Chapter 5
Consultation and Coordination

Introduction

This chapter describes the consultation and coordination associated with the Restoration Project. Public involvement, agency and PG&E[1] involvement, and environmental laws, regulations, and executive orders are discussed.

Because of the federal and state actions associated with the Restoration Project, compliance with both NEPA (40 CFR 1500-1508) and CEQA (Public Resources Code §21000 *et seq*.) is required. As the federal lead agency, Reclamation is responsible for complying with all applicable environmental laws and regulations associated with the Restoration Project, including NEPA. FERC, a cooperating federal agency, is responsible for ensuring that the proposed modifications to the Hydroelectric Project associated with the Restoration Project comply with all applicable environmental laws and regulations, including NEPA, prior to issuing a license amendment for the Hydroelectric Project. Corps Individual and Nationwide Permits and FERC licensing actions in California, including new licenses, material license amendments, and relicensing, require CWA (33 USC 1251 *et seq*.) Section 401 water quality certification from the State Water Board. The State Water Board is the state lead agency for ensuring CEQA compliance. NEPA and CEQA compliance will be fulfilled through the preparation of a joint EIS/EIR.

Public Involvement

Public Scoping

Public involvement is a vital and required component of the NEPA and CEQA processes. Scoping is a process to gather input from the public, including their issues and concerns and, together with technical input and agency considerations, to define the significant issues to be addressed in the environmental document. NEPA regulations (40 CFR 1500 *et seq.*) define *scoping* as "an early and open process for determining the scope of issues to be addressed, and for identifying

[1] PG&E, the utility regulated by the California Public Utility Commission, owned the Battle Creek Hydroelectric Project (FERC Project No. 1121) at the time this document was prepared.

the significant issues related to the proposed action." The CEQA guidelines (Title 14 CCR §§15000 *et seq*.) require scoping meetings under limited circumstances and encourages scoping activities; however, it is encouraged.

The main objectives of the scoping process are to:

- provide the public and potentially affected agencies with adequate information and time to review and provide oral and/or written comments on a project,
- help ensure that issues related to the project are identified early and properly studied,
- ensure that the project alternatives are balanced and thorough, and
- prepare the appropriate environmental documentation.

Reclamation placed a Notice of Intent to prepare an EIS/EIR and notice of a public scoping meeting in the *Federal Register* on January 12, 2000. A brief description of the proposed Restoration Projec and details on the public scoping meeting were included in the notice.

A joint federal and state public scoping meeting was held on January 31, 2000, at the Manton School Gymnasium in Manton, California. During this meeting, the public was presented with an overview of the Restoration Project, including the purpose and need for the project, a project description, and the current project alternatives. In addition, written and oral comments were received from the public at this meeting.

The State Water Board issued a Notice of Preparation of a draft EIS/EIR for the Restoration Project on April 12, 2000. The notice was circulated through the State Clearinghouse for agency review and comment on April 13, 2000.

The Scoping Report[2] provides an overview of the Restoration Project; describes the environmental compliance process associated with the Restoration Project, including the role of public scoping; discusses the public scoping meeting; describes Restoration Project alternatives; and contains comments received throughout the scoping process.

Public Participation in Restoration Project Meetings

In addition to the public scoping process, public participation has been encouraged and has occurred at Restoration Project meetings. Public input received at Restoration Project meetings, including the BCWG, Environmental and Technical Design Team, and PMT meetings, has been used throughout the development of the EIS/EIR.

[2] The Scoping Report is available on Reclamation's web site at http://www.mp.usbr.gov/regional/battlecreek.

Public Review of the Draft Environmental Impact Statement/Environmental Impact Report

The release of the draft EIS/EIR is another opportunity for the public to provide input on the analysis of the environmental effects of the proposed project and the other alternatives examined in the EIS/EIR. The draft EIS/EIR was released for a 90-day public review on July 18, 2003. Responses to the comments received during the review of the draft EIS/EIR are included in Volume III of this Final EIS/EIR.

In addition to responding to and publishing responses to comments received during the 90-day public review of the Draft EIS/EIR, Reclamation with participation from the Battle Creek Project Management Team (PMT) and Technical Team members conducted two public information workshops in Manton, California, for stakeholders and members of the public (July 23, 2003, and August 12, 2003). On March 15, 2004, Reclamation with participation from the PMT, Technical Team members, and the Nature Conservation, and CHRC held a public meeting in Red Bluff, California, specifically to address public questions about the incremental benefits between the proposed Restoration Project and the Eight Dam Removal Alternative, which has been eliminated from further consideration (see Master Response B in Chapter 2 of this volume). Public comments have been encouraged at all public meetings on the Restoration Project.

