, environmental commitments described in Chapter 2 include mitigation for sediment control during dam removal and excluding spawning fish from disturbance areas. Those

measures that have been incorporated as part of the Restoration Project will not be addressed further in this section.

AFISH1. Implement EIS/EIR Mitigation Measure EFISH1. This conservation measure implements the EIS/EIR mitigation measure EFISH1 (described above) and tiers from the bolded portion of the MSCS programmatic conservation measure for winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead listed below:

- **Implement construction BMPs including** SWPPPs, **toxic materials control and spill response plans, vegetation protection plans**, and restrictions on materials used in channel and on levee embankments:
  - All materials that are used for construction of in-channel structures must meet applicable state and federal water quality criteria. Avoid or minimize the use of such materials that are deleterious to aquatic organisms.
  - Before implementing CALFED actions that require dredging, dredge materials should be tested to determine the presence of materials deleterious to [winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead]. Only sediment meeting all water quality standards and free from toxic substances in toxic amounts should be accepted for aquatic disposal.
  - Discharges from controllable sources of pollutants and releases from water supply reservoirs shall be conducted in a manner that attains those water quality objectives designated by the CVRWQCB for the maintenance of salmon and steelhead in designated habitats. All materials that are used for construction of in-channel structures must meet applicable State and federal water quality criteria.

The non-bolded text of the MSCS programmatic conservation measure listed above is already identified in the description of the Restoration Project, including environmental commitments (see Chapter 2). Implementing the Restoration Project meets the first and third requirements listed above, as the project is specifically designed to benefit winter-run and spring-run Chinook salmon and steelhead. As required by the second bullet, materials that will be dredged from behind the five dams proposed for removal were sampled on October 6, 1999; none of the sediment was found to be toxic to aquatic life.

AFISH2. Implement EIS/EIR Mitigation Measures EFISH2 and EFISH3. This conservation measure implements the EIS/EIR mitigation measures EFISH2 and EFISH3 (described above) and tiers from the bolded portion of the MSCS programmatic conservation measure for

Table 4-12. Approximate Summer Stream Surface Area (acres) by Reach for Minimum Required Instream Flows for Baseline Conditions and the Restoration Project

Reach	Baseline	Restoration Project
Below Keswick	7.7	7.7
Below North Battle Creek Feeder Diversion Dam	9.9	15.1
Below Eagle Diversion Dam	5.8	9.2
Below Wildcat Diversion Dam	5.7	8.0
Above South Diversion Dam	23.2	23.2
Below South Diversion Dam	19.4	24.2
Below Inskip Diversion Dam	16.1	22.6
Below Coleman Diversion Dam	7.4	10.8
Below Confluence of North Fork and South Fork Battle Creek	13.7	54.6
Total	108.9	175.3

winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead listed below:

- **For all in-channel and near-channel construction activities, implement construction BMPs (such as erosion and sediment control measures)** and conservation measures in the Clean Water Act Section 404 Nation Wide Permit, General Permits, and PL84-99 USACE flood relief biological opinions:
  - Avoid or minimize channel modifications during time periods when [winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead] are vulnerable to direct and indirect adverse effects of construction activities.
  - Avoid or minimize channel modifications in important natal, rearing, and migratory habitats that may result in habitat degradation and diminished habitat connectivity.
  - Avoid, minimize, and compensate for all adverse impacts on instream, shallow-water, riparian and shaded riverine aquatic habitats resulting from CALFED actions, including bank protection of in-channel islands, construction of attached berms, and levee program actions.
  - Compensate for adverse impacts on habitats by in-kind, onsite replacement of habitats and their functional values. Compensation shall result in a net increase in the extent and connectivity of these habitats for migrating, rearing, and spawning [winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead].

  The non-bolded text of the MSCS programmatic conservation measure listed above is already identified in the project description of the Restoration Project, including environmental commitments (see Chapter 2). The environmental commitments stipulate that environmental timeframes be implemented. Implementing the Restoration Project meets the first and second bulleted requirements listed above, as the project is specifically designed to benefit winter-run and spring-run Chinook salmon and steelhead. The listed permits do not apply to this project, nor do the third and fourth bulleted conditions because the Restoration Project channel modifications will benefit spawning, rearing, and migratory habitats, and the Restoration Project was designed to increase the net extent and connectivity of winter-run Chinook salmon, spring-run Chinook salmon, and steelhead habitats.

Implementation of the ASIP conservation measures AFISH1 and AFISH2 will fully mitigate effects of the Restoration Project on winter-run Chinook salmon, spring-run Chinook salmon, fall/late fall–run Chinook salmon, and steelhead; no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of ASIP conservation measures AFISH1 and AFISH2 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the Sacramento River winter-run Chinook salmon, the Central Valley spring-run Chinook salmon, Central Valley fall/late fall–run Chinook salmon, and the Central Valley steelhead (see Covered Species and NCCP Community Goals in Chapter 1) and on EFH for all Chinook salmon runs. The Restoration Project will restore conditions supporting adult and juvenile migration (e.g., fish ladders, fish screens, and increased flow) in approximately 42 miles of spawning and rearing habitat in Battle Creek, and an additional 6 miles of spawning and rearing habitat in its tributaries.

The Restoration Project, consistent with the ASIP goals, contributes to the recovery of the Sacramento River winter-run Chinook salmon. The recommended actions for winter run-recovery will follow guidelines established by NOAA Fisheries in the 1997 draft winter-run recovery plan (NOAA Fisheries 1997), which states:

1) Conduct a feasibility analysis of establishing viable, naturally self-sustaining populations in other rivers and creeks within the Sacramento River watershed. As part of this analysis, potential Sacramento Valley streams should be identified for the introduction or reintroduction of winter-run Chinook salmon. Battle Creek, a tributary to the Sacramento River, appears to have once supported a population of winter-run Chinook salmon during wet water years. Flows in Battle Creek were subsequently diverted for hydropower, but the creek could be re-operated to provide sufficient coldwater flows during summer months to protect incubating winter-run Chinook salmon eggs and fry, even during severe drought years.

2) Based on information developed from the proposed feasibility analysis, develop and implement recommendations for establishing supplemental or experimental populations. For those streams identified for introduction, stream restoration actions should be developed to provide suitable habitat conditions for winter-run Chinook salmon, including water quality and flows for adult and juvenile Chinook salmon passage, adult holding, spawning, egg incubation, and juvenile rearing. Recommendations need to also consider: 1) the genetic implications to supplemental and overall population of winter-run Chinook salmon; and 2) the magnitude of the main Sacramento River population needed before introductions begin.

In the 1997 draft plan it was envisioned that this program of developing supplemental populations could be implemented in a manner that would not create an undue regulatory burden on other users of resources in the watershed because of the recognized need to treat it as an experimental approach.

Currently a multi-agency team is developing specific actions for recovery of winter-run Chinook salmon within their historical range, including Battle Creek. This technical recovery team (TRT) should have recommendations for Battle Creek by the time restoration is complete and may choose to take an experimental approach to supplemental populations in Battle Creek.

The Restoration Project, consistent with the ASIP goals, contributes to the recovery of the Central Valley spring-run Chinook salmon. Currently a multi-agency team is developing specific actions for recovery of spring-run within their historical range, including Battle Creek. This technical recovery team should have recommendations covering the range of the species and may include recommendations for Battle Creek by the time restoration is complete.

The Restoration Project, consistent with the ASIP goals, contributes to the recovery of the Central Valley fall/late fall–run Chinook salmon. Fall-run and late fall–run are also included in the restoration goals for Battle Creek and are listed as candidate species under the ESA. Restoration of fall-run and late fall–run Chinook salmon may be delayed until a determination has been made that the species that are the priority of the restoration project have attained population goals that would make them resilient to potential negative interactions with fall-run Chinook salmon.

CALFED Contribution to Recovery

Implementation of the Restoration Project was designed to recover populations of Chinook salmon and steelhead in Battle Creek. In addition to this recovery effort, the overall contribution of the CALFED program will benefit the recovery of these species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will contribute to the recovery of Chinook salmon and steelhead (see Table I-1 in Appendix I for more detailed information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that are relevant to the recovery of Chinook salmon and steelhead. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Valley Elderberry Longhorn Beetle

Current Status in the Project Area

There are no known valley elderberry longhorn beetle occurrences in the Restoration Project area, and no valley elderberry longhorn beetles were observed during field surveys; however, numerous elderberry shrubs that may provide habitat for the beetle were found during field surveys. Many had stems greater than 1 inch in diameter, which could provide habitat for the larval stage. Elderberry shrubs with old exit holes have been found 0.7 mile east of Paynes Creek, approximately 5 miles away from the Restoration Project area (California

Natural Diversity Database 2003). All stems were surveyed for exit holes; none were identified. General information on potential valley elderberry longhorn beetle habitat is presented in Table 1-2 of this report. More detailed information on each elderberry occurrence identified within the study area and the presence or absence of exit holes in stems is presented in Table II-3 in Volume II of the *Biological Survey Summary Report* (Jones & Stokes 2001b). For a full species account, see Appendix E.

Information on elderberry shrubs that could be potentially affected by the Restoration Project is shown on Table 4-13.

Table 4-13. Elderberry Shrub Survey Results at the Restoration Project Sites, April 17, 2003 and April 5, 2004

Shrub #	Site Location	Riparian or Upland	Stems 1–3 inches	Stems 3–5 inches	Stems >5 inches	Exit Holes Present
1	South Canal	Riparian	0	0	1	No
2	South Canal	Riparian	4	1	3	No
3	South Canal	Riparian	0	0	1	No
4[a]	South Canal	Riparian	0	0	1	No
5	South Canal	Riparian	5	3	0	No
6	South Canal	Riparian	2	0	0	No
7	South Canal	Riparian	1	2	0	No
8	South Canal	Riparian	0	1	0	No
9	South Canal	Upland	3	4	0	No
10	Inskip Diversion Dam/ South Powerhouse	Upland	3	0	1	No
11[b]	Lower Ripley Creek Feeder	Upland	1	0	0	No
12	Lower Ripley Creek Feeder	Upland	3	0	2	No
13	South Canal	Upland	3	0	1	No
14	Eagle Canyon Diversion Dam	Riparian	1	0	2	No
15	Inskip Diversion Dam/South Powerhouse	Upland	7	5	15	No
16	Inskip Diversion Dam/South Powerhouse	Upland	18	4	2	No
17	Inskip Diversion Dam/South Powerhouse	Upland	0	4	0	No
18	Inskip Diversion Dam/South Powerhouse	Upland	2	2	0	No
19	Inskip Diversion Dam/South Powerhouse	Upland	0	0	1	No

Shrub #	Site Location	Riparian or Upland	Stems 1–3 inches	Stems 3–5 inches	Stems >5 inches	Exit Holes Present
20	Inskip Diversion Dam/South Powerhouse	Upland	2	0	0	No
21	Inskip Diversion Dam/South Powerhouse	Upland	1	1	0	No
Total			56	27	30	

[a] Could not see base of shrub; however, shrub appeared to have two large trunks coming from one base.

[b] Many small stems sprouting from a larger dead shrub.

Methods to Assess Project-Related Effects

For the purpose of this document, the areas surveyed for elderberry shrubs included the diversion dams, flumes, pipelines, open canals, access roads, and staging areas. The study area for each Restoration Project site was based on the presence of suitable habitat for the valley elderberry longhorn beetle, 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 maps WL-1 through WL-9 presented in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). A 100-foot buffer of these areas was also surveyed.

Existing information was reviewed to determine whether the valley elderberry longhorn beetle could exist in the project area and to document the location of known valley elderberry longhorn beetles within the vicinity of the Restoration Project. The sources of this information included DFG's CNDDB (California Natural Diversity Database 2000, 2003) and Jones & Stokes file information.

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 valley elderberry longhorn beetle surveys. Protocol-level surveys for valley elderberry longhorn beetle were conducted at various times between April and August in 2000 and 2001.

Additional protocol-level surveys for the valley elderberry longhorn beetle were conducted on April 17, 2003, and April 5, 2004. The surveys in 2003 were necessary because 2 years had elapsed since the previous valley elderberry longhorn beetle surveys. Only previously mapped shrubs in the project area were surveyed during the 2003 field visit. The surveys in 2004 were necessary because elderberry shrubs were located near a recently proposed alternate access road to the Inskip Diversion Dam/South Powerhouse site and these shrubs had not been surveyed in 2003. Both surveys included visiting each elderberry shrub that may be affected by the Restoration Project, measuring the diameter of each

stem of the shrub at ground level, and visually inspecting each stem for the presence of exit holes. Global Positioning System (GPS) readings were recorded at each shrub location so that the location of each shrub could be plotted on maps for each project site and easily located in the field.

An informal telephone consultation took place with USFWS biologist Pete Epanchin on August 20, 2003. The purpose of this meeting was to discuss potential effects to the valley elderberry longhorn beetle as a result of implementing the Restoration Project. Avoidance measures to reduce project-related effects were also discussed during this consultation. Recommendations resulting from the informal consultation are reflected in the effects discussion below.

Effects of the Restoration Project

Construction- and restoration-related activities and implementation of mitigation measures for the elderberry longhorn beetle may result in take of this species. Twenty-one elderberry shrubs (Table 4-13) that are capable of providing habitat for the valley elderberry longhorn beetle are located within 100 feet of Restoration Project sites or access roads to the project sites and could potentially be affected by project activities (Figures 4-23 through 4-27). Table 4-14 describes project-related effects on each shrub.

Table 4-14. Potential Project-Related Effects on Elderberry Shrubs

Shrub #	Site Location	Type of Impact	Description of Potential Effect
1–8	South Canal	Indirect	Located along South Canal, which is scheduled to be decommissioned and dewatered as a result of implementing the Restoration Project; the South Canal may provide a critical water source for the shrubs, and dewatering the canal may cause the shrubs to die.
9	South Canal	None	Located greater than 20 feet from an existing access road; BMPs, such as watering access roads, have been incorporated in the project description to minimize effects associated with dust; shrub would not be affected by construction activities (Epanchin pers. comm.).
10	Inskip Diversion Dam/South Powerhouse	None	Located more than 20 feet from an existing access road; BMPs, such as watering access roads, have been incorporated into the project description to minimize effects associated with dust; shrub would not be affected by project activities (Epanchin pers. comm.).
11	Lower Ripley Creek Feeder	None	Located more than 20 feet from the construction area for the removal of Lower Ripley Creek Feeder Diversion Dam; shrub would not be directly affected by project activities
12	Lower Ripley Creek Feeder	None	Located more than 20 feet from an existing access road; BMPs, such as watering access roads, have been incorporated into the project description to minimize effects associated with dust; shrub would not be affected by project activities (Epanchin pers. comm.).

Shrub #	Site Location	Type of Impact	Description of Potential Effect
13	South Diversion Dam	None	Located more than 20 feet from an existing access road; BMPs, such as watering access roads, have been incorporated into the project description to minimize effects associated with dust; shrub would not be affected by project activities (Epanchin pers. comm.).
14	Eagle Canyon Diversion Dam	Direct	Located in the immediate vicinity of proposed project features and would be directly affected by project activities; shrub would be removed as a result of project construction.
15–21	Inskip Diversion Dam/South Powerhouse	None	Located more than 20 feet from an alternate access road to Inskip Diversion Dam/South Powerhouse project site; BMPs, such as watering access roads, have been incorporated into the project description to minimize effects associated with dust; shrub would not be affected by construction activities (Epanchin pers. comm.).

This project is likely to adversely affect the valley elderberry longhorn beetle because one elderberry shrub would be removed as a result of Restoration Project activities at the Eagle Canyon Diversion Dam site. Additionally, there may be an indirect loss of elderberry shrubs as a result of dewatering the South Canal. South Canal may provide a critical water source for the shrubs and dewatering the canal may cause the shrubs to die. The loss of these shrubs could result in the injury or death of valley elderberry longhorn beetles that may be living in the stems of these shrubs, resulting in the take of this species.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the valley elderberry longhorn beetle:

> **EVELB1. Implement USFWS Standard Valley Elderberry Longhorn Beetle Compensation Guidelines.**[4] Reclamation will mitigate effects on the valley elderberry longhorn beetle by implementing standard valley elderberry longhorn beetle compensation guidelines (U.S. Fish and Wildlife Service 1999). In general, the guidelines require compensation for direct and indirect effects in the form of transplanting shrubs during November to mid-February that would be directly affected by the project and planting seedling elderberry shrubs at a secure mitigation site. Table 4-15 presents compensation ratios that are based on USFWS conservation guidelines for valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1999).
>
> A qualified biologist designated by Reclamation, in consultation with USFWS, will conduct preconstruction surveys at each Restoration Project construction site. The surveys will begin before, or during, the November–February transplant season before construction begins, such that any necessary transplanting could be done before the end of the

[4] Mitigation Measure EVELB1 is identified as "Mitigation Measure for Impact 4.2-5" in the draft EIS/EIR (Jones & Stokes 2003a).

transplant season. Because an extended period of time has passed since the original field surveys were performed to identify elderberry shrubs in the project area (2001), a programmatic BO from USFWS will be provided. The programmatic BO will include allowances for a given number of possible additional affected shrubs (to be determined in the BO) should any be identified during preconstruction surveys. If additional valley elderberry longhorn beetle compensation is identified from preconstruction surveys, supplemental BOs will be needed at that time and will tier from the programmatic BO. Before the final ASIP is completed, it will be necessary to ensure that Stillwater Plains Mitigation Bank can accommodate potential compensation for a reasonable number of additional elderberry shrubs.

Table 4-15. Compensation Ratios Based on USFWS Conservation Guidelines for Valley Elderberry Longhorn Beetle

Location	Stems (maximum diameter at ground level)	Exit Holes? (No/Yes)	Elderberry Seedling Ratio	Associated Native Plant Ratio
Nonriparian	Stems 1–3"	No:	1:1	1:1
		Yes:	2:1	2:1
Nonriparian	Stems 3–5"	No:	2:1	1:1
		Yes:	4:1	2:1
Nonriparian	Stems >5"	No:	3:1	1:1
		Yes:	6:1	2:1
Riparian	Stems 1–3"	No:	2:1	1:1
		Yes:	4:1	2:1
Riparian	Stems 3–5"	No:	3:1	1:1
		Yes:	6:1	2:1
Riparian	Stems >5"	No:	4:1	1:1
		Yes:	8:1	2:1

Avoidance of impacts requires a 100-foot no-disturbance buffer between the shrub and construction activities. USFWS will allow some activities within the 20-to-100-foot range, e.g., driving construction vehicles along access roads, as long as dust control measures are implemented to minimize dust disturbance on those shrubs location within 20 to 100 feet of the roads (Epanchin pers. comm.). Reclamation and/or the construction contractor will implement the following dust control measures along all dirt access roads and construction sites to minimize the effects of dust on nearby elderberry shrubs:

- All disturbed areas, including storage piles, that are not actively used for construction purposes, will be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or tarp or other suitable cover or vegetative ground cover.

- All on-site unpaved roads and off-site unpaved access roads will be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities will be effectively controlled of fugitive dust emissions by applying water or by presoaking.
- When materials are transported off site, all material will be covered or effectively wetted to limit visible dust emissions, and at least 6 inches of freeboard space from the top of the container shall be maintained.
- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles will be effectively stabilized of fugitive dust emissions using sufficient water or chemical stabilizer/suppressant.
- Within urban areas, trackout will be immediately removed when it extends 50 or more feet from the site and at the end of each workday.

According to 2003 and 2004 field survey results, 21 elderberry shrubs are located within 100 feet of project features and may be affected by proposed construction and operation activities. Eleven elderberry shrubs, shrubs #9, #10, #12, and #13, and #15—#21 are located more than 20 feet from existing access roads and would not be affected by Restoration Project activities as long as dust control measures are implemented to minimize dust disturbance caused by construction vehicles using the access roads (Epanchin pers. comm.) (Figures 4-23, 4-24, 4-25, and 4-26).

One elderberry shrub, shrub #11, is located less than 100 feet, but more than 20 feet, from the Lower Ripley Creek Feeder Diversion Dam construction site and will require avoidance mitigation but will not require compensation measures (Figure 4-25).

Eight elderberry shrubs, shrubs #1 through #8 along South Canal, would be indirectly affected by the dewatering South Canal (Figure 4-23). South Canal may provide a critical water source for the shrubs and dewatering the canal may cause some or all of the shrubs to die. If it appears that any of these elderberry shrubs will die as a result of dewatering South Canal, then the elderberry shrubs will be transplanted.

One elderberry shrub, shrub #14 at Eagle Canyon Diversion Dam, would be directly affected by construction of a fish ladder at this site (Figure 4-27). Although the Restoration Project may directly affect shrub #14, it may be difficult to transplant this shrub because of its location at Eagle Canyon Diversion Dam. The shrub is located at the bottom of a deep, narrow canyon that has no vehicle access, and the large size of this shrub

may require the use of large mechanical equipment for removal. Appropriate compensation to mitigate for project-related effects on shrub #14 is summarized below.

In summary, the Restoration Project construction and operation activities would affect nine elderberry shrubs (shrubs #1 though #8 and shrub #14). Additionally, avoidance mitigation would be implemented for shrub #11. Impacts on the valley elderberry longhorn beetle will be minimized by the following measures outlined in the USFWS's *Conservation Guidelines for Valley Elderberry Longhorn Beetles* (U.S. Fish and Wildlife Service 1999):

- A qualified biologist will identify and mark all elderberry shrubs with stems 1.0 inch or more in diameter within 100 feet of the impact area. A 100-foot buffer will be established around all elderberry shrubs, and no construction activities will be permitted within the buffer zone without the approval of USFWS. In areas where encroachment on the 100-foot buffer has been approved by USFWS, no ground-disturbing activities will be permitted within 20 feet of the dripline of each elderberry shrub. Any ground-disturbing activities within 20 feet of the dripline will need prior approval by USFWS and will require additional mitigation (outlined in the fifth bullet below). No riparian vegetation within 100 feet of elderberry shrubs will be removed by construction activities.
- Orange fencing will be placed around all shrubs to avoid inadvertent effects.
- Signs will be erected every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. The Endangered Species Act of 1973, as amended, protects this species. Violators are subject to prosecution, fines, and imprisonment." The signs will be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.
- An environmental education program will be presented to all construction personnel to brief them on the status of the valley elderberry longhorn beetle, the need to avoid impacts on the beetle and its habitat, and the penalty for not complying with these requirements.
- Reclamation intends to use the Stillwater Plains Mitigation Bank near Redding, California, to fully mitigate project-related effects on valley elderberry longhorn beetle habitat that cannot be avoided. According to the manager, Stillwater Plains Mitigation Bank has sufficient availability for additional compensation if necessary (Haws pers. comm. 2004). Mitigation bank arrangements will be completed prior to groundbreaking activities where valley elderberry longhorn beetle effects are assumed, e.g. Eagle Canyon Diversion Dam and along South Canal. Stillwater Plains Mitigation Bank will

implement the following mitigation measures where the Restoration Project cannot avoid project-related effects on elderberry shrubs:

- Prior to groundbreaking activities at sites where impacts on valley elderberry longhorn beetle are assumed, all elderberry shrubs with one or more stems measuring 1.0 inch or more in diameter that will be directly affected by construction activities (i.e., that would otherwise be destroyed) will be transplanted to a conservation area (e.g., Stillwater Plains Mitigation Bank) in accordance with USFWS's *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (U.S. Fish and Wildlife Service 1999).
- Each elderberry stem measuring 1.0 inch or more at ground level that is within 100 feet of construction and will be negatively affected by construction activities will be compensated for by planting elderberry seedlings or cuttings at a ratio between 1:1 and 8:1 depending on the diameter of the stem at ground level, whether the shrub is located in riparian habitat, and whether the shrub has evidence of exit holes. Table 4-16 lists valley elderberry longhorn beetle compensation measures for shrubs 1 through 8 and shrub 14.

Table 4-16. Valley Elderberry Longhorn Beetle Compensation for Shrubs 1 through 8 and Shrub 14

Stem Size (inches)	Number of Stems	Exit Holes?	Riparian?	Elderberry Compensation Ratio	Elderberry Compensation (number of seedlings)	Native Plant Compensation Ratio[a]	Native Plant Compensation (number of seedlings)
1–3	13	No	Yes	2:1	26	1:1	26
3–5	7	No	Yes	3:1	21	1:1	21
>5	8	No	Yes	4:1	32	1:1	32
Total Compensation:					**79**		**79**

[a] The Native Plant Compensation Ratio is based on the Elderberry Compensation number.

- A mix of native tree/plant species associated with the elderberry shrubs at the project site will be planted in the conservation area at ratios of 1:1 for elderberry shrubs without exit holes or 2:1 for elderberry shrubs with exit holes (native tree/plant species to each elderberry seedling or cutting) (see Tables 4-13 and 4-16). A mixture of native grasses and forbs will also be planted in the conservation area. Plant stock provided for erosion control measures, replanting of habitat, or any other uses should be derived from local stock and free of Argentine ants (*Linepithema humile*) from the supplier. This is required because the introduction of this exotic ant is detrimental to the valley

elderberry longhorn beetle, and introduction through re-vegetation efforts can lead to an increase in the ant's range.

- Each transplanted elderberry shrub, if necessary, will have at least 1,800 square feet of area. As many as five elderberry seedlings or cuttings and up to five associated native species may be planted within the 1,800–square foot transplant area. Therefore, a total of 28,440 square feet (0.65 acre) [i.e., (79 elderberry seedlings/5) (1,800 square feet] will be required for relocating elderberry shrubs, elderberry seedlings, and associated native species, based on USFWS compensation guidelines. A qualified biologist will monitor on-site dust control measures, transplanting of elderberry shrubs, and the restoration of valley elderberry longhorn beetle habitat at the Stillwater Plains Mitigation Bank (conservation area) to ensure that the mitigation measures are implemented according to the Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS 1999). If unauthorized take occurs, the monitor will have the authority to stop work until corrective measures have been completed. The monitor will immediately report any unauthorized take of the beetle or its habitat to the USFWS and to DFG.

- A qualified biologist will monitor and assess the general condition of the avoidance and conservation areas and the condition of the elderberry and associated native plantings for either 10 consecutive years and report annually or 7 years over a 15-year period with reports on years 1, 2, 3, 5, 7, 10, and 15. Biologists will survey at least twice between February 14 and June 30 of year survey year.

- A qualified biologist will record the following data that will be presented in each report: visual population census of adult beetles with condition, behavior, and precise location noted; census of beetle exit holes in elderberry stems, noting precise locations and estimated ages; evaluation of elderberry plants and associated native plants on the site and on the conservation area; an evaluation of the adequacy of fencing, signs, and weed control efforts in the avoidance and conservation areas; and a general assessment of the habitat and real or potential threats to the habitat such as erosion, fire, excessive grazing, off-road vehicle use, vandalism, excessive weed growth, etc. Copies of the written monitoring report will be submitted by December 31 of the same year to the Chief of Endangered Species, Sacramento Fish and Wildlife Service Office; to the Supervisor, Environmental Services, Department of Fish and Game, 1416 Ninth St., Sacramento, CA; to the Staff Zoologist, California Natural History Diversity Data Base, Department of Fish and Game, 1220 S. St., Sacramento, CA 95814; and to the Librarian, California Academy of Sciences, Golden Gate Park, San

Francisco, CA 94118. Copies of field notes, raw data and photographs must be submitted with each report.

- Success of the mitigation in the conservation area will be measured by a minimum survival rate of at least 60% of elderberry and associated native plants throughout the monitoring period. Within 1 year of discovery that survival has dropped below 60%, failed plantings must be replaced to bring survival above this level.
- All appropriate federal permits will be obtained prior to initiating the field studies.

ASIP Conservation Measures

ASIP conservation measures for the valley elderberry longhorn beetle are described below.

AVELB1. Implement EIS/EIR Mitigation Measure EVELB1. This conservation measure implements the EIS/EIR mitigation measure EVELB1 (described above) and tiers from the following MSCS programmatic conservation measure for the valley elderberry longhorn beetle:

> Until the valley elderberry longhorn beetle has been recovered, implement the USFWS' guidelines for mitigating project effects on the valley elderberry longhorn beetle to compensate for CALFED impacts on the species.

Implementation of this conservation measure will fully mitigate effects of the Restoration Project on the valley elderberry longhorn beetle and no additional conservation measures are required. As mentioned above, Stillwater Plains Mitigation Bank will be used to fully mitigate project-related effects on valley elderberry longhorn beetle habitat.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure AVELB1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the valley elderberry longhorn beetle. Implementation of this conservation measure will help ensure that the existing abundance and distribution of the beetle in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to contribute to the recovery of the valley elderberry longhorn beetle, but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, will contribute to the recovery of the beetle. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will contribute to the recovery of the valley elderberry longhorn beetle (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that are relevant to the recovery of the valley elderberry longhorn beetle. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Northwestern Pond Turtle

Current Status in the Project Area

Surveys located one adult northwestern pond turtle, a subspecies of the western pond turtle, in Ripley Creek, just upstream of the Lower Ripley Creek Feeder Dam. The turtles are likely to occur elsewhere in both forks of Battle Creek, but no turtles were found during field surveys. Information on this single observation and its potential for occurrence elsewhere in the Restoration Project area is presented in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementation of mitigation measures may result in temporary loss of habitat and harassment of the northwestern pond turtle. Surveys conducted for the Restoration Project indicate that northwestern pond turtle occurs in the project area. Construction activities could temporarily degrade habitat for this species at Lower Ripley Creek Feeder Diversion Dam, Inskip Diversion Dam/South Powerhouse, Soap Creek Feeder, and South Diversion Dam. Restoration activities in these areas could disturb the pond and other open water habitats and basking sites required by northwestern pond turtle, as well as increasing flows in areas that have been constrained by dam operations for many years. In addition, individual turtles could be killed during construction. The overall effects of the project, however, are considered beneficial to this species because the process of restoring the affected drainages will ultimately return them to an approximation of their former natural conditions.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the Northwestern pond turtle:

> **EWPTU1. Perform Preconstruction Surveys and Relocate Individuals.**[5] Within 2 weeks prior to construction activities at Lower Ripley Creek Feeder Diversion Dam, Inskip Diversion Dam/South Powerhouse, Soap Creek Feeder, and South Diversion Dam, qualified biologists will conduct protocol-level surveys for northwestern pond turtle. If turtles are detected, barrier fencing will be constructed in the work area in a manner that will exclude turtles from entering the work area. For 3 days prior to construction activities (one survey each day), qualified biologists will survey each of these work sites for turtles and will relocate any turtle found within the exclusion area. If turtles are found within previously unoccupied sites, exclusion areas will be established at those sites. Turtles will be relocated to the nearest suitable habitat outside the exclusion area. After construction has been completed, the barrier fencing will be removed and the habitat will be restored.

ASIP Conservation Measures

ASIP conservation measures for the northwestern pond turtle are described below.

> **AWPTU1. Implement EIS/EIR Mitigation Measure EWPTU1.** This conservation measure implements the EIS/EIR mitigation measure EWPTU1 (described above) and tiers from the following MSCS programmatic conservation measure for the northwestern pond turtle:
>
> > To the extent practicable, capture individuals from habitat that would be affected by CALFED actions, and relocate them to nearby suitable existing, restored, or enhanced habitat.

Implementation of this conservation measure will fully mitigate effects of the proposed action on the northwestern pond turtle and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure AWPTU1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of

[5] Mitigation Measure EWPTU1 is identified as "Mitigation Measure for Impact 4.2-7" in the draft EIS/EIR (Jones & Stokes 2003a).

Restoration Project actions on the northwestern pond turtle. Implementation of this conservation measure will help ensure that the existing abundance and distribution of the turtle in the project area are maintained. In addition, restoration of the affected drainages is expected to improve habitat conditions for the species.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit northwestern pond turtle, but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the northwestern pond turtle (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit northwestern pond turtle populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Bald Eagle

Current Status in the Project Area

During the 2000 and 2001 breeding seasons, surveys did not locate an active bald eagle nest. However, bald eagles may forage along North Fork and South Fork Battle Creek during the winter nonbreeding season (September through January). Breeding bald eagles that nest in the surrounding area, but outside the project area, also use Battle Creek as foraging habitat during the breeding season (February through July).

Information on bald eagle observations is presented in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). For a full species account, see Appendix E.

Effects of the Restoration Project

The long-term effects of the Restoration Project are considered beneficial to bald eagles because much of the project area will be restored to its pre-dam condition, allowing greater movement of fish and creating natural pools. In the short term, construction noise disturbance and helicopter flights associated with restoration activities could temporarily displace roosting or foraging bald eagles. However,

because of the low number of bald eagles apparently using the project area and the extent of available habitat throughout the project region, this level of possible displacement is not expected to disrupt overall bald eagle use of the area, affect individual eagles' ability to forage successfully, or affect reproductive efforts during any construction year. The Restoration Project would not likely adversely affect this species; however, if a pair of bald eagles nests in the project area, the nesting species could be disturbed by construction activities.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the bald eagle:

> **EBAEA1. Perform Preconstruction Surveys, Limit Construction Activities, and Establish Buffers.**[6] A qualified biologist will conduct a series of three surveys at the project sites during the breeding season before construction activities begin each construction year to locate active bald eagle nests. The three sets of surveys will take place during late February–early March, late April–May, and early June–July. Because construction of the Restoration Project is scheduled to begin in May 2005, before the June–July survey for 2005, USFWS recommends that surveys be conducted in late April–May and early June–July in 2004, in addition to a series of three surveys in 2005, for those sites where construction will begin in 2005. Performing additional surveys in the year before construction begins applies if construction is scheduled to begin at a time of year before the series of three surveys has been completed. Performing surveys the year before construction begins may help determine potential nesting sites within 0.5 mile of a construction site or access road for the year when construction activities start. If an active bald eagle nest within that area should be discovered in the June–July survey after construction has begun, it would be necessary to stop construction.
>
> If a nest is occupied, Reclamation and/or the construction contractor will limit construction activities near the nest to the nonbreeding season (August 1 to February 1). A qualified biologist, as designated by Reclamation, will establish a 0.5 mile–radius, direct-line-of-sight buffer for active bald eagle nests. In addition, Reclamation and/or the construction contractor will maintain a 0.5-mile, direct-line-of-sight helicopter-exclusion zone around any active nests. The buffers, identified as work exclusion zones, will be delineated and marked as explained under the environmental commitments described in Chapter 2. These buffers will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from

[6] Mitigation measure EBAEA1 is similar to the measure described in "Mitigation Measure for Impact 4.2-9" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-9 will be revised in the final EIS/EIR to include mitigation measure EBAEA1 as presented in this ASIP.

construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.

If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If potential nesting habitat (i.e., traditional nest site and structure) must be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If a project site is farther than the 0.5-mile buffer zone, disturbance probably can be assumed insignificant, but project contacts at USFWS and DFG will be consulted for known occurrences of bald eagle in the study area.

ASIP Conservation Measures

ASIP conservation measures for the bald eagle are described below.

ABAEA1. Implement EIS/EIR Mitigation Measure EBAEA1. This conservation measure implements the EIS/EIR mitigation measure EBAEA1 (described above) and tiers from the following MSCS programmatic conservation measures for the bald eagle:

- Before implementing CALFED actions that could result in the loss of nesting structures or disturbance to nesting pairs, conduct surveys to determine the presence and distribution of active nest sites along the Sacramento River and other major tributaries to the Bay-Delta.
- Avoid or minimize disturbances that could be associated with implementing CALFED actions within 0.5 mile of active nest sites during the nesting period (February–July).
- Avoid or minimize disturbances that could be associated with implementing CALFED actions that could result in the loss of traditional nesting trees or degradation of habitat within 0.5 mile of traditional nesting trees.

Implementation of conservation measure ABAEA1 will fully mitigate effects of the Restoration Project on the bald eagle and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure ABAEA1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the bald eagle. Implementation of this

conservation measure will help ensure that the existing abundance and distribution of the bald eagle in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the bald eagle but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the bald eagle (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit bald eagle populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Cooper's Hawk

Current Status in the Project Area

During the 2000 and 2001 breeding seasons, surveys did not locate an active Cooper's hawk nest. Information on Cooper's hawk observations is presented in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementation of mitigation measures may result in harassment of nesting Cooper's hawks. Construction activities occurring in the immediate vicinity of active Cooper's hawk nests could cause abandonment of nests and potentially result in death of young or eggs. The Cooper's hawk is a locally and regionally uncommon species, and the abandonment of active nests could affect local and regional breeding populations.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the Cooper's hawk:

ECOHA1. Perform Preconstruction Surveys, Limit

Construction Activities, and Establish Buffers.[7] A qualified biologist will survey the project sites during the breeding season (generally March through August) before construction activities begin each construction year to locate active Cooper's hawk nests. If a nest is occupied, Reclamation and/or the construction contractor will limit construction activities near the nest to the nonbreeding season (September 1 to March 1). A qualified biologist, designated by Reclamation, will establish a 500 foot–radius, direct-line-of-sight buffer for active Cooper's hawk nests. In addition, Reclamation and/or the construction contractor will maintain a 0.5-mile, direct-line-of-sight helicopter-exclusion zone around any active nests. The buffers, identified as work exclusion zones, will be delineated and marked as explained under the environmental commitments described in Chapter 2. These buffers will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.