Public Review of the Draft Supplemental EIS/ Revised EIR

After the close of the public comment period for the Draft EIS/EIR, Reclamation and the State Water Board began responding to comments that had been received during public review. As a result of this process, and subsequent reviews that were performed outside the NEPA/CEQA process, it became evident that significant new information would need to be added to the Draft EIS/EIR. Therefore, Reclamation and the State Water Board recirculated portions of the Draft EIS/EIR for public comment in the Draft Supplemental EIS/Revised EIR.

The public comment period for the Draft Supplemental EIS/Revised EIR began on March 1, 2005, with an announcement of the availability of the Draft Supplemental EIS/Revised EIR. The formal public comment period closed on April 29, 2005.

Copies of the Draft Supplemental EIS/Revised EIR were distributed to the public, interested parties, federal and state agencies, local governments, elected officials, and various non-governmental groups. In addition, copies of the Draft Supplemental EIS/Revised EIR were sent to the Tehama County Library, the Shasta County Library, the Susanville Library, and the Natural Resources Library for the Department of the Interior located in Washington, D.C. for public

viewing. Notice was placed in the *Federal Register* in compliance with NEPA. Copies were provided to the State Clearinghouse for distribution to state agencies in compliance with CEQA. Pursuant to its issuance, the Draft Supplemental EIS/Revised EIR was provided to others upon their request at no cost.

Agency and PG&E Involvement

U.S. Department of the Interior, Bureau of Reclamation

Reclamation is participating in the Restoration Project pursuant to the CVPIA (Title 34, Public Law 102-575) and the California Bay-Delta Environmental Enhancement Act (Title 11, Public Law 104-333). As the federal agency that will carry out the Restoration Project, Reclamation will act as the federal lead agency. Reclamation is responsible for complying with all applicable environmental laws and regulations associated with the Restoration Project, including NEPA, Section 106 of the National Historic Preservation Act (16 USC 470), the FWCA (16 USC 661-667e), the ESA (16 USC 1531-1544), and the CWA (33 USC 1251-1376).

Federal Energy Regulatory Commission

FERC is participating in the Restoration Project as the licensor of the Hydroelectric Project. As a cooperating federal agency, FERC is required to ensure that proposed changes in the Hydroelectric Project comply with NEPA, Section 7 of the ESA, Section 106 of the National Historic Preservation Act, the FWCA, and Section 401 of the CWA before issuing the license amendment.

FERC Authority and Responsibilities for Hydroelectric Project License Amendment Approval or Denial

The proposed federal action for FERC with regard to the Restoration Project is its decision whether to issue a license amendment for the Hydroelectric Project, and if so, what conditions should be placed in the amended license.

After receiving the license amendment application from PG&E, FERC will issue a public notice requesting any comments, protests, or motions to intervene concerning the proposed application. FERC intends to use this EIS/EIR and the biological opinion for the Restoration Project to fulfill NEPA and ESA compliance requirements when deciding whether to approve the license amendment request.

Subject to the comments received in response to the public notice, and CWA, NEPA, and ESA compliance, FERC may decide to amend the license and incorporate any terms and conditions that were required as part of NEPA mitigation, FWCA, CWA Section 401 water quality certification issued by the state, and any conditions resulting from the ESA consultation process.

National Marine Fisheries Service

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service, is participating in the Restoration Project pursuant to its jurisdiction over anadromous fish and its mandates under the ESA.

U.S. Department of the Interior, U.S. Fish and Wildlife Service

The USFWS is participating in the Restoration Project pursuant to the CVPIA (Title 34, Public Law 102-575), the ESA (16 USC 1531-1544, as amended), FWCA (16 USC 661-667e), and the Fishery Conservation and Management Act (16 USC Sections 1801-1882). A Draft Fish and Wildlife Coordination Act Report is provided in Appendix Q of this document, and can also be accessed on the web site of USFWS's Sacramento office (http://sacramento.fws.gov), under the section titled "Of Special Interest."

State Water Resources Control Board

The State Water Board is responsible for administering surface water rights throughout California (Water Code §§1000–5976). Among other things, the State Water Board issues permits and licenses to appropriate water users; acts on petitions to change the point of diversion, place of use, or purpose of use authorized under a permit or license; and investigates complaints against water users.