If construction at or near an old Cooper's hawk nest must occur between March 1 and August 31, it should be assumed that the site contains suitable breeding habitat, and construction should begin by March 1 (approximate start of the breeding season). If a Cooper's hawk pair appears at or near a construction site and attempts to nest, typical levels of activity and noise disturbance that would occur at the site during the breeding season will be sustained such that the pair will accept or reject that site based upon its assessment of disturbance. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate the construction noise and activity. If a breeding pair commences to nest, construction noise and activity should continue on a routine basis through the end of August or until construction is completed. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If potential nesting habitat (i.e., traditional nest site and structure) must be affected during the breeding season, project contacts at USFWS and DFG will be consulted before disturbance begins. If a project site is farther than the 0.5-mile buffer zone, disturbance probably can be assumed insignificant, but project contacts at USFWS and DFG will be consulted for known occurrences of Cooper's hawk in the study area.

[7] Mitigation measure ECOHA1 is similar to the measure described in "Mitigation Measure for Impact 4.2-9" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-9 will be revised in the final EIS/EIR to include mitigation measure ECOHA1 as presented in this ASIP.

ASIP Conservation Measures

ASIP conservation measures for the Cooper's hawk are described below.

ACOHA1. Implement EIS/EIR Mitigation Measure ECOHA1. This conservation measure implements the EIS/EIR mitigation measure ECOHA1 (described above) and tiers from the following MSCS programmatic conservation measures for the Cooper's hawk:

- Before implementing CALFED actions that could result in the loss of nesting structures or disturbance to nesting pairs, conduct surveys to determine the presence and distribution of active nest sites along the Sacramento River and other major tributaries to the Bay-Delta.
- Avoid or minimize disturbances that could be associated with implementing CALFED actions near active nest sites during the nesting period (March–August).
- Avoid or minimize disturbances that could be associated with implementing CALFED actions that could result in the loss of traditional nesting trees.

Implementation of conservation measure ACOHA1 will fully mitigate effects of the Restoration Project on the Cooper's hawk and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure ACOHA1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the Cooper's hawk. Implementation of this conservation measure will help ensure that the existing abundance and distribution of the Cooper's hawk in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the Cooper's hawk but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the Cooper's hawk (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit Cooper's hawk populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Osprey

Current Status in the Project Area

During the 2000 and 2001 breeding seasons, surveys located an active nest. Information on the osprey nest location and observations is presented in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementation of mitigation measures may result in harassment of nesting osprey. Construction activities occurring in the immediate vicinity of active osprey nests could cause abandonment of nests and potentially result in death of young or eggs. The osprey is a locally and regionally uncommon species, and the abandonment of active nests could affect local and regional breeding populations.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the osprey:

> **EOSPR1. Perform Preconstruction Surveys, Limit Construction Activities, and Establish Buffers.**[8] A qualified biologist will survey the project sites during the breeding season (generally March through August) before construction activities begin each construction year to locate active osprey nests. If a nest is occupied, Reclamation and/or the construction contractor will limit construction activities near the nest to the nonbreeding season (September 1 to March 1). A qualified biologist, designated by Reclamation, will establish a 500 foot–radius, direct-line-of-sight buffer for active osprey nests. In addition, Reclamation and/or the construction contractor will maintain a 0.5-mile, direct-line-of-sight helicopter-exclusion zone around any active nests. The buffers, identified as work exclusion zones, will be delineated and marked as explained under the

[8] Mitigation measure EOSPR1 is identified as "Mitigation Measure for Impact 4.2-9" in the draft EIS/EIR (Jones & Stokes 2003a).

environmental commitments described in Chapter 2. These buffers will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.

If construction at or near an old osprey nest must occur between March 1 and August 31, it should be assumed that the site contains suitable breeding habitat, and construction should begin by March 1 (approximate start of the breeding season). If an osprey pair appears at or near a construction site and attempts to nest, typical levels of activity and noise disturbance that would occur at the site during the breeding season will be sustained such that the pair will accept or reject that site based upon its assessment of disturbance. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate the construction noise and activity. If a breeding pair commences to nest, construction noise and activity should continue on a routine basis through the end of August or until construction is completed. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If potential nesting habitat (i.e., traditional nest site and structure) must be affected during the breeding season, project contacts at USFWS and DFG will be consulted before disturbance begins. If a project site is farther than the 0.5-mile buffer zone, disturbance probably can be assumed insignificant, but project contacts at USFWS and DFG will be consulted for known occurrences of osprey in the study area.

ASIP Conservation Measures

ASIP conservation measures for the osprey are described below.

AOSPR1. Implement EIS/EIR Mitigation Measure EOSPR1. This conservation measure implements the EIS/EIR mitigation measure EOSPR1 (described above) and tiers from the following MSCS programmatic conservation measures for the osprey:

- Before implementing CALFED actions that could result in the loss of nesting structures or disturbance to nesting pairs, conduct surveys to determine the presence and distribution of active nest sites along the Sacramento River and other major tributaries to the Bay-Delta.
- Avoid or minimize disturbances that could be associated with implementing CALFED actions near active nest sites during the nesting period (March–August).

- Avoid or minimize disturbances that could be associated with implementing CALFED actions that could result in the degradation or loss of nesting structures.

Implementation of conservation measure AOSPR1 will fully mitigate effects of the Restoration Project on the osprey and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure AOSPR1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the osprey. Implementation of this conservation measure will help ensure that the existing abundance and distribution of the osprey in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the osprey, but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the osprey (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit osprey populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

American Peregrine Falcon

Current Status in the Project Area

During the 2000 and 2001 breeding seasons, surveys did not locate an active nest. Information on the peregrine falcon observation is presented in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementation of mitigation measures may result in harassment of nesting peregrine falcon. Construction activities occurring in the immediate vicinity of active peregrine falcon nests could cause abandonment of nests and potentially result in death of young or eggs. The peregrine falcon is a locally and regionally rare species, and the abandonment of active nests could affect local and regional breeding populations.

The Restoration Project EIS/EIR includes the following mitigation measure that will minimize the effects of construction- and restoration-related activities on the peregrine falcon:

> **EPEFA1. Perform Preconstruction Surveys, Limit Construction Activities, and Establish Buffers.**[9] Prior to construction activities during the breeding season (generally March through July) of each construction year, a qualified biologist will survey the project sites to locate active peregrine falcon nests. If a nest is occupied, Reclamation and/or the construction contractor will limit construction activities near the nest to the nonbreeding season (August 1 to March 1). A qualified biologist, designated by Reclamation, will establish a 500 foot–radius, direct-line-of-sight buffer for active peregrine falcon nests. In addition, Reclamation and/or the construction contractor will maintain a 0.5-mile direct-line-of-sight helicopter-exclusion zone around any active nests. The buffers, identified as work exclusion zones, will be delineated and marked as explained under the environmental commitments described in Chapter 2. These buffers will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.
>
> If construction at or near a peregrine falcon's nest must occur between March 1 and August 31, it should be assumed that the site contains suitable breeding habitat, and construction should begin by March 1 (approximate start of the breeding season). If a peregrine falcon pair appears at or near a construction site and attempts to nest, typical levels of activity and noise disturbance that would occur at the site during the breeding season will be sustained such that the pair will accept or reject that site based upon its assessment of disturbance. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate the construction noise and activity. If a breeding pair

[9] Mitigation measure EPEFA1 is similar to the measure described in "Mitigation Measure for Impact 4.2-9" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-9 will be revised in the final EIS/EIR to include mitigation measure EPEFA1 as presented in this ASIP.

commences to nest, construction noise and activity should continue on a routine basis through the end of August or until construction is completed. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If potential nesting habitat (i.e., traditional nest site and structure) must be affected during the breeding season, project contacts at USFWS and DFG will be consulted before disturbance begins. If a project site is farther than the 0.5-mile buffer zone, disturbance probably can be assumed insignificant, but project contacts at USFWS and DFG will be consulted for known occurrences of peregrine falcon in the study area.

ASIP Conservation Measures

ASIP conservation measures for the peregrine falcon are described below.

APEFA1. Implement EIS/EIR Mitigation Measure EPEFA1. This conservation measure implements the EIS/EIR mitigation measure EPEFA1 (described above) and tiers from the following MSCS programmatic conservation measures for the peregrine falcon:

- Before implementing CALFED actions that could result in the loss of nesting structures or disturbance to nesting pairs, conduct surveys to determine the presence and distribution of active nest sites along the Sacramento River and other major tributaries to the Bay-Delta.
- Avoid or minimize disturbances that could be associated with implementing CALFED actions near active nest sites during the nesting period (March–August).

Implementation of conservation measure APEFA1 will fully mitigate effects of the Restoration Project on the peregrine falcon, and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measure APEFA1 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the peregrine falcon. Implementation of this conservation measure will help ensure that the existing abundance and distribution of the peregrine falcon in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the peregrine falcon but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the peregrine falcon (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit peregrine falcon populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Yellow-Breasted Chat

Current Status in the Project Area

Surveys located yellow-breasted chats at three riparian sites containing blackberry brambles and riparian scrub: Coleman Diversion Dam/Inskip Powerhouse, Lower Ripley Creek Feeder, and Inskip Diversion Dam/South Powerhouse. Information on the yellow-breasted chat occurrences at Coleman Diversion Dam/Inskip Powerhouse is in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). The occurrences at the Lower Ripley Creek Feeder and Inskip Diversion Dam/South Powerhouse have not been provided in Volume II because the chats observed at these sites were migrants and do not nest in the area. For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementing mitigation measures for this species may result in temporary loss of habitat and harassment of the yellow-breasted chat. During surveys for the Restoration Project, yellow-breasted chats were detected and are considered to be breeding at the Coleman Diversion Dam/Inskip Powerhouse project site. Construction at the Coleman Diversion Dam/Inskip Powerhouse may remove riparian scrub habitat required by this species for breeding and cover. Effects on this habitat during the breeding season could also include destruction of active nests and mortality of individual chats or their eggs. Yellow-breasted chat is an uncommon species in California; it is restricted to a single habitat type (riparian scrub) that has declined substantially over past decades, and local breeding populations are considered to be declining.

The Restoration Project EIS/EIR includes the following mitigation measures that will minimize the effects of construction- and restoration-related activities on the yellow-breasted chat:

EYBCH1. Perform Preconstruction Surveys, Install Barriers, and Establish Buffers.[10] Yellow-breasted chats are known to breed at the Coleman Diversion Dam/Inskip Powerhouse project site. Although no breeding was detected during surveys, potential breeding habitat exists at the Lower Ripley Creek Feeder and Inskip Diversion Dam/South Powerhouse project sites. Before construction begins during the breeding season of the construction year, a qualified biologist will survey all project sites to determine chat occupancy. Surveys will be conducted between April 25 and May 25 or prior to construction if construction begins during that time period. If no breeding chats are detected, no further mitigation is required.

If breeding chats are detected, a qualified biologist will install orange barrier fencing around the riparian vegetation to protect it from incidental damage. To minimize the potential for mortality or nest abandonment, Reclamation and/or the construction contractor will establish a 500-foot no-disturbance buffer around all active nesting sites during the breeding season (mid-April to August). This buffer, identified as a work exclusion zone, will be delineated and marked as explained under the environmental commitments described in Chapter 2. The buffer will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.

If construction at a site must occur between April 15 and August 31, it should begin by April 15, and typical levels of activity and noise disturbance that would occur at the site should be sustained on a routine basis through the end of August or until the construction is completed. A qualified biologist will monitor construction sites for bird nesting activity during the breeding season. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate the construction noise and activity.

EYBCH2. Avoid and Minimize Removal and Disturbance of Riparian Habitat.[11] Reclamation and/or the construction contractor will ensure that the unnecessary removal or disturbance of riparian habitat (habitat for yellow-breasted chat) adjacent to the construction

[10] Mitigation Measure EYBCH1 is identified as "Mitigation Measure for Impact 4.2-8" in the draft EIS/EIR (Jones & Stokes 2003a).

[11] Mitigation measure EYBCH2 is included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a).

area will be avoided by installing orange construction barrier fencing (and sedimentation fencing in some cases) between the construction site and the riparian/creek area. Removal of woody riparian vegetation will be avoided by creating a work exclusion zone (buffer) around woody riparian vegetation near the construction zone, educating construction crews about the importance of avoiding sensitive habitat, and monitoring construction to ensure avoidance. The exclusion zone will be demarcated by orange construction fencing placed 20 feet beyond the dripline of the vegetation. The work exclusion zone will be delineated and marked as explained under the environmental commitments described in Chapter 2. The fencing will be installed before construction activities begin and will be maintained throughout the construction period.

EYBCH3. Minimize Long-Term Impacts on Woody Riparian Vegetation and Associated Habitat.[12] Reclamation and/or the construction contractor will minimize long-term impacts on woody riparian vegetation by trimming trees and shrubs rather than removing entire woody plants. Where possible, shrubs and trees should be cut at least 1 foot above ground level to leave the root systems intact and allow for more rapid regeneration following construction. To avoid the take of eggs or nestlings of yellow-breasted chats and avoid violating the Migratory Bird Treaty Act (MBTA), riparian vegetation should be removed during the nonbreeding season (September–mid-April) before construction begins. If such timing is not feasible, riparian vegetation should not be removed until it can be demonstrated that it is not supporting nesting birds. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins.

EYBCH4. Compensate for the Loss of Woody Riparian Habitat.[13] Reclamation will compensate for temporary and permanent impacts on woody riparian habitat to ensure no net loss of habitat functions and values. Where woody riparian habitat loss is temporary, compensation will include full restoration of the affected habitat as well as on-site or off-site restoration at a ratio of 2:1 (2 acres restored or enhanced for every 1 acre affected) (U.S. Fish and Wildlife Service 2003). The compensation for permanent loss of woody riparian habitat will be provided at a minimum ratio of 3:1 (3 acres restored or enhanced for every 1 acre affected) and may be a combination of on-site restoration/creation and use of habitat credits from a CALFED–funded conservation easement located within the project area.

[12] Mitigation measure EYBCH3 is included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a).

[13] Mitigation measure EYBCH4 is similar to the measure included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-1 will be revised in the final EIS/EIR to include mitigation measure EYBCH4 as presented in this ASIP.

For on-site restoration of riparian habitat, Reclamation will develop a Riparian Restoration Plan through coordination with NOAA Fisheries, USFWS, DFG, and the Corps, described in detail as part of the Battle Creek Implementation Plan (see the environmental commitments described in Chapter 2). Reclamation will retain a qualified ecologist to prepare the Riparian Restoration Plan to compensate for the removal of riparian vegetation along Battle Creek. This measure will apply to trees and shrubs that are removed entirely (including root systems) for construction of the Restoration Project. Enhancement of riparian habitat could be accomplished along Battle Creek through the removal of invasive species and replacement with native riparian species. The feasibility of removing nonnative species and replanting native species will be evaluated as part of the Riparian Restoration Plan. The Riparian Restoration Plan will include design specifications, an implementation plan, maintenance requirements, and a monitoring program for on-site restoration.

Monitoring of on-site riparian restoration efforts will be conducted for a 10-year period, or until the performance standards have been met without human intervention for 3 years, to document the degree to which success criteria are achieved and to identify remedial actions that may be needed (U.S. Fish and Wildlife Service 2003). Annual monitoring reports will be submitted to the appropriate resource agencies. The report will summarize the data collected during monitoring periods and describe how the habitats are progressing in terms of the success criteria (to be determined as part of the restoration plan). Success criteria will be determined through coordination with the resource agencies. A brief letter report summarizing the results of monitoring and recommending additional needed actions will be submitted to the appropriate resource agencies.

Off-site restoration of riparian habitat will be implemented by using habitat credits at the Burton Ranch property, a CALFED–funded conservation easement managed by The Nature Conservancy and located on the mainstem of Battle Creek (for more information, see the habitat compensation approach presented in Appendix F of this document). Monitoring and reporting for the conservation easement will be conducted by The Nature Conservancy as part of their commitment to stewardship of this easement.

The Battle Creek Adaptive Management Plan proposes a draft riparian monitoring program to document project-related benefits to riparian habitats hypothesized to result from increased minimum streamflow. Riparian enhancement expected from increased minimum instream flows should provide additional riparian compensation benefits and should make the Restoration Project partially self-mitigating. For more information on the riparian monitoring plan, see the Adaptive Management Plan (Appendix C).

ASIP Conservation Measures

ASIP conservation measures for the yellow-breasted chat are described below.

AYBCH1. Implement EIS/EIR Mitigation Measure EYBCH1. This conservation measure implements the EIS/EIR mitigation measure EYBCH1 (described above) and tiers from the following MSCS programmatic conservation measures for the yellow-breasted chat:

- Before implementing CALFED actions that could result in the loss or degradation of occupied nesting habitat or disturbance to nesting pairs, conduct surveys in suitable nesting habitat within the portions of the species' breeding range that could be affected by CALFED actions to locate nesting pairs.
- Avoid or minimize disturbances to nesting pairs that could be associated with implementing CALFED actions during the nesting period (mid-April–August).

AYBCH2. Implement EIS/EIR Mitigation Measures EYBCH2 and EYBCH3. This conservation measure implements the EIS/EIR mitigation measures EYBCH2 and EYBCH3 (described above) and tiers from the following MSCS programmatic conservation measure for montane riparian habitat:

- Avoid or minimize disturbance to existing habitat.

AYBCH3. Implement EIS/EIR Mitigation Measure EYBCH4. This conservation measure implements the EIS/EIR mitigation measure EYBCH4 (described above) and tiers from the following MSCS programmatic conservation measure for montane riparian habitat:

- Restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts would occur before implementing actions that could result in the loss or degradation of habitat.

Implementation of conservation measures AYBCH1, AYBCH2, and AYBCH3 will fully mitigate effects of the Restoration Project on the yellow-breasted chat and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measures AYBCH1, AYBCH2, and AYBCH3 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the yellow-breasted chat.

Implementation of these conservation measures will help ensure that the existing abundance and distribution of the yellow-breasted chat in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the yellow-breasted chat, but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the yellow-breasted chat (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit yellow-breasted chat populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Little Willow Flycatcher

Current Status in the Project Area

Surveys located willow flycatchers at one riparian site (Lower Ripley Creek Feeder) and another site above Eagle Canyon in blue oak savanna and scrub (near Eagle Canyon Diversion Dam). Information on the willow flycatcher occurrences is summarized in Table 1-2 of this report and in Table II-3 in Volume II of the Biological Survey Summary Report (Jones & Stokes 2001b). Because willow flycatchers were not present during surveys after the end of their migration period (after 15 June), the flycatchers at the Lower Ripley Creek Feeder and above Eagle Canyon Diversion Dam were determined to be migrants and not nesting in the area during the year of the survey. For a full species account, see Appendix E.