In addition, the State Water Board is charged with the prevention of the waste or unreasonable use of water, the conservation of beneficial uses of water, including instream beneficial uses, and the protection of the public interest (Cal. Const., Article X, §2; Water Code §§100, 275). The public trust doctrine imposes upon the State Water Board the affirmative duty to supervise the protection of public trust interests, including interests in commerce, fishery, recreation, and ecology in navigable water bodies (National Audubon Society v. Superior Court [1983] 33 Cal. 3d 419 [658 P.2d 709, 189 Cal. Rptr. 346]).

The CWA (33 USC 1251 *et seq*.) was enacted "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC 1251[a]). Section 101(g) of the CWA (33 USC. 1251[g]) requires federal

agencies to "cooperate with state and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources." Section 401 of the CWA (33 USC 1341) requires every applicant for a federal license or permit to provide the responsible federal agency with certification that the project will be in compliance with specified provisions of the CWA, including Section 303 (Water Quality Standards and Implementation Plans, 33 USC §1313); directs the state agency responsible for certification to prescribe effluent limitations and other limitations necessary to ensure compliance with the CWA and with any other appropriate requirement of state law; and provides that state certification conditions shall become conditions of any federal license or permit for the project.

The State Water Board is the agency responsible for water quality certification in California (Water Code §13160); and has delegated this function to the Executive Director by regulation (Title 23 CCR §3838, subd. [a]).

The California RWQCBs have adopted and the State Water Board has approved Water Quality Control Plans for each watershed basin in accordance with provisions of Section 303 of the CWA related to the establishment of water quality standards and planning (33 USC 1313). These plans identify beneficial uses of the waters within each region.

The California CVRWQCB, in its Water Quality Control Plan for the Central Valley Region, Sacramento River and San Joaquin River Basins, has identified the beneficial uses of Battle Creek as irrigation, stock watering, hydropower generation, contact and noncontact recreation, canoeing and rafting, cold freshwater habitat, warm freshwater habitat, salmon and steelhead migration, warm and cold spawning, and wildlife habitat.

Protection of the chemical, physical, and biological integrity of waters of the state for instream beneficial uses identified in the Basin Plans requires the maintenance of adequate streamflows as well as effluent limitations and other limitations on discharges of pollutants from point and nonpoint sources to navigable waters and their tributaries.

The State Water Board is participating as the state lead agency for CEQA compliance. It is responsible for approving or denying the issuance of certifications of compliance with Section 401 of the CWA for any federal permits or license amendments necessary to carryout the Restoration Project. In addition, the State Water Board may be petitioned pursuant to Water Code Section 1707 (a)(1) to change the purpose of use of PG&E water rights that may be transferred as a result of the adoption of the proposed alternative. Water Code Section 1707 (a)(1) authorizes any person entitled to the use of water, whether based upon an appropriative, riparian, or other right, to petition the State Water Board for a change in purpose of use for preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in or on the water.

California Department of Fish and Game

The DFG participation in the Restoration Project is based on its responsibilities as trustee agency for the fish and wildlife resources of California and its jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (Fish and Game Code §§1801-1802), the CESA (Fish & Game Code §§2050-2068) and other applicable state and federal laws.

Pacific Gas and Electric Company

PG&E is participating in the Restoration Project as the owner and operator of the Hydroelectric Project. As PG&E, it is responsible for submitting a license amendment application to FERC for the modifications to the Hydroelectric Project associated with the Restoration Project.

Hydroelectric Project License Amendment Application

To implement changes to the Hydroelectric Project, PG&E is required by the Federal Power Act (FPA) (16 USC 791-828c) to submit a license amendment application to FERC and obtain its concurrence. In May 2000, PG&E received approval from FERC to use the alternative licensing procedures set forth in 18 CFR § 4.34(i) for its license amendment application.

Process Protocol

As part of its alternative licensing process, PG&E has prepared a communications protocol entitled, “Communications Protocol for Preparing NEPA/CEQA Documents, the FERC License Amendment Application, and Other Related Documents for the Battle Creek Salmon and Steelhead Restoration Project, Battle Creek Hydroelectric Project, FERC Project No. 1121” (Pacific Gas and Electric Company 1999) (Communications Protocol). The Communications Protocol reviews general distribution methods for documenting communication and consultation among parties during the preparation of environmental compliance documents and the license amendment application. It also includes relevant background information regarding ongoing cooperation between PG&E and federal and state regulatory agencies interested in fishery restoration in Battle Creek, participants in the compliance documents process, public reference files for the Restoration Project, and specific information regarding written communications, telephone conversations, and public meetings and notices consistent with the Communications Protocol.

Consultation on Restoration Project and License Amendment

In the summer of 1999, several technical teams studied and reviewed the construction and environmental impacts of the project alternatives and developed a final Adaptive Management Plan (Appendix C) for the Proposed Action Alternative. Members of the teams included Reclamation, USFWS, NOAA Fisheries, FERC, DFG, State Water Board, California Department of Water Resources, PG&E, BCWG, BCWC, The Nature Conservancy, Friends of the River, and others. The teams were:

- **PMT**: The PMT assessed progress and addressed issues that arose in the broad range of concurrent efforts associated with the implementation of the Restoration Project.
- **Adaptive Management Policy and Technical Teams**: The Adaptive Management Policy and Technical Teams developed a draft Adaptive Management Plan for the Proposed Action Alternative.
- **Design Technical Team**: The Design Technical Team met with the Fish Passage Technical Team as design work evolved for various proposed Restoration Project features.
- **Environmental Technical Team**: The Environmental Technical Team has worked to identify the environmental compliance requirements for the Restoration Project and supported the development of documentation to meet these requirements.
- **Fish Passage Technical Team**: The Fish Passage Technical Team evaluated options to improve or restore fish passage as part of the Restoration Project.
- **Real Estate Team**: The Real Estate Team has met with property owners and has prepared surveys of lands within the Restoration Project.

Most of the teams met monthly; meetings were open to the public. The meetings were announced on Reclamation's web page for the Restoration Project (Reclamation n.d.) for the Restoration Project.

Laws, Regulations, and Executive Orders

The following sections briefly describe each law, regulation, and executive order as they are understood and interpreted by the applicable regulating agency. Federal, state, and local environmental laws, regulations, and executive orders that may be applicable to the Restoration Project are reviewed briefly below:

National Environmental Policy Act

Funding and implementation of the Restoration Project qualifies as a major federal action under NEPA (42 USC 4321-4347). NEPA regulations (40 CFR 1508.18) define a *major federal action* to include actions that may be major and that are potentially subject to federal control and responsibility. Such actions include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies (40 CFR 1508.18[a]). The Restoration Project also qualifies as a federal action because it involves federal approval of specific projects, such as construction or management activities located in a defined geographic area, and includes actions approved by permit or other regulatory decision as well as federal and federally assisted activities (40 CFR 1508.18[b][4]).

The Proposed Action and other alternatives analyzed in this EIS/EIR account for these other essential considerations through the carefully developed balancing of fishery restoration measures and the preservation of an economically valuable source of clean, renewable hydropower.

Federal Power Act

Originally enacted in 1920, the FPA (16 USC 791-828c) provided for cooperation between FERC and other federal agencies, including resource agencies, in licensing and relicensing power projects. The FPA provides FERC the exclusive authority to license non-federal hydroelectric power projects on navigable waterways and federal lands. Many of the subsequent amendments have not involved resource issues; however, the 1935 and 1986 amendments added new requirements to incorporate fish and wildlife concerns in licensing, relicensing, and exemption procedures.

FERC is authorized to issue licenses to construct, operate, and maintain dams, water conduits, reservoirs, and transmission lines to improve navigation and to develop power from any streams or other bodies of water over which it has jurisdiction (16 USC 797[e]). Navigable waters (for which FERC has jurisdiction under the Commerce Clause) are defined to include “streams or other bodies of water over which Congress has jurisdiction to regulate commerce among foreign nations and among the States” (16 USC 796). Any license application for a project must contain conditions deemed necessary by the federal department that has jurisdiction to protect the resources (16 USC 797[e]).

The FPA requires PG&E to file an application with FERC for an amendment to the existing license to operate the hydroelectric facilities. Licenses are normally issued for terms of 30 years but may be issued for terms of up to 50 years (16 USC 799). The selected project must be the project best adapted to a comprehensive plan for improving or developing a waterway for several public benefits, including the “adequate protection, mitigation and enhancement of fish and wildlife” (16 USC 803[a]). These conditions are to be based on

recommendations received pursuant to the FWCA from the USFWS, NOAA Fisheries, and state fish and wildlife agencies (16 USC 803[j][1]). The FPA empowers FERC to resolve any instances in which such recommendations are viewed as inconsistent, while according "due weight to the recommendations, expertise, and statutory responsibilities" of the resource agencies.