Effects of the Restoration Project

Construction- and restoration-related activities and implementing mitigation measures for this species may result in temporary loss of habitat and harassment of the willow flycatcher. During surveys for the Restoration Project, willow flycatchers were detected but were not considered to be breeding at the Lower Ripley Creek Feeder project site.

Construction at the Lower Ripley Creek Feeder may remove riparian vegetation required by this species for breeding habitat and as migratory stopover habitat. Impacts on this habitat during the breeding season could also result in destruction of active nests and mortality of individual flycatchers or their eggs. The willow flycatcher is a rare breeding species in California; it is restricted to habitat types (riparian and willow scrub in wet meadow complexes) that have declined substantially over past decades, and local breeding populations are considered to be declining.

The flycatchers seen on the lip of Eagle Canyon at the trailhead to Eagle Canyon Diversion Dam were not in breeding habitat nor were they in typical riparian migratory stopover habitat. Construction- and restoration-related activities and implementing mitigation measures at Eagle Canyon Diversion Dam are not expected to result in effects on the nesting willow flycatchers because of the lack of potential breeding habitat.

The Restoration Project EIS/EIR includes the following mitigation measures that will minimize the effects of construction- and restoration-related activities on the willow flycatcher:

EWIFL1. Perform Preconstruction Surveys, Install Barriers, and Establish Buffers.[14] Willow flycatchers may breed at the Lower Ripley Creek Feeder project site. Although no breeding was detected during surveys, potential breeding habitat exists in the riparian corridor. If construction- and restoration-related activities are to occur during the breeding season, a qualified biologist will survey the Lower Ripley Creek Feeder project site to determine flycatcher occupancy. At least three surveys will be conducted between May 15 and July 25, or at least one to two surveys will be conducted prior to construction if construction begins during that time period. At least one survey must be conducted between June 20 and July 1 to determine presence of non-migratory willow flycatchers. If no breeding flycatchers are detected, no further mitigation is required.

If breeding flycatchers are detected, a qualified biologist will install orange barrier fencing around the riparian vegetation to protect it from incidental damage. To minimize the potential for mortality or nest abandonment, Reclamation and/or the construction contractor will establish a 500-foot no-disturbance buffer around all active nesting sites during the breeding season (mid-May to August). This buffer, identified as a work exclusion zone, will be delineated and marked as explained under the environmental commitments described in Chapter 2. The buffer will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and

[14] Mitigation measure EWIFL1 is similar to the measure included in "Mitigation Measure for Impact 4.2-8" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-8 will be revised in the final EIS/EIR to include mitigation measure EWIFL1 as presented in this ASIP.

the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced if approved by DFG and USFWS.

If construction at a site must occur between May 15 and August 1, it should begin by May 15, and typical levels of activity and noise disturbance that would occur at the site should be sustained on a routine basis through the end of August or until the construction is completed. A qualified biologist will monitor construction sites for bird nesting activity during the breeding season. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate the construction noise and activity.

EWIFL2. Avoid and Minimize Removal and Disturbance of Riparian Habitat at the Lower Ripley Creek Feeder Project Site.[15] Reclamation and/or the construction contractor will ensure that the unnecessary removal or disturbance of riparian habitat (habitat for willow flycatcher) adjacent to the construction area will be avoided by installing orange construction barrier fencing (and sedimentation fencing in some cases) between the construction site and the riparian/creek area. Removal of woody riparian vegetation will be avoided by creating a work exclusion zone (buffer) around woody riparian vegetation near the construction zone, educating construction crews about the importance of avoiding sensitive habitat, and monitoring construction to ensure avoidance. The exclusion zone will be demarcated by orange construction fencing placed 20 feet beyond the dripline of the vegetation. The work exclusion zone will be delineated and marked as explained under the environmental commitments described in Chapter 2. The fencing will be installed before construction activities begin and will be maintained throughout the construction period.

EWIFL3. Avoid Long-Term Impacts on Woody Riparian Vegetation and Associated Habitat at the Lower Ripley Creek Feeder Project Site.[16] Reclamation and/or the construction contractor will avoid long-term impacts on woody riparian vegetation by trimming trees and shrubs rather than removing entire woody plants. Where possible, shrubs and trees should be cut at least 1 foot above ground level to leave the root systems intact and allow more rapid regeneration following construction. To avoid the take of eggs or nestlings of willow flycatchers and avoid violating the MBTA, riparian vegetation should be removed during the nonbreeding season (mid-August–mid-May) before construction begins. If such timing is not feasible, riparian vegetation should not be removed until it can be demonstrated that it is not supporting nesting birds. If disturbance of a nest with eggs or young

[15] Mitigation measure EWIFL2 is included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a).

[16] Mitigation measure EWIFL3 is included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a).

appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins.

EWIFL4. Compensate for the Loss of Woody Riparian Habitat at the Lower Ripley Creek Feeder Project Site.[17] Reclamation will compensate for temporary and permanent impacts on woody riparian habitat to ensure no net loss of habitat functions and values. Where woody riparian habitat loss is temporary, compensation will include full restoration of the affected habitat as well as on-site or off-site restoration at a ratio of 2:1 (2 acres restored or enhanced for every 1 acre affected) (U.S. Fish and Wildlife Service 2003). The compensation for permanent loss of woody riparian habitat will be provided at a minimum ratio of 3:1 (3 acres restored or enhanced for every 1 acre affected) and may be a combination of on-site restoration/creation and use of habitat credits from a CALFED–funded conservation easement located within the project area.

For on-site restoration of riparian habitat, Reclamation will develop a Riparian Restoration Plan through coordination with NOAA Fisheries, USFWS, DFG, and the Corps, described in detail as part of the Battle Creek Implementation Plan (see the environmental commitments described in Chapter 2). Reclamation will retain a qualified ecologist to prepare the Riparian Restoration Plan to compensate for the removal of riparian vegetation along Battle Creek. This measure will apply to trees and shrubs that are removed entirely (including root systems) for construction of the Restoration Project. Enhancement of riparian habitat could be accomplished along Battle Creek through the removal of invasive species and replacement with native riparian species. The feasibility of removing nonnative species and replanting native species will be evaluated as part of the Riparian Restoration Plan. The Riparian Restoration Plan will include design specifications, an implementation plan, maintenance requirements, and a monitoring program for on-site restoration.

Monitoring of on-site riparian restoration efforts will be conducted for a 10-year period, or until the performance standards have been met without human intervention for 3 years, to document the degree to which success criteria are achieved and to identify remedial actions that may be needed (U.S. Fish and Wildlife Service 2003). Annual monitoring reports will be submitted to the appropriate resource agencies. The report will summarize the data collected during monitoring periods and describe how the habitats are progressing in terms of the success criteria (to be determined as part of the restoration plan). Success criteria will be determined through coordination with the resource agencies. A brief letter report summarizing the results of monitoring and recommending

[17] Mitigation measure EWIFL4 is similar to the measure included in "Mitigation Measures for Impact 4.2-1" in the draft EIS/EIR (Jones & Stokes 2003a). The mitigation measure for Impact 4.2-1 will be revised in the final EIS/EIR to include mitigation measure EWIFL4 as presented in this ASIP.

additional needed actions will be submitted to the appropriate resource agencies.

Off-site restoration of riparian habitat will be implemented by using habitat credits at the Burton Ranch property, a CALFED–funded conservation easement managed by The Nature Conservancy and located on the mainstem of Battle Creek (for more information, see the habitat compensation approach presented in Appendix F of this document). Monitoring and reporting for the conservation easement will be conducted by The Nature Conservancy as part of their commitment to stewardship of this easement.

The Battle Creek Adaptive Management Plan proposes a draft riparian monitoring program to document project-related benefits to riparian habitats hypothesized to result from increased minimum streamflow. Riparian enhancement expected from increased minimum instream flows should provide additional riparian compensation benefits and should make the Restoration Project partially self-mitigating. For more information on the riparian monitoring plan, see the Adaptive Management Plan (Appendix C).

ASIP Conservation Measures

ASIP conservation measures for the willow flycatcher are described below.

AWIFL1. Implement EIS/EIR Mitigation Measure EWIFL1. This conservation measure implements the EIS/EIR mitigation measure EWIFL1 (described above) and tiers from the following MSCS programmatic conservation measures for the willow flycatcher:

- Before implementing CALFED actions that could result in the loss or degradation of occupied nesting habitat or disturbance to nesting pairs, conduct surveys in suitable nesting habitat within the portions of the species' breeding range that could be affected by CALFED actions to locate nesting pairs.

- Avoid or minimize disturbances to nesting pairs that could be associated with implementing CALFED actions during the nesting period (mid-May–August).

AWIFL2. Implement EIS/EIR Mitigation Measures EWIFL2 and EWIFL3. This conservation measure implements the EIS/EIR mitigation measures EWIFL2 and EWIFL3 (described above) and tiers from the following MSCS programmatic conservation measure for montane riparian habitat:

- Avoid or minimize disturbance to existing habitat.

AWIFL3. Implement EIS/EIR Mitigation Measure EWIFL4. This conservation measure implements the EIS/EIR mitigation measure EWIFL4 (described above) and tiers from the following MSCS programmatic conservation measure for montane riparian habitat:

- Restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts would occur before implementing actions that could result in the loss or degradation of habitat.

Implementation of conservation measures AWIFL1, AWIFL2, and AWIFL3 will fully mitigate effects of the Restoration Project on the willow flycatcher and no additional conservation measures are required.

Expected Outcomes with Implementation of Conservation Measures

Implementation of the ASIP conservation measures AWIFL1, AWIFL2, and AWIFL3 achieves the ASIP goal of avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the willow flycatcher. Implementation of these conservation measures will help ensure that the existing abundance and distribution of the willow flycatcher in the project area are maintained.

CALFED Contribution to Species Conservation

The Restoration Project is not designed to specifically benefit the willow flycatcher, but will fully mitigate effects of project implementation on the species. Implementation of other CALFED program actions, however, are expected to substantially benefit the species. Appendix I lists the CALFED projects that are being implemented, or will be implemented in the near future, that will benefit the willow flycatcher (see Table I-1 in Appendix I for more information related to each project).

Appendix J identifies ecosystem restoration milestones described in the Programmatic BOs and NCCP Determination that will benefit willow flycatcher populations. These milestones are required to be achieved in the first 7 years of CALFED implementation, as a condition of the Programmatic BOs and NCCP Determination.

Golden Eagle and Foothill Yellow-Legged Frog

The golden eagle and foothill yellow-legged frog are MSCS evaluated species that could potentially be affected by Restoration Project actions, but are not

covered under the Programmatic BOs or NCCP Determination. Incidental take authorizations, therefore, cannot be provided for these species under Section 7 of the ESA or Section 2835 of the NCCPA. Table 4-17 summarizes the potential project effects, conservation measures, and expected outcomes for these species. A detailed assessment of baseline conditions and project effects on these species is provided in the EIS/EIR and is incorporated into the ASIP by reference.

Table 4-17. Summary of Project Effects, Conservation Measures, and Expected Outcomes for ASIP Evaluated Species That Are Not Covered under the Programmatic BOs and NCCP Determination

Species	Potential Project Effects	Conservation Measures	Expected Outcomes
Golden eagle	Potential disturbance to nesting golden eagles. Although no active golden eagle nests were observed during surveys, suitable nesting habitat exists in the project area.	Prior to construction activities during the breeding season (generally March through July) of each construction year, a qualified biologist will survey the project sites to locate active golden eagle nests. If a nest is occupied, Reclamation and/or the construction contractor will limit construction activities near the nest to the nonbreeding season (August 1 to March 1). A qualified biologist, designated by Reclamation, will establish a 500 foot–radius, direct-line-of-sight buffer for active golden eagle nests. In addition, Reclamation and/or the construction contractor will maintain a 0.5-mile direct-line-of-sight helicopter-exclusion zone around any active nests. The buffers, identified as work exclusion zones, will be delineated and marked as explained under the environmental commitments described in Chapter 2. These buffers will remain in place until the young have successfully fledged or the nest has failed as determined by a qualified biologist. The effectiveness of the buffer will be monitored by a qualified biologist, and the buffer will be readjusted if the nesting birds appear agitated from construction and other operations. If monitoring shows no impacts, the buffer distance may be reduced pending approval by DFG and USFWS. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation or feeding of young may be affected, project contacts at USFWS and DFG will be consulted before disturbance begins. If potential nesting habitat (i.e., traditional nest site and structure) must be affected during the breeding season, project contacts at USFWS and DFG will be consulted before disturbance begins. If a project site is farther than the 0.5-mile buffer zone, disturbance probably can be assumed insignificant, but a project contact at USFWS and DFG will be contacted for known occurrences of golden eagle in the study area.	Avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the golden eagle.
Yellow-legged frog	Potential disturbance of yellow-legged frog habitat.	Preconstruction surveys will be conducted, and if any frogs, tadpoles, or egg masses are found, exclusion areas will be constructed at the work sites, and all frogs will be removed from the exclusion areas and placed in a safe location. After construction, frog habitat will be restored.	Avoidance, minimization, and full mitigation of adverse effects of Restoration Project actions on the yellow-legged frog, as well as an ultimate increase in quantity of amphibian habitat as a result of increased minimum instream flows.

Figure 4.1. Seasonal Occurrence of Selected Life Stages of Anadromous Salmonids in the Upper Sacramento River

Life Stage	Species	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Migration	Steelhead												
	Winter-run Chinook				X								
	Spring-run Chinook					X							
	Fall-run Chinook										X		
	Late fall–run Chinook	X											
Spawning	Steelhead												
	Winter-run Chinook						X						
	Spring-run Chinook									X			
	Fall-run Chinook											X	
	Late fall–run Chinook		X										
Juvenile Residence	Steelhead												
	Winter-run Chinook												
	Spring-run Chinook												
	Fall-run Chinook												
	Late fall–run Chinook												

Notes

Source: Schafter 1980; Vogel and Marine 1991.

X denotes the approximate peak of life stage if a significant peak occurs.

Figure 4-2

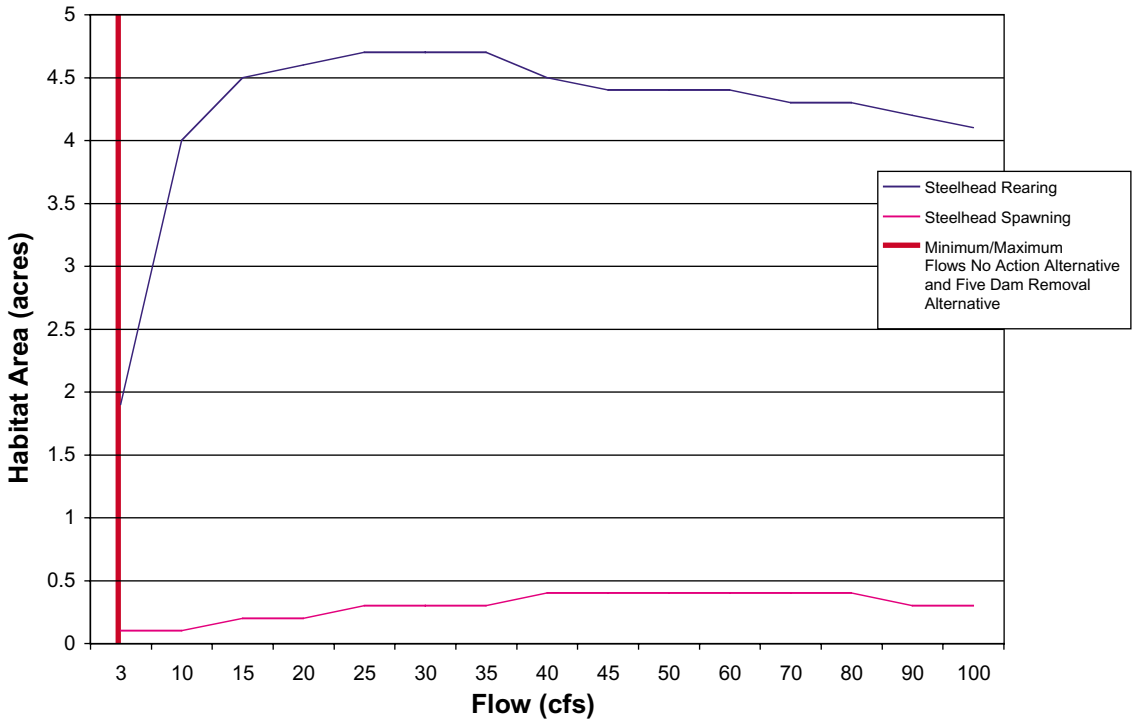
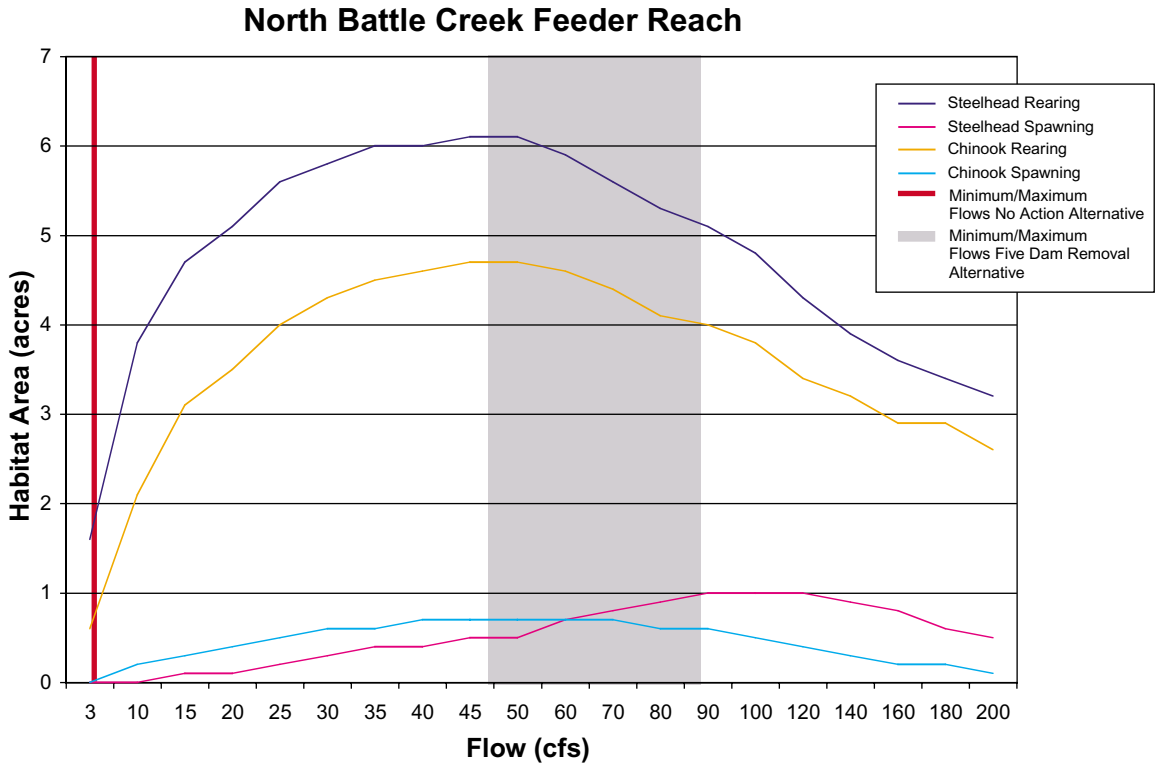