Clean Water Act

Section 401, Water Quality Certification

Section 401 of the CWA (33 USC 1251 *et seq*.) requires that proposed actions with federal agency involvement, including actions requiring federal agency approvals of a license or permit, that may result in a discharge of a pollutant into waters of the United States must not violate state or federal water quality standards. Section 401 also requires that any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities that may result in any discharge into navigable waters shall provide the licensing or permitting agency a certification from the state in which the discharge originates. The certification shall state that any such discharge will comply with the applicable provisions of the following CWA sections:

- 301: Effluent Limitations
- 302: Water Quality Related Effluent Limitations
- 303: Water Quality Standards and Implementation Plans
- 306: National Standards of Performance
- 307: Toxic and Pretreatment Effluent Standards

The State Water Board must issue its water quality certification before FERC can approve PG&E's license amendment for the Hydroelectric Project. Similarly, CWA Section 401 water quality certification is needed before the Corps can issue Section 404 permits for the discharge of dredged or fill material.

Section 402, National Pollutant Discharge Elimination System

In 1972, the CWA was amended to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with an NPDES permit. The 1987 amendments to the CWA, which added Section 402(p), established a framework for regulating municipal and industrial stormwater discharges under the NPDES program.

The CWA, therefore, requires that all point sources that discharge pollutants into waters of the United States must obtain an NPDES permit. The NPDES program controls direct discharges into navigable waters. Direct discharges, or point

source discharges, are from discrete conveyances such as pipes or human-made ditches and sewers. NPDES permits, which are issued by the state, contain industry-specific, technology-based, and/or water quality–based limits and establish pollutant monitoring and reporting requirements.

The regulations provide that discharges of stormwater to waters of the United States from construction projects that encompass 1 or more acres of soil disturbance are effectively prohibited unless the discharge is in compliance with an NPDES permit. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set forth the conditions and effluent limitations under which a facility may make a discharge.

While federal regulations allow two permitting options for stormwater discharges (individual permits and general permits), the State Water Board may elect to adopt the statewide General Permit. The General Permit requires all discharges whose construction activity disturbs 1 acre or more to:

- develop and implement a SWPPP that specifies BMPs to minimize accelerated erosion and prevent all construction pollutants from contacting stormwater;
- eliminate or reduce nonstormwater discharges to storm sewer systems and other waters of the nation; and
- perform inspections of all BMPs.

The CV RWQCB will enforce any General Permit issued for the Restoration Project. Restoration Project construction activity subject to a General Permit would include clearing, grading, disturbances to the ground such as stockpiling, or excavation that results in soil disturbances of at least 5 acres of total land area. Construction activity resulting in soil disturbances of less than 5 acres is subject to a General Permit if it is part of a larger common plan of development that encompasses 5 or more acres of soil disturbance or if it results in significant water quality impairment. The SWPPP for the Restoration Project will apply to all construction clearing, grading, or disturbances to the ground such as stockpiling or to excavation that results in soil disturbance. The SWPPP will also address construction-related nonstormwater discharges and hazardous material spill prevention and recovery.

Section 404

Section 404 of the CWA requires that a permit be obtained from the Corps for the discharge of dredged or fill material into waters of the United States, including wetlands. The Corps has jurisdictional authority to regulate all activities that dredge, dam, or divert navigable waters or that result in the deposit of dredged and fill material into waters of the United States, which includes perennial and intermittent streams, lakes, ponds, and nonisolated wetlands.

Under the Corps's evaluation, an analysis of practicable alternatives is a screening mechanism used to determine the appropriateness of permitting a discharge (CWA Section 404[b][1]). The Corps's evaluation also includes an analysis of compliance with other requirements of EPA guidelines, a public interest review, and an evaluation of potential impacts on the environment in compliance with NEPA.

General Nationwide Permits may be issued for similar actions with similar environmental effects, or individual permits may be issued for separate actions. Permit requirements for Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) are less extensive and prohibit the unauthorized obstruction or alteration of any navigable waters of the United States without a permit from the Corps. Where applicable, the Corps combines the permit requirements of Section 10 with those of Section 404 under one permit application. Restoration actions, except water acquisitions, water allocations, and water rights adjudications, may require successfully completing the Section 404 and Section 10 compliance process.

To issue a Nationwide Permit under Section 404, the Corps must ensure that the discharge will not violate the state's water quality standards. In California, all Nationwide Permits related to FERC project activities that may result in a discharge to a surface water of the United States must obtain an individual 404 permit, which requires a Section 401 water quality certification or a waiver of certification from the State Water Board. Additionally, the Corps must comply with the requirements of Section 7 of the ESA (16 USC 1531-1544) and Section 106 of the National Historic Preservation Act (16 USC 470). The Restoration Project, if approved, will likely be authorized under Section 404 by the use of several Nationwide Permits and Letter of Permission (LOP). The Corps uses an abbreviated process to issue Letters of Permission for individual actions that have minimal adverse environmental effects.

An LOP is a type of Standard Permit issued through an abbreviated processing procedure, which includes coordination with federal and state fish and wildlife agencies as required by the FWCA, and a public interest evaluation, but without publishing of an individual public notice. Activities that qualify for processing through LOP procedures are fill activities that do not qualify for existing nationwide permit(s) or other general permit. These fill activities have minor impacts and therefore do not warrant more detailed processing. The LOP will be used only for those projects where the applicant performs a thorough pre-application coordination among the regulatory and resource agencies.

The LOP is an expedited process for an individual permit, where a decision to issue authorization is made within 45 days. (CWA 33 USC 1344; 33 CFR 325.2(e)(1)(ii).)

Federal Endangered Species Act

Section 7 of the ESA of 1973 (16 USC 1531-1544, as amended) requires federal agencies, in consultation with the USFWS and the NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of ESA-listed endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies request information from the USFWS and NOAA Fisheries regarding the existence of listed species or species proposed for listing in a project area.
- Following receipt of the USFWS and NOAA Fisheries responses to this request, lead agencies generally prepare a biological assessment to determine whether any listed species or species proposed for listing are likely to be affected by a proposed action.
- Lead agencies initiate formal consultation with the USFWS and NOAA Fisheries if the proposed action would adversely affect listed species.
- The USFWS and NOAA Fisheries prepare a biological opinion to determine whether the action would jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitat.
- If a finding of jeopardy or destruction or adverse modifications of critical habitat is made in the biological opinion, the USFWS and NOAA Fisheries recommend reasonable and prudent alternatives that would avoid jeopardy, and the lead agency must modify the project to ensure that listed species are not jeopardized and that their critical habitat is not adversely modified, unless an exemption from this requirement is granted.

Because the Restoration Project is a CBDA action that could result in adverse effects on one or more listed species or the destruction or adverse modification of their critical habitat, Reclamation, as the federal lead agency, must comply with Section 7 of the ESA. In addition, the FERC license amendment approval process and the Corps Section 404 authorization, as federal actions, also will require compliance with Section 7 of the ESA.

The Restoration Project is funded by CBDA, and, therefore, it is required, as a condition of several CALFED Program agreements, that an ASIP be prepared. An ASIP serves as a single document for entities implementing CBDA actions to simultaneously fulfill the requirements of the ESA, CESA, and the NCCPA. ASIPs provide project-level compliance with these acts and tier from the CALFED Program Multi-Species Conservation Strategy, which served as the CALFED programmatic biological assessment and NCCP, and are consistent with the requirements of the CALFED programmatic biological opinions and NCCP determination. In the context of compliance with Section 7 of the ESA, the ASIP will serve as the biological assessment for the Restoration Project.

A draft ASIP and ASIP addendum have been prepared to assess the effect of the Restoration Project on the species listed or proposed for listing that are covered in the CALFED programmatic biological opinions. The draft ASIP was submitted in April 2004 and the ASIP addendum was submitted in June 2005 with a request for formal Section 7 consultation with the USFWS and NOAA Fisheries. The formal consultation concludes within 90 days of the request for consultation being submitted to the USFWS and NOAA Fisheries. During consultation, the ASIP findings are reviewed. Based on that review, discussions may take place to modify the proposed action's features, designs, mitigation measures, and management plans to protect listed species while satisfying project objectives to the extent practicable. Within 135 days of beginning formal consultation, the USFWS and NOAA Fisheries must prepare biological opinions to determine whether the Restoration Project would jeopardize the continued existence of listed species or adversely modify or destroy their critical habitat.