Figure 4-3



03035.03 ASIP

Figures 4-2 and 4-3
Spawning and Rearing Habitat in the Keswick Reach and North Battle Creek Feeder Reach of North Fork Battle Creek

Figure 4-4

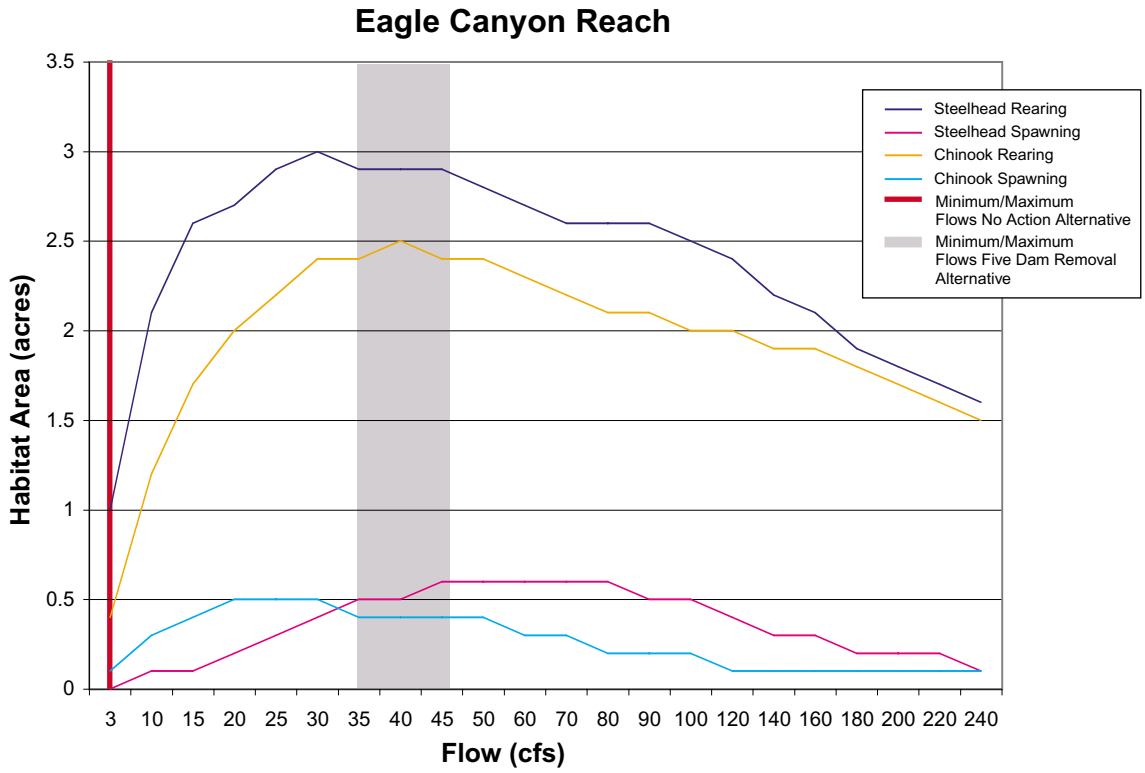
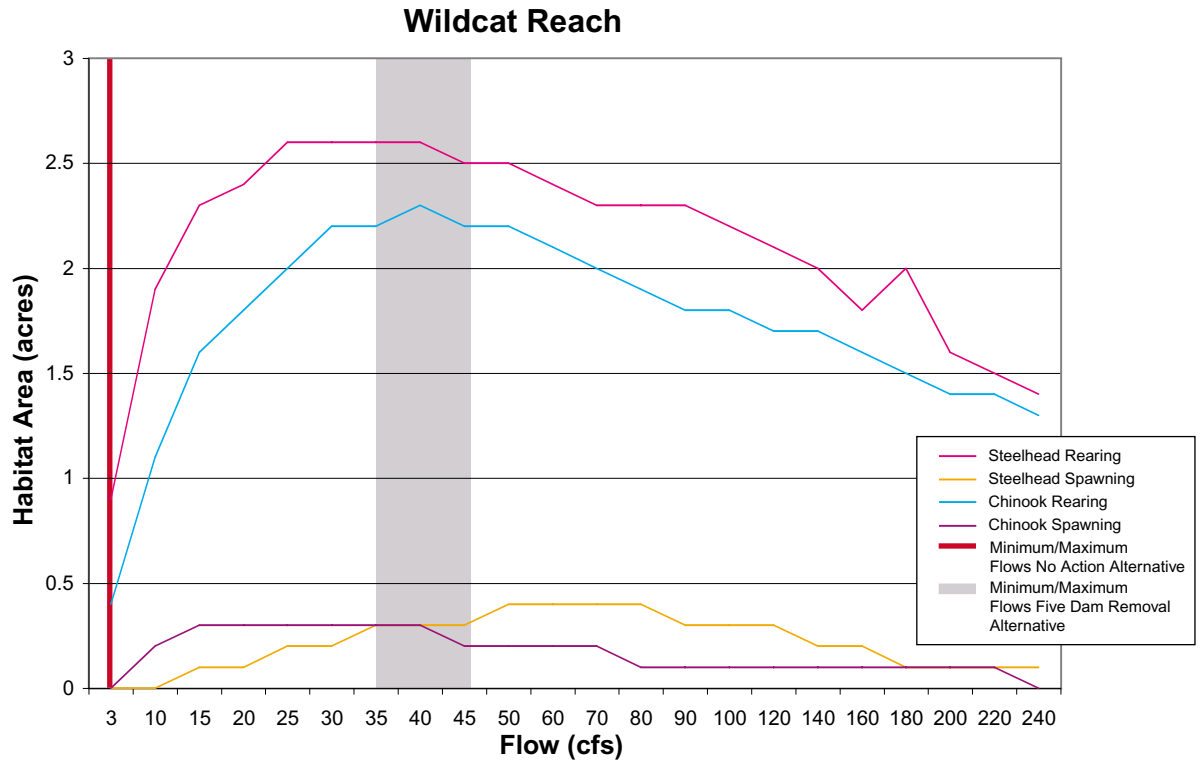


Figure 4-5



03035.03 ASIP

Figures 4-4 and 4-5
Spawning and Rearing Habitat in the Eagle Canyon Reach and Wildcat Reach of North Fork Battle Creek

Figure 4-6

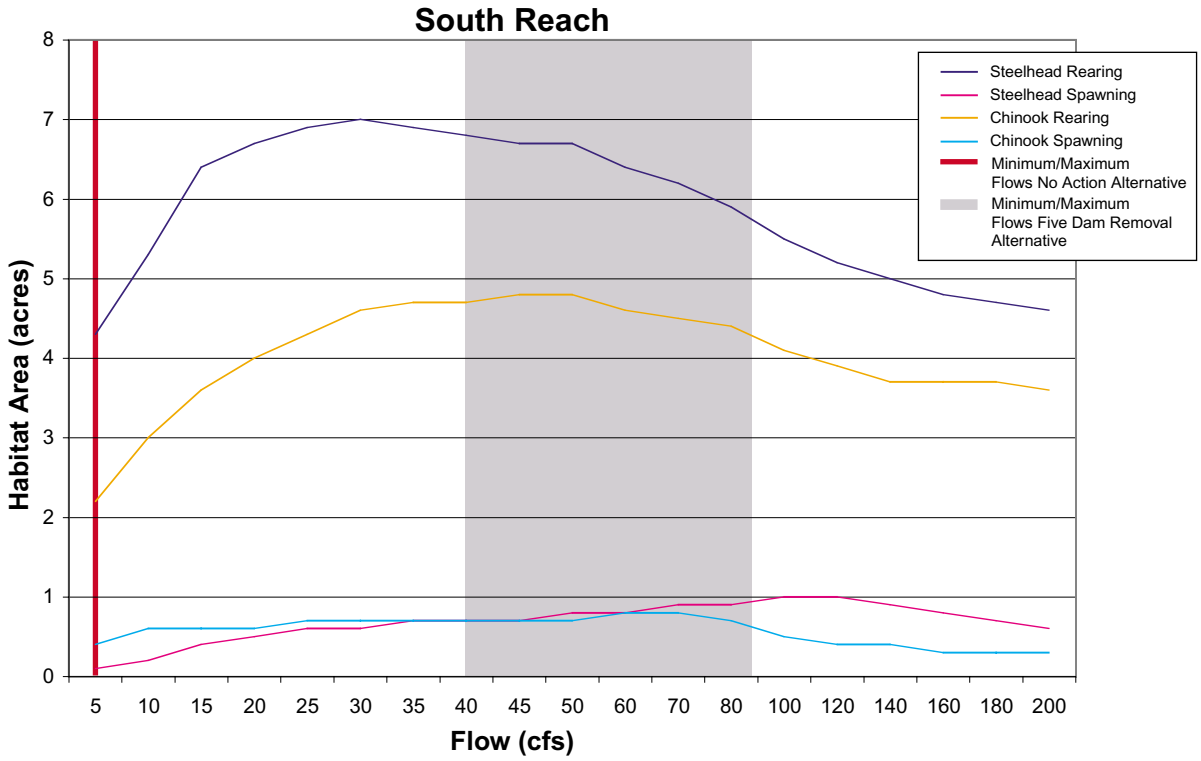
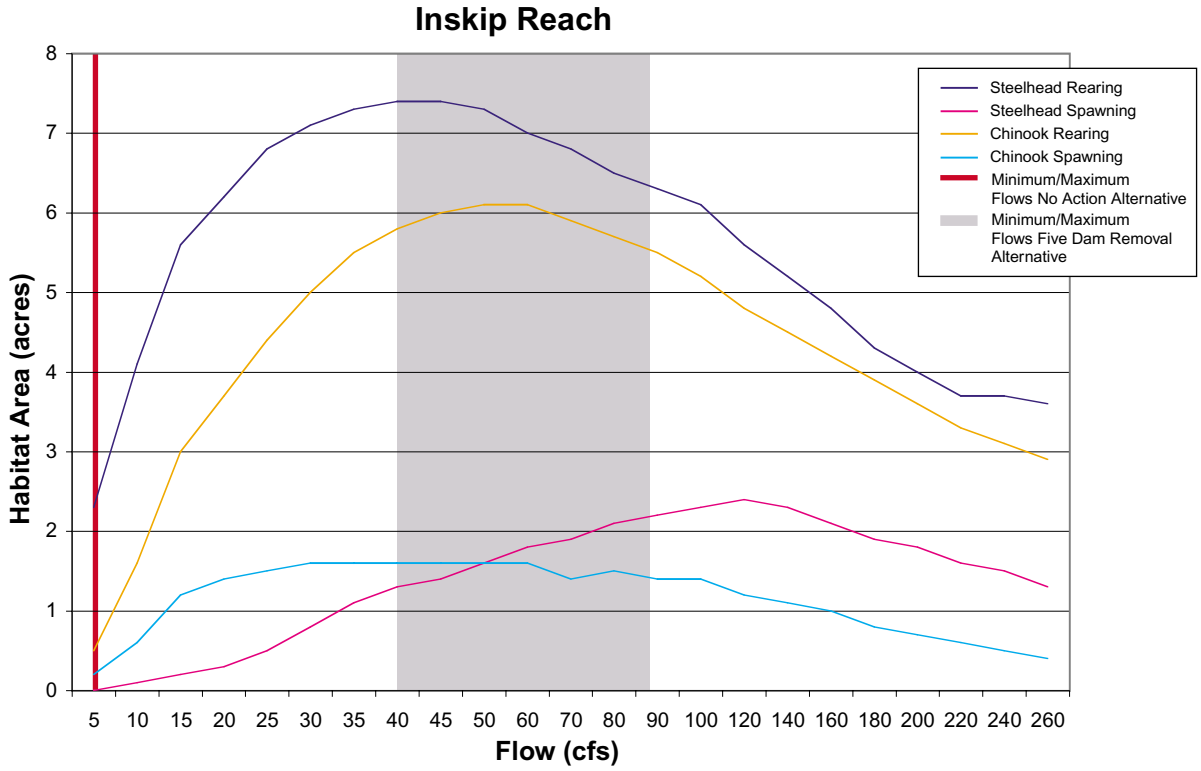


Figure 4-7



03035.03 ASIP

Figures 4-6 and 4-7
Spawning and Rearing Habitat in the South Reach and Inskip Reach of South Fork Battle Creek

Figure 4-8

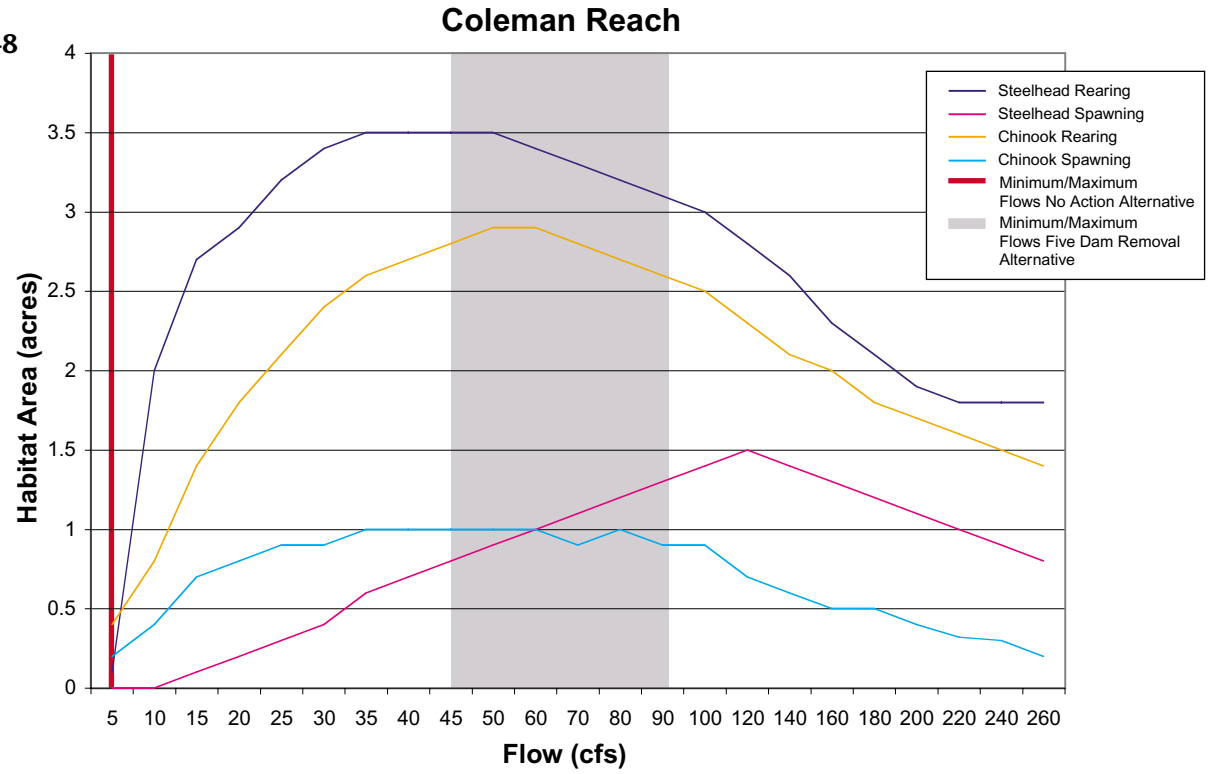
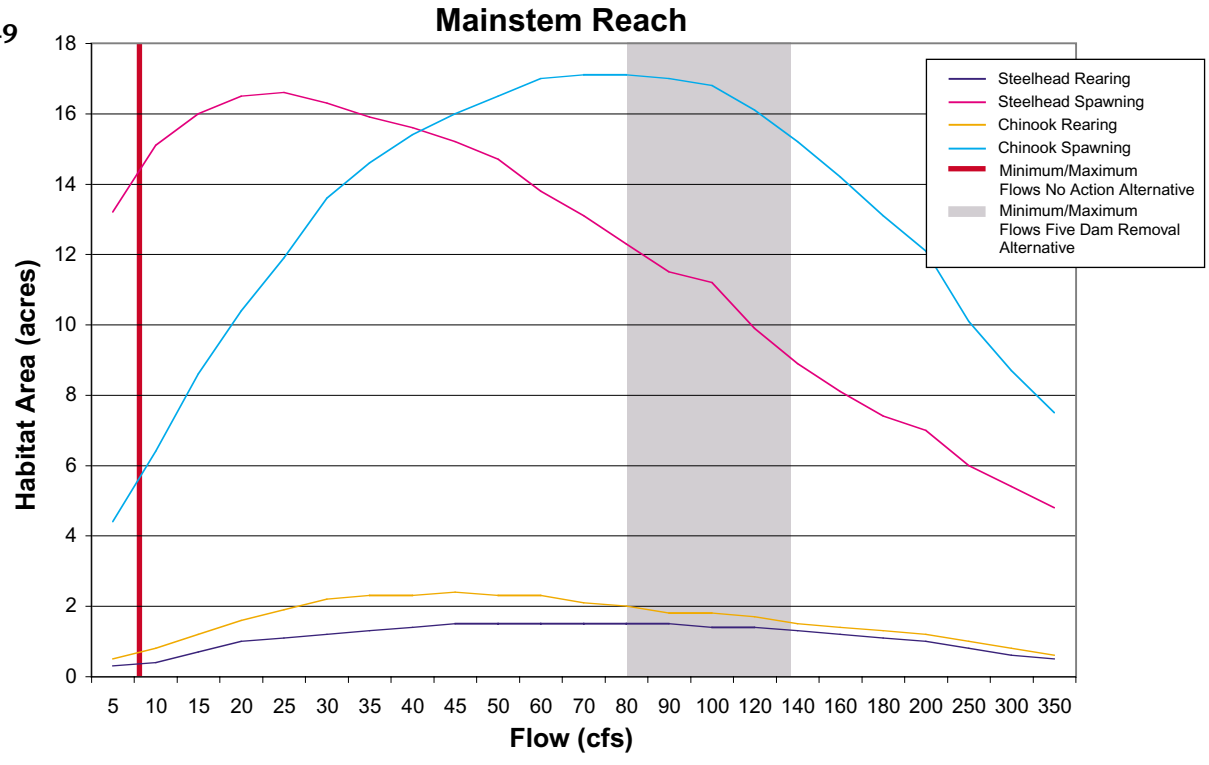
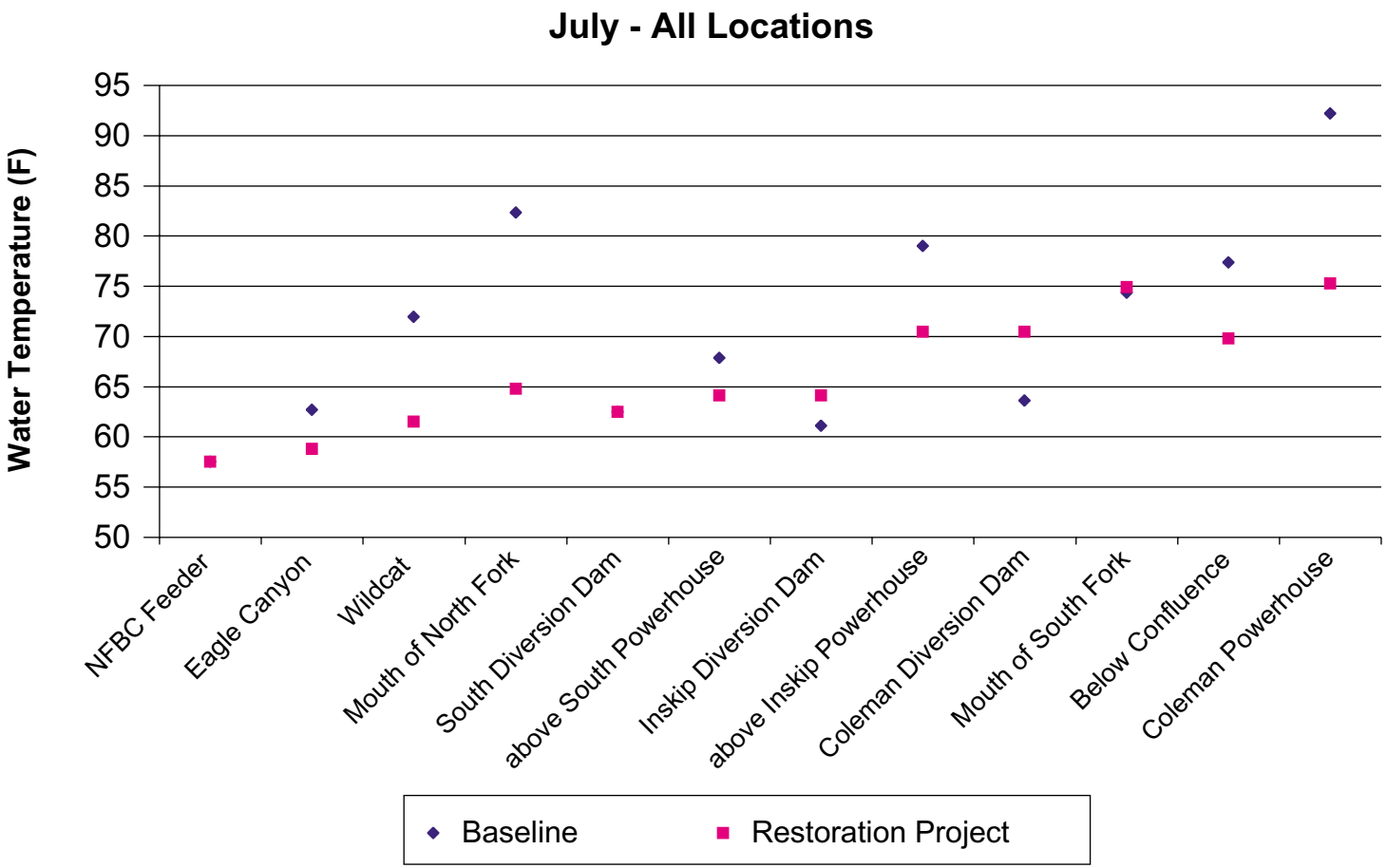


Figure 4-9



03035.03 ASIP

Figures 4-8 and 4-9
Spawning and Rearing Habitat in the Coleman Reach and Mainstem Reach of South Fork Battle Creek



03035.03 ASIP

Figure 4-10
Estimated Average July Water Temperature for Selected Locations on Battle Creek, Minimum Instream Flow Requirements under Baseline Conditions and for the Restoration Project

Figure 4-11

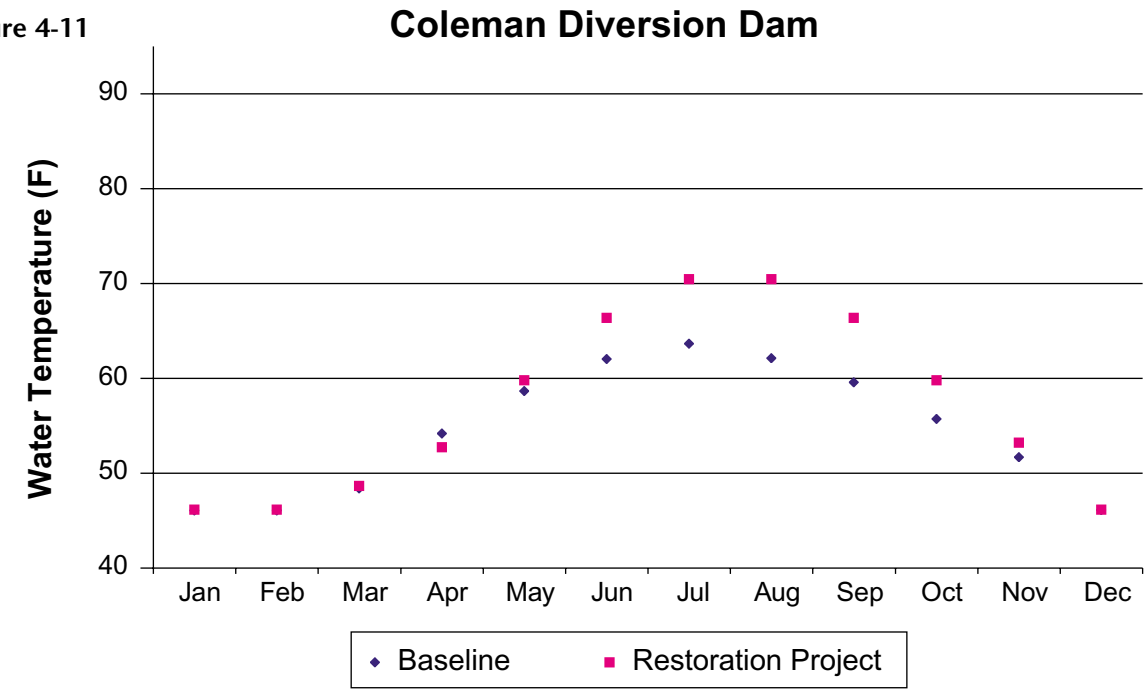
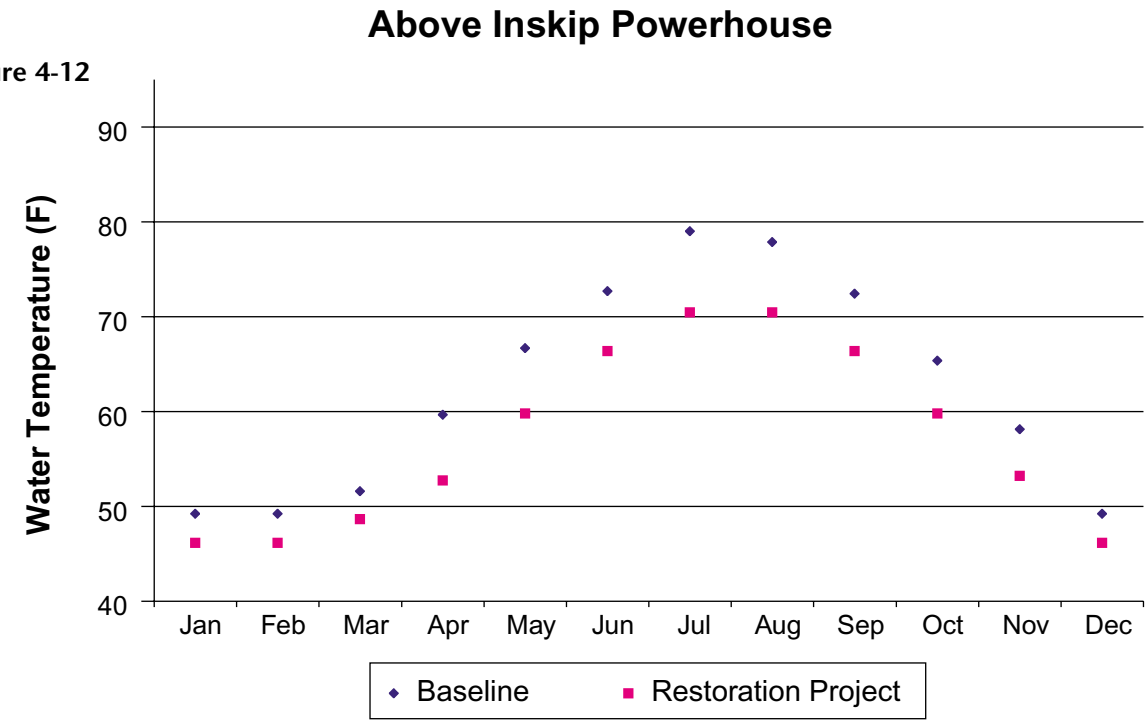


Figure 4-12



0303503 ASIP

Figures 4-11 and 4-12
Estimated Average Monthly Water Temperature at Coleman Diversion Dam and above Inskip Powerhouse, Minimum Instream Flow Requirements under Baseline Conditions and for the Restoration Project

Figure 4-13

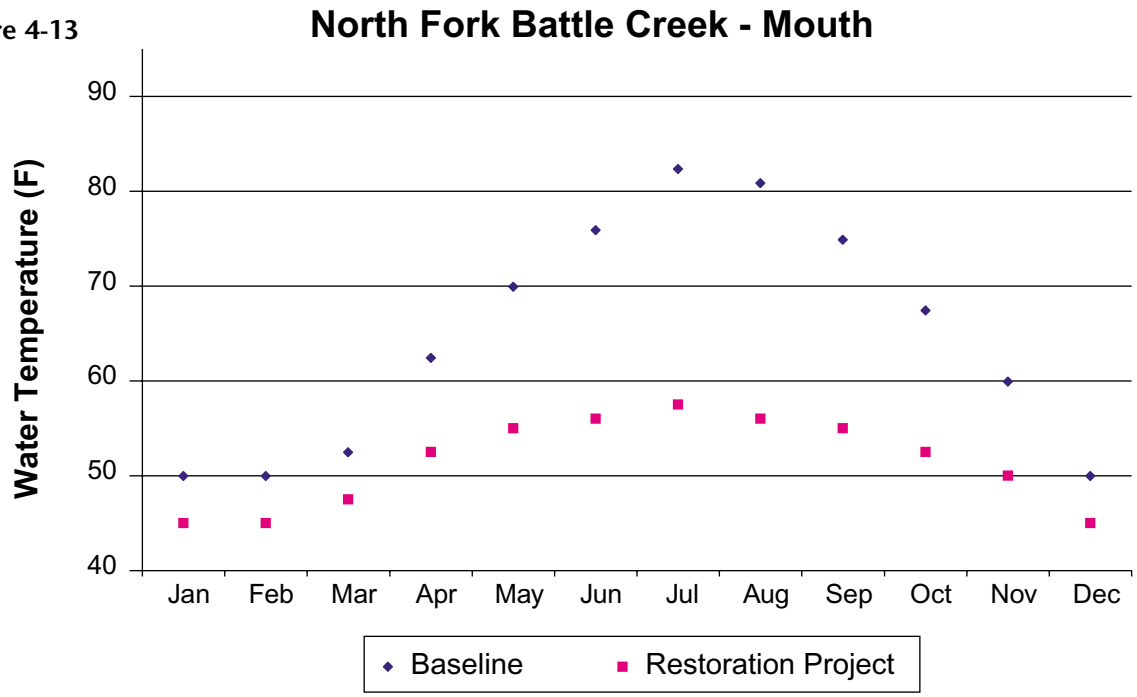
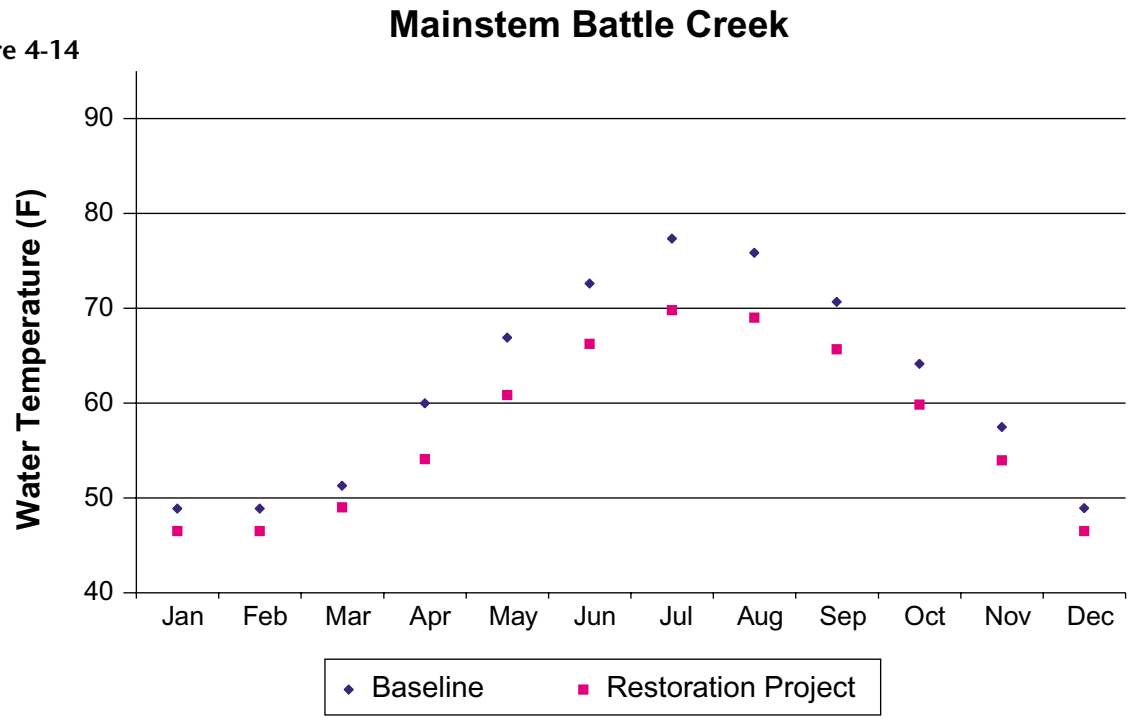


Figure 4-14

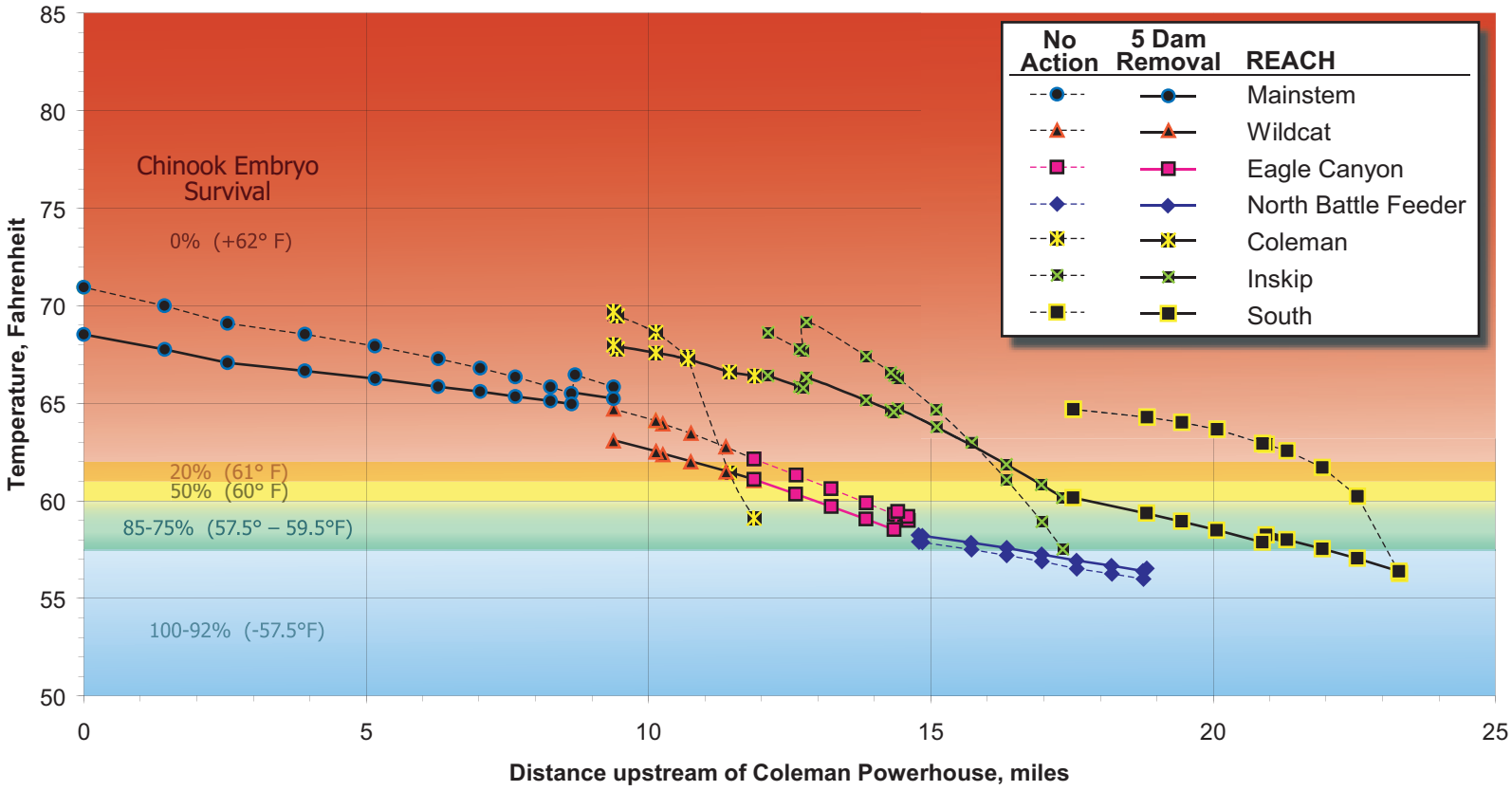


03035.03 ASIP

Figures 4-13 and 4-14
Estimated Average Monthly Water Temperature at the Mouth of North Fork Battle Creek and on the Mainstem of Battle Creek, Minimum Instream Flow Requirements under Baseline Conditions and for the Restoration Project

SNTEMP Temperature Model

Daily Average Water Temperature Profile in June, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative Compared to No Action Alternative
Temperature Response of Developing Winter-run Chinook Embryos



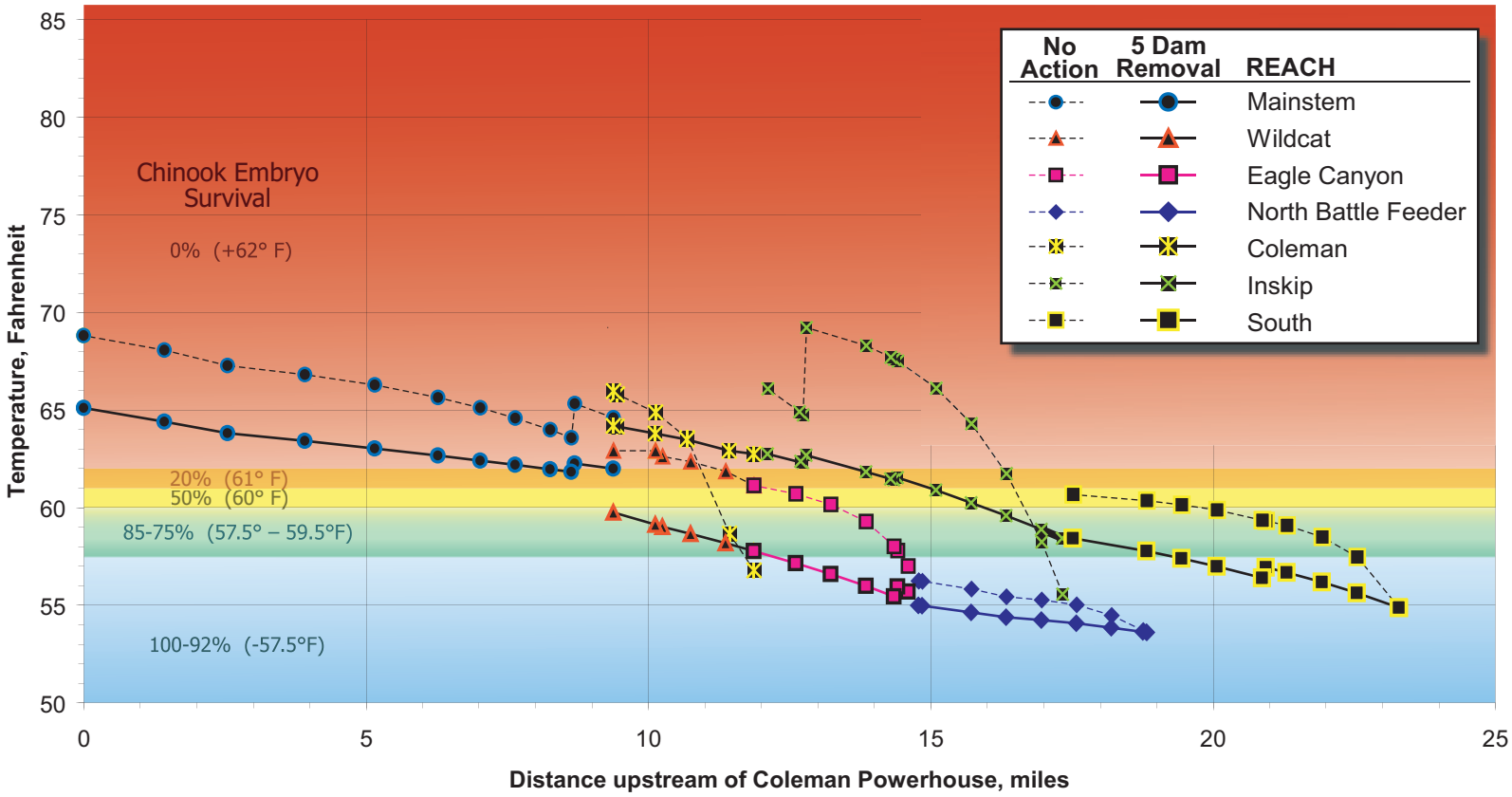
03035.03

Jones & Stokes

Figure 4-15
Temperature Response of Developing Winter-run Chinook Embryos

SNTEMP Temperature Model

Daily Average Water Temperature Profile in September, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative Compared to No Action Alternative
Temperature Response of Developing Spring-run Chinook Embryos



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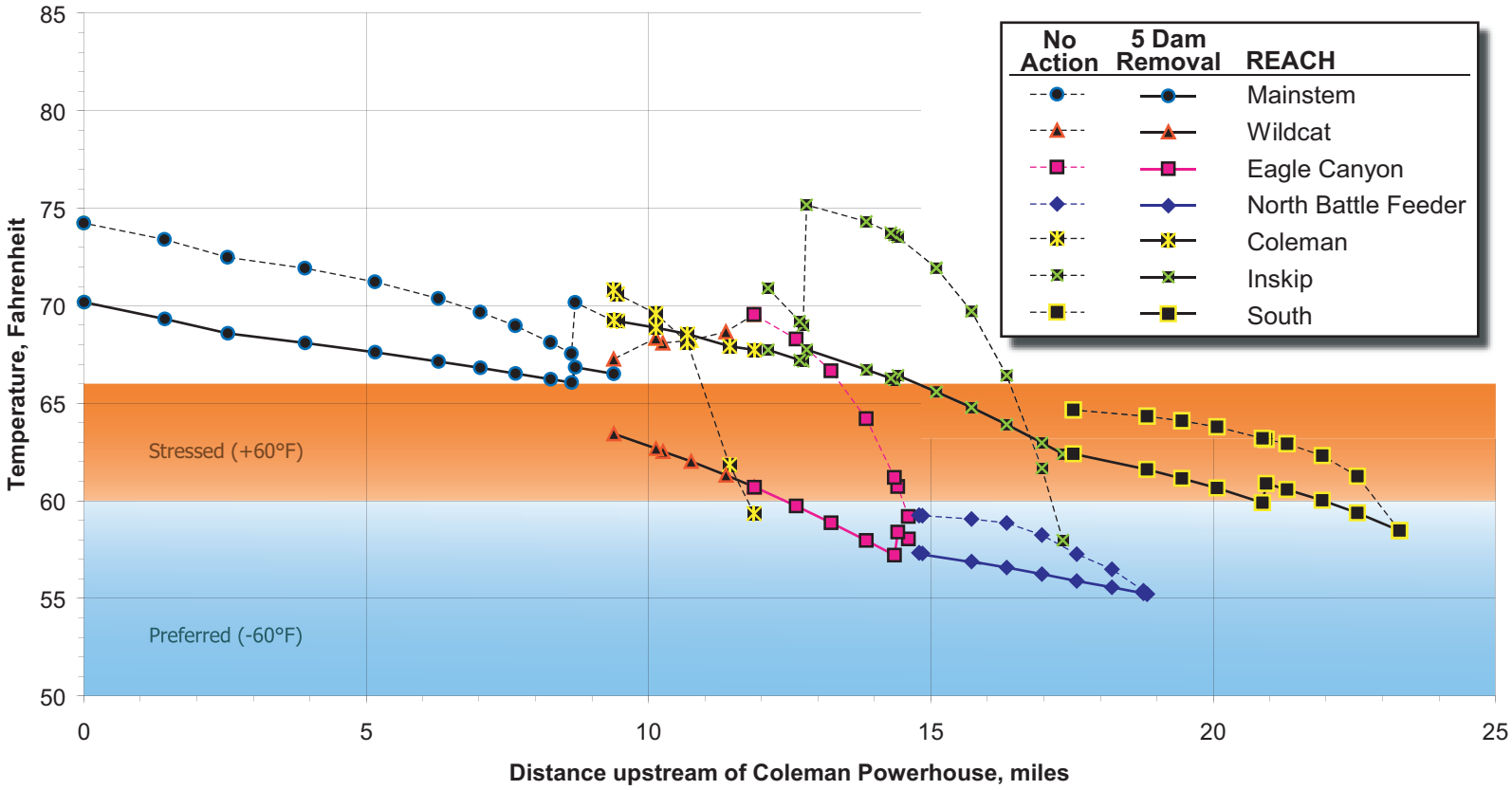
Jones & Stokes

Figure 4-16
Temperature Response of Developing Spring-run Chinook Embryos

SNTEMP Temperature Model

Daily Average Water Temperature Profile in August, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative compared to No Action Alternative
Temperature Response of Over-summering Spring-run Chinook



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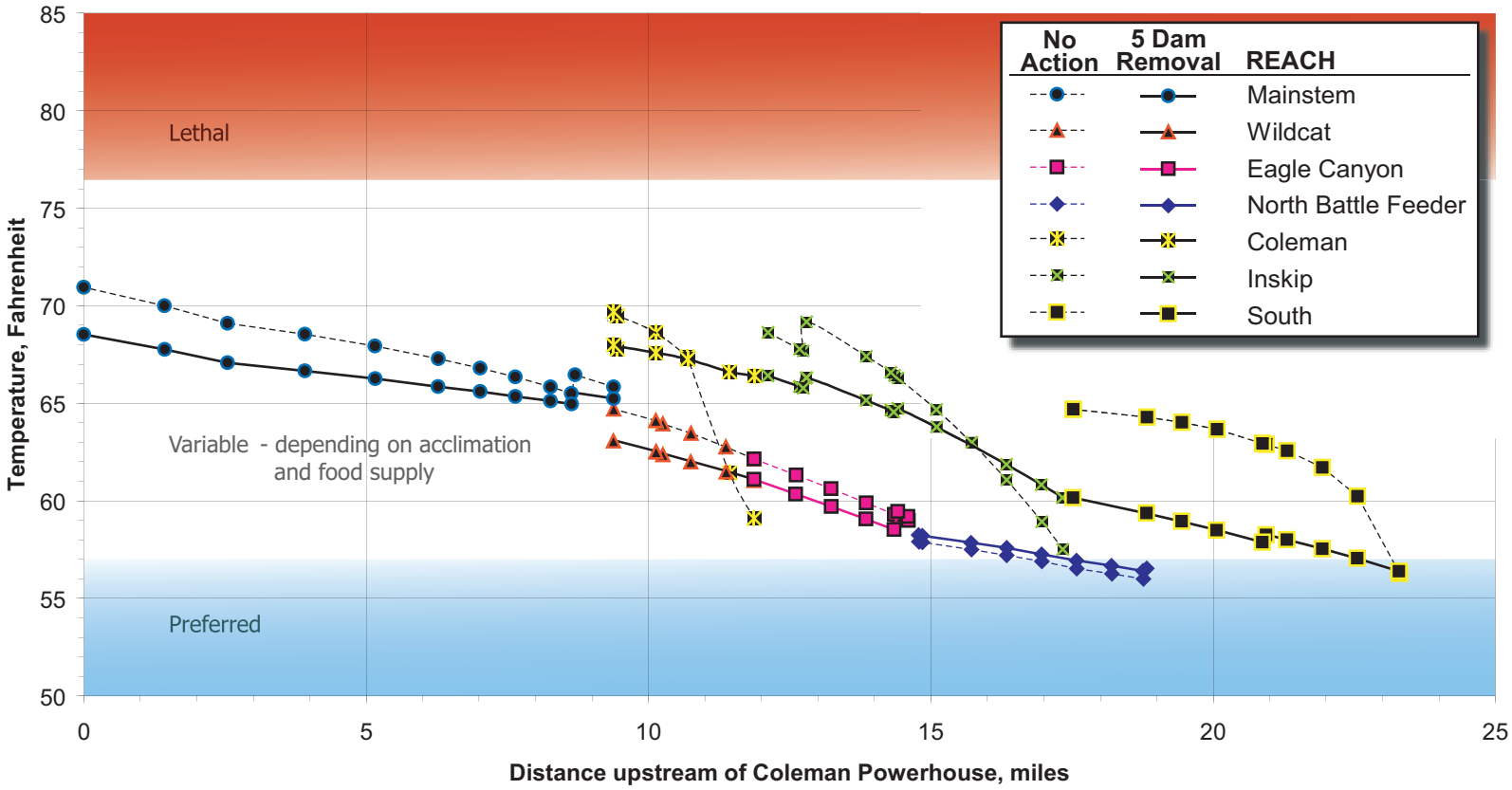
Jones & Stokes

Figure 4-17
Temperature Response of Over-summering Spring-run Chinook Adults

SNTEMP Temperature Model

Daily Average Water Temperature Profile in June, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative Compared to No Action Alternative
Temperature Response of Chinook Juveniles



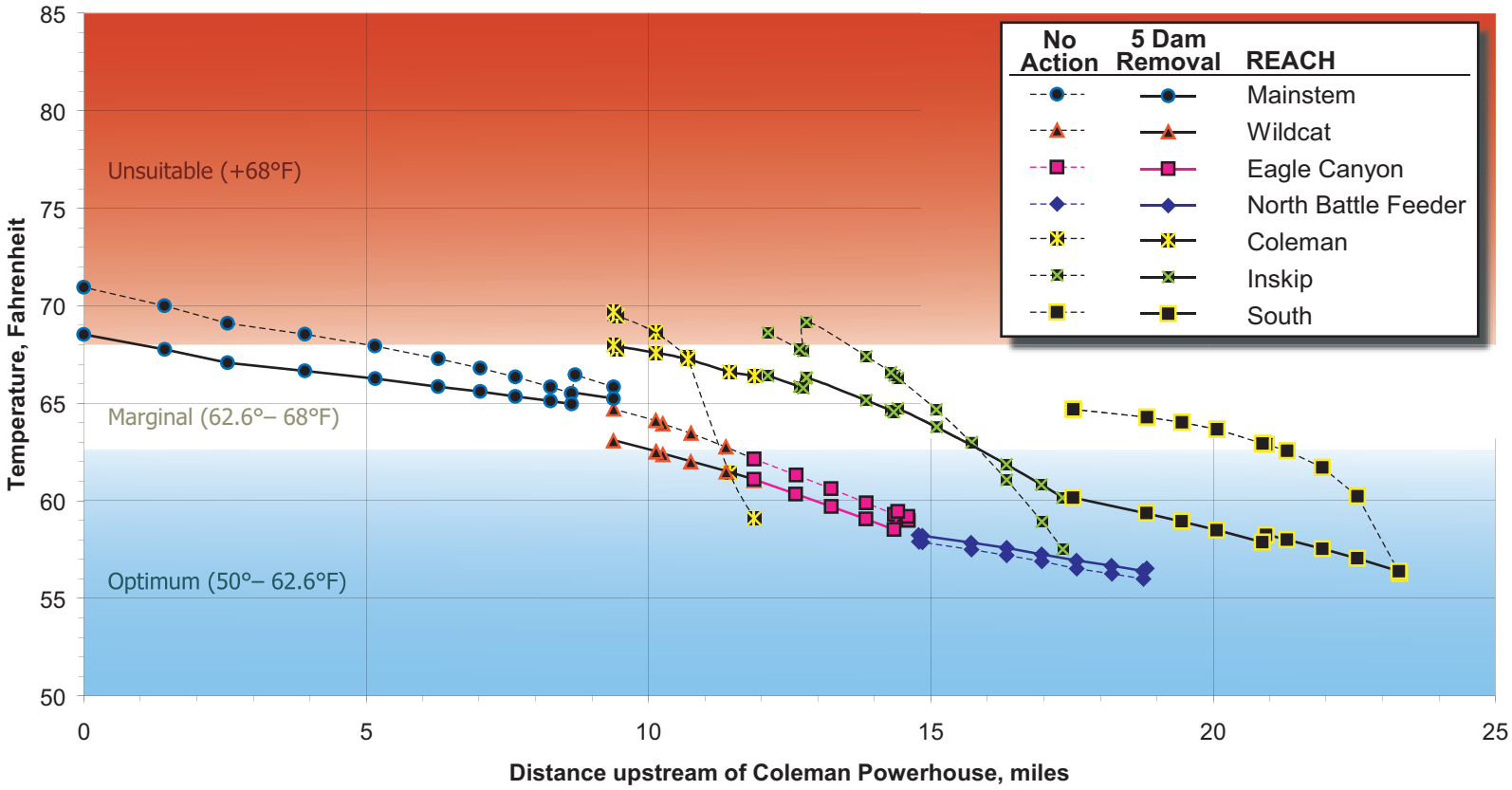
03035.03

Jones & Stokes

Figure 4-18
Temperature Response of Chinook Juveniles

SNTEMP Temperature Model

Daily Average Water Temperature Profile in June, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative Compared to No Action Alternative
Temperature Tolerance of Chinook Smolts



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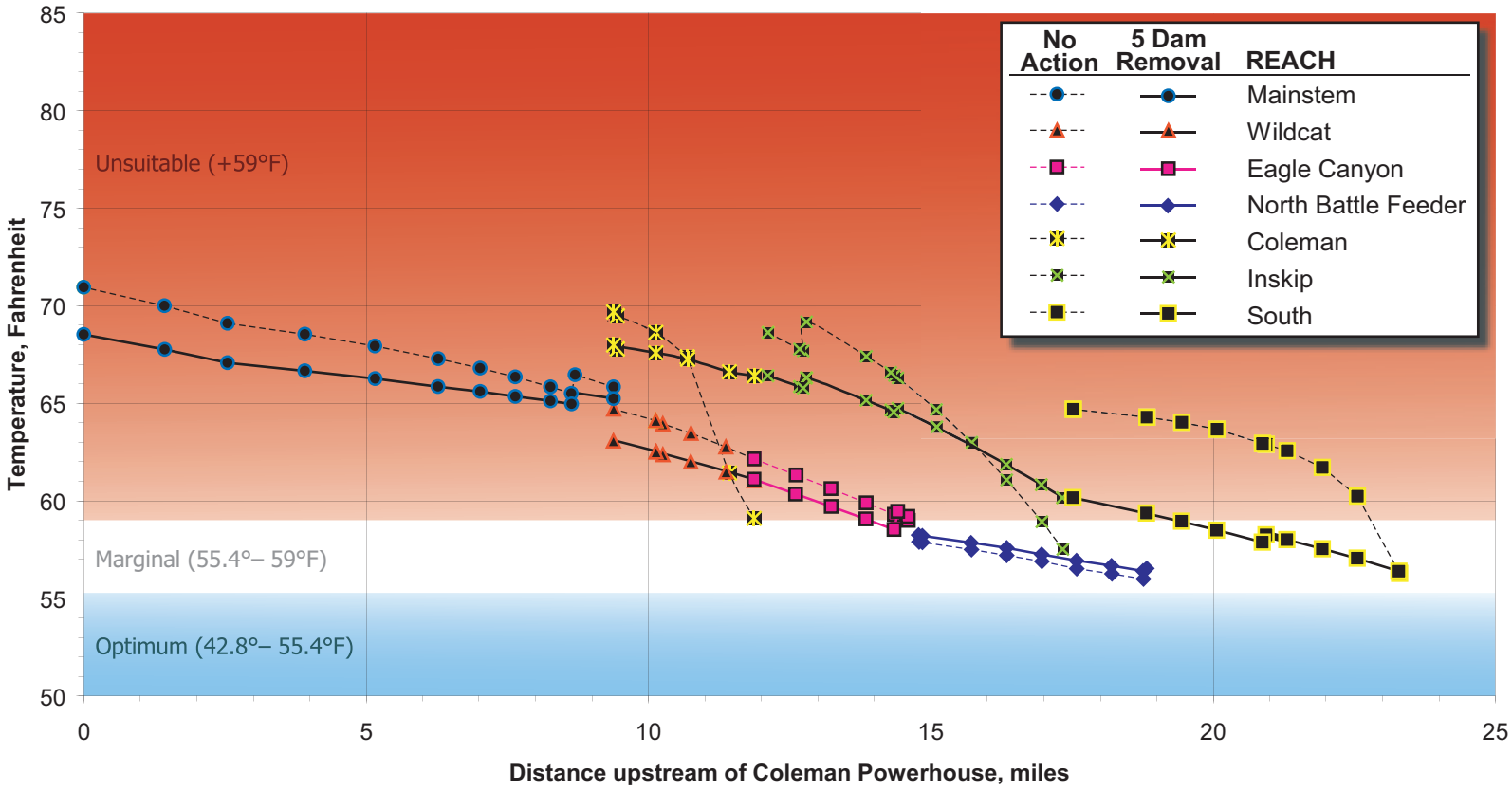
Jones & Stokes

Figure 4-19
Temperature Tolerance of Chinook Smolts

SNTEMP Temperature Model

Daily Average Water Temperature Profile in June, Normal Water Year Condition
Under Minimum Flows for Five Dam Removal Alternative Compared to No Action Alternative
Temperature Tolerance of Steelhead Smolts



03035.03

Jones & Stokes

Figure 4-20
Temperature Tolerance of Steelhead Smolts

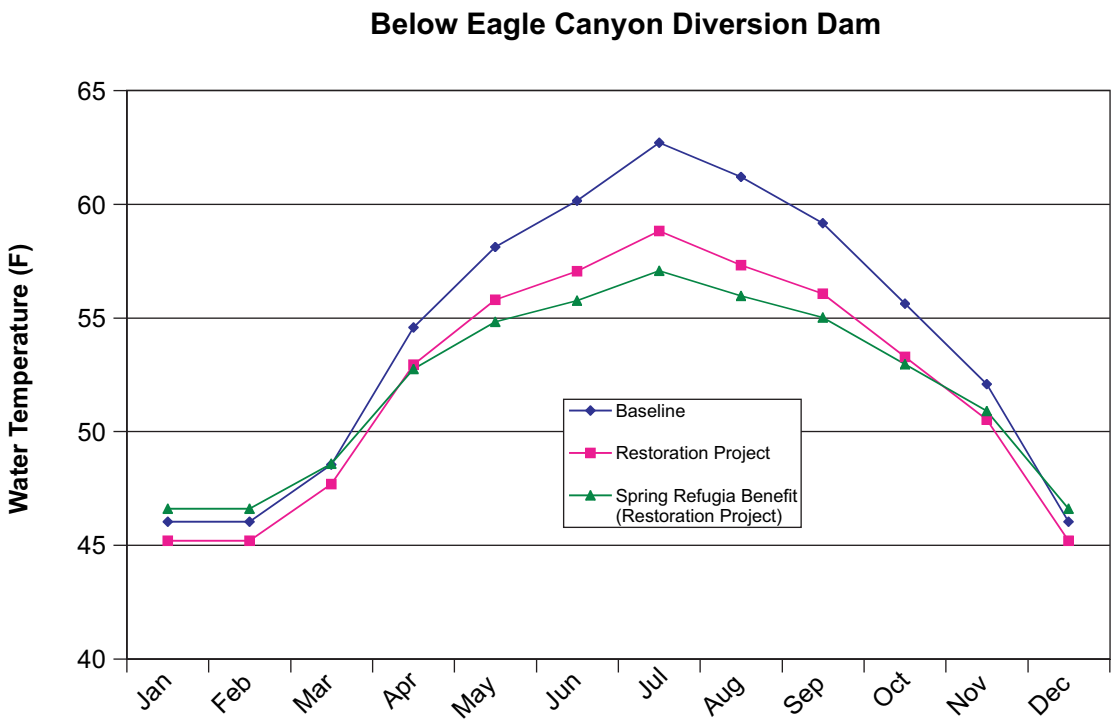


Figure 4-21. Water Temperature Effects to North Fork Battle Creek below Eagle Canyon Diversion Dam.

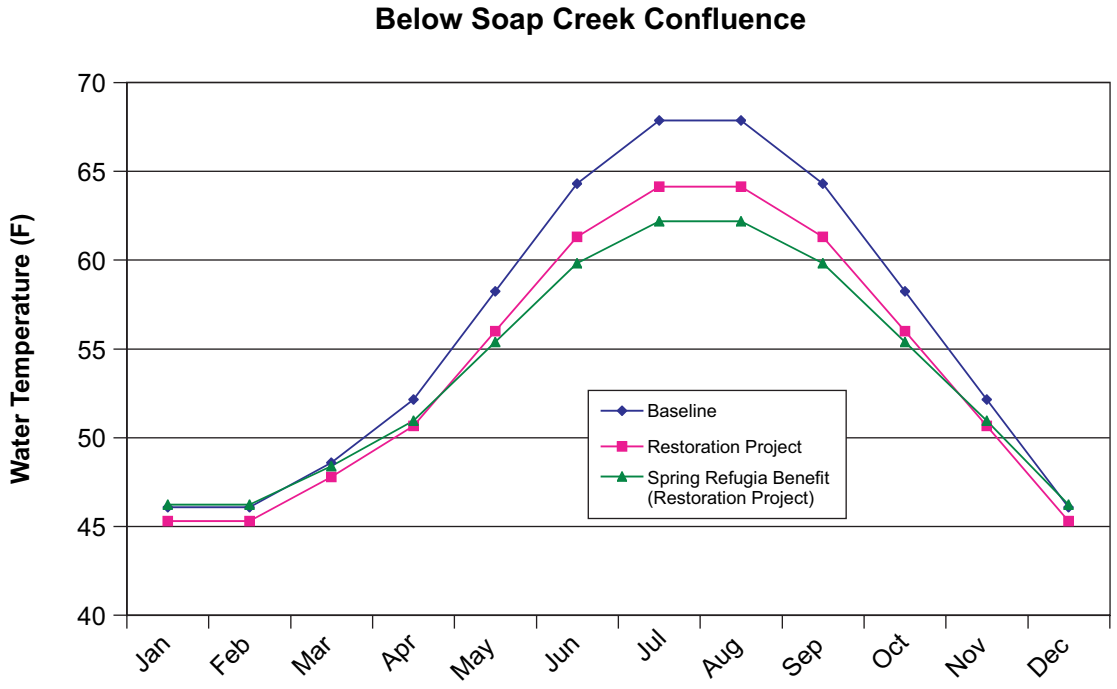
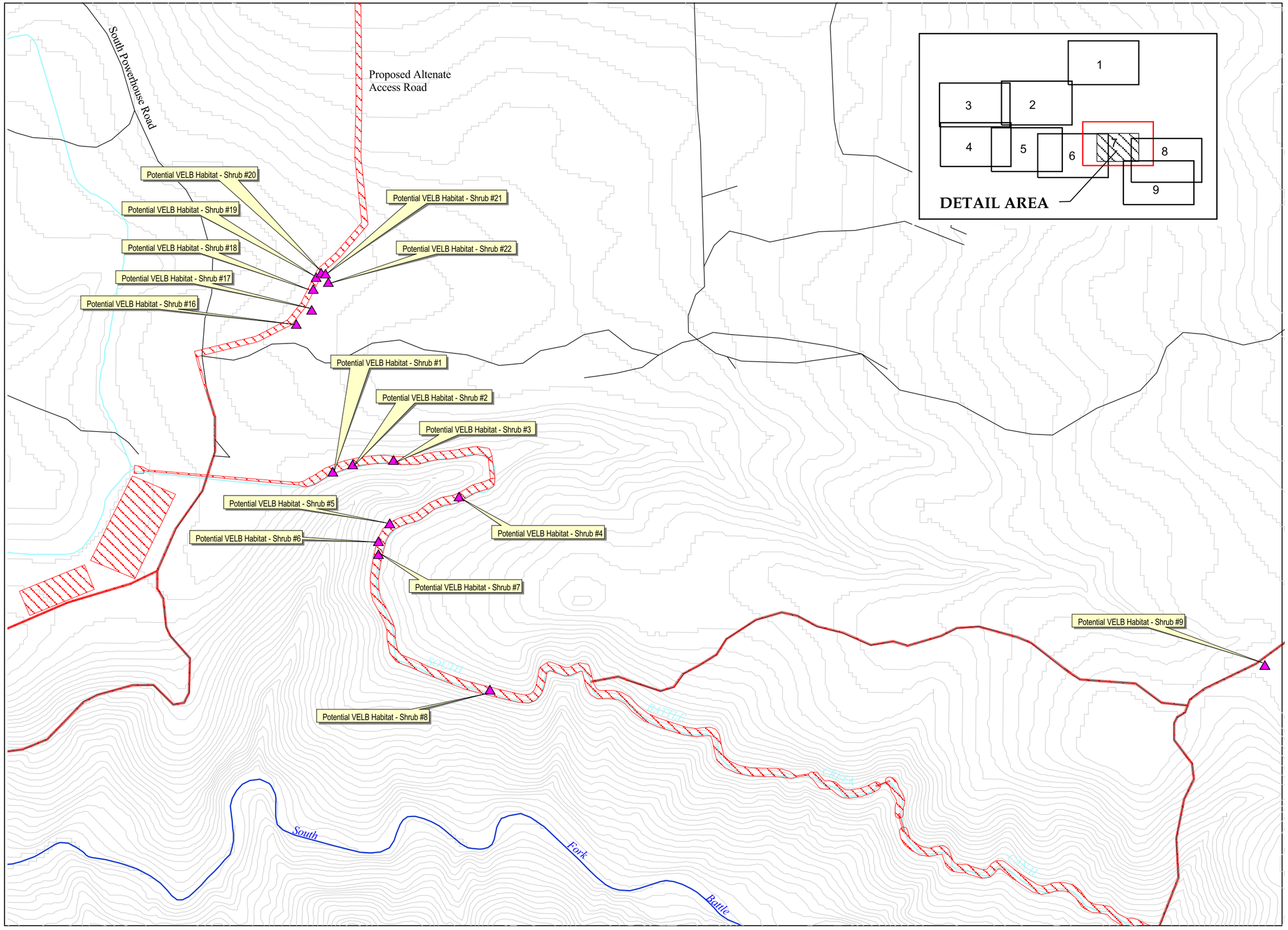


Figure 4-22. Water Temperature Effects to South Fork Battle Creek below the Soap Creek Confluence.

Potential Valley Elderberry Longhorn Beetle Habitat Documented along Aternative Access Road to Inskip Diversion Dam/ South Powerhouse

Figure 4-23



LEGEND

- Road
- Construction Activity Physical Disturbance
- Canal or Tunnel
- Contour Interval 5 Meters
- Potential VELB Habitat

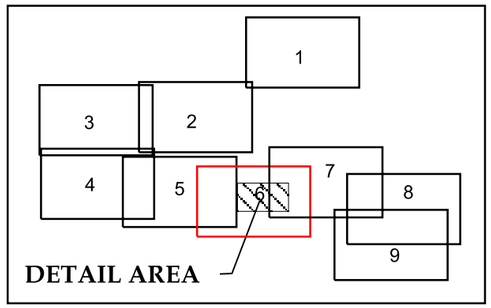
N

0 200 400

METERS

Potential Valley Elderberry Longhorn Beetle Habitat Documented at Inskip Diversion Dam - South Powerhouse

Figure 4-24



LEGEND

- Powerhouse
- Dam
- Road
- Proposed Construction Area/ Physical Disturbance
- Canal or Tunnel
- Contour Interval 5 Meters
- Potential VELB Habitat

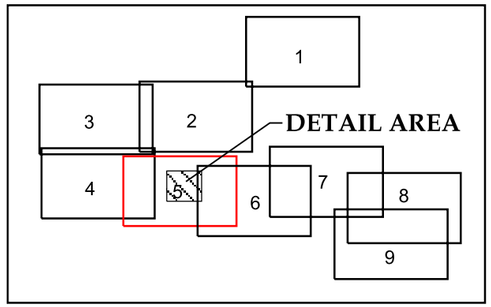
N

0 100 200

METERS

Potential Valley Elderberry Longhorn Beetle Habitat Documented at Lower Ripley Creek Feeder

Figure 4-25



Potential VELB Habitat - Shrub #11

Potential VELB Habitat - Shrub #12

Lower Ripley Creek Feeder

Creek

INSKIP

Ripley

CANAL

South Fork Battle Creek

LEGEND

- Dam
- Road
- Construction Activity Physical Disturbance
- Canal or Tunnel
- Contour Interval 5 Meters
- Potential VELB Habitat

N

0 100 200

METERS

Potential Valley Elderberry Longhorn Beetle Habitat Documented along Access Road to South Diversion Dam

Figure 4-26

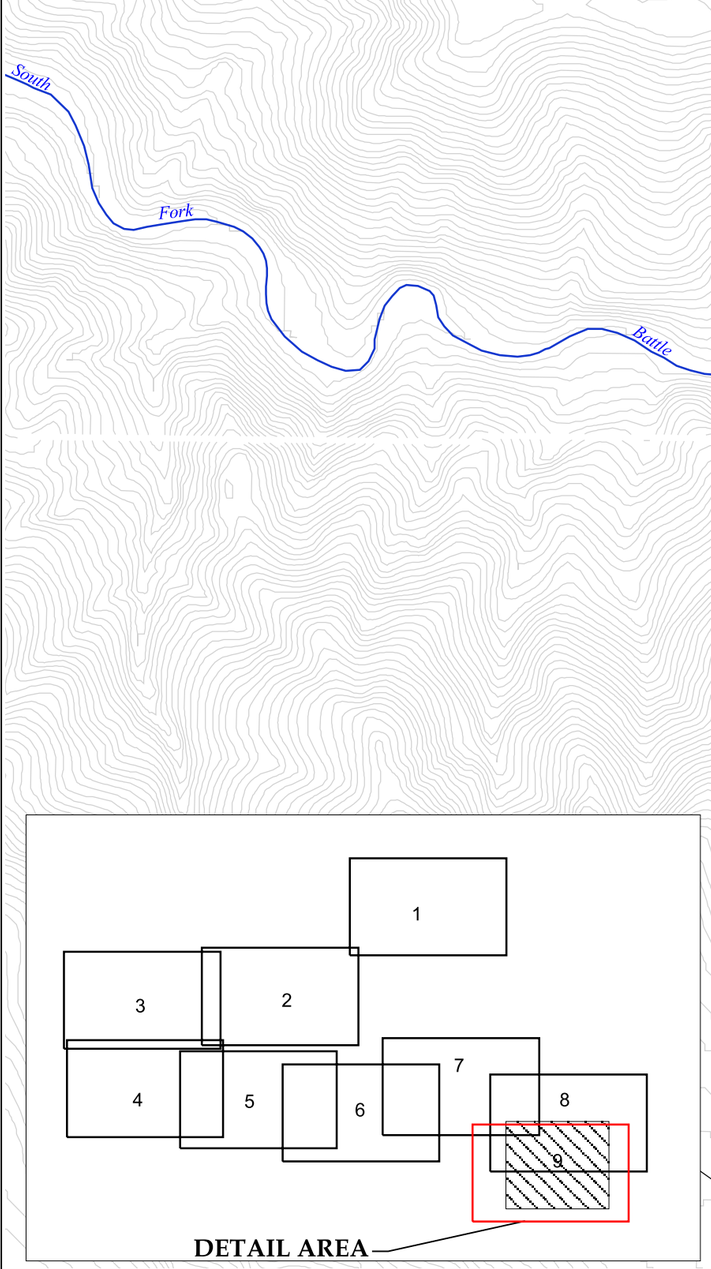
Tunnel

Potential VELB Habitat - Shrub #13

South Fork Battle Creek

SOUTH BATTLE CREEK CANAL

South Diversion Dam



LEGEND

- Dam
- Road
- Proposed Construction Area/ Physical Disturbance
- Canal or Tunnel
- Contour Interval 5 Meters
- Potential VELB Habitat

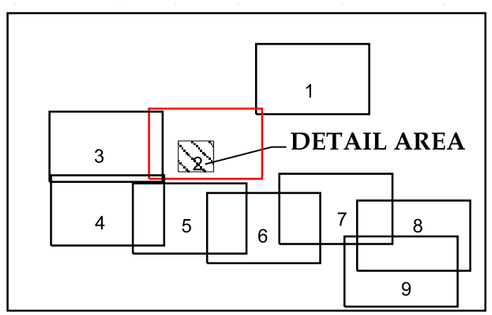
N

0 200 400

METERS

Potential Valley Elderberry Longhorn Beetle Habitat Documented at Eagle Canyon Diversion Dam

Figure 4-27



Potential VELB Habitat - Shrub #14

Eagle Canyon Diversion Dam

Battle Creek

CANAL

North Fork

CANYON

EAGLE

Road

Access

Eagle Canyon

LEGEND

- Dam
- Road
- Proposed Construction Area/ Physical Disturbance
- Canal or Tunnel
- Contour Interval 5 Meters
- Potential VELB Habitat

N

0 100 200

METERS