Fish and Wildlife Coordination Act

The FWCA (16 USC 661 et seq.) requires federal agencies to consult with the USFWS, NOAA Fisheries, and the state fish and wildlife resource agency (in this instance, the DFG) before undertaking or approving water projects that control or modify surface water. Under Subsection 2(a) of the FWCA, federal agencies are responsible for consulting with the USFWS for the purpose of conserving wildlife resources by preventing their loss and damage and providing for their development and improvement in connection with water resource projects. Also, under Subsection 2(b), the USFWS is required to report its recommendations for wildlife conservation and development and the results expected and to describe the potential damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for this damage. Federal agencies undertaking water projects are required to fully consider recommendations made by the USFWS, NOAA Fisheries, and the state fish and wildlife resource agency in project reports, such as the NEPA and CEQA documents, and to include measures to reduce impacts on wildlife in project plans. A Draft Fish and Wildlife Coordination Act Report is provided in Appendix Q of this document, and can also be accessed on the web site for the USFWS's Sacramento Office (http://sacramento.fws.gov), under the section titled "Of Special Interest."

Federal Clean Air Act

The federal Clean Air Act, promulgated in 1970 and amended twice thereafter (including the 1990 amendment), establishes the framework for modern air pollution control. The purpose of the federal Clean Air Act (42 USC 7401-7661) is to protect and enhance the quality of the nation's air resources and, thereby, to promote the public health and welfare and the productive capacity of its population. The Clean Air Act requires that any federal action be evaluated to determine its potential impact on air quality in the project region. Specifically, the federal agency must make a conformity determination.

The Clean Air Act directs the EPA to establish ambient air standards for six pollutants: ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, and sulfur dioxide. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety and the latter to protect environmental values, such as plant and animal life.

The primary legislation that governs federal air quality regulations is the Clean Air Act Amendments of 1990 (CAAA). The CAAA delegates primary responsibility for clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

The EPA has established NAAQS for criteria pollutants (Table 4.11-3). Criteria pollutants include CO, NO_2, SO_2, ozone, PM10, and lead.

Areas that do not meet the federal NAAQS shown in Table 4.11-3 are called *nonattainment* areas. For these nonattainment areas, the federal Clean Air Act requires states to develop and adopt SIPs, which are air quality plans showing how air quality standards will be attained. The SIP, which is reviewed and approved by the EPA, must demonstrate how federal standards will be achieved. Failing to submit a plan or secure approval could lead to denial of federal funding and permits for improvements such as highway construction and sewage treatment plants. In cases where the SIP is submitted by the state but fails to demonstrate achievement of the standards, the EPA is directed to prepare a Federal Implementation Plan. In California, the EPA has delegated authority to prepare SIPs to the California Air Resources Board, which, in turn, has delegated that authority to individual air districts.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act (16 USC 470 *et seq*.) requires federal agencies to evaluate the effects of federal undertakings on significant cultural resources, termed historic properties. It requires federal agencies to coordinate with the SHPO and possibly the Advisory Council on Historic Preservation (ACHP) regarding the effects an undertaking may have on historic properties. Reclamation, FERC, and Corps involvement in implementing the Restoration Project activities and in authorizing federal licenses and permits triggers the need to comply with Section 106.

Section 106 defines the purpose and requirements of the federal review process to ensure that historic properties are considered during federal project planning and execution under the administration of the ACHP. The federal agency involved in a proposed project is responsible for initiating and completing the Section 106 review process. In general, Section 106 requires the federal agency to consult with the SHPO regarding a proposed project's effect on properties listed or eligible for listing on the NRHP. Other agencies may work with the SHPO and the ACHP throughout the process and may include other participants

(e.g., federal and nonfederal agencies, Native American tribes, or applicants for federal grants, licenses, or permits) when proposed actions may affect their interests or activities.

Compliance with Section 106 will follow these steps:

- Historic or archaeological properties in the Restoration Project area, including properties listed on the NRHP and those properties that Reclamation and the SHPO agree are eligible for listing on the NRHP, are identified.
- If the Restoration Project is determined to have an adverse effect on historic properties, consultation with the SHPO and possibly the ACHP occurs to develop alternatives or mitigation measures to allow the project to proceed.

American Indian Religious Freedom Act of 1978

The American Indian Religious Freedom Act of 1978 (42 USC 1996 *et seq.*) sets forth the policy of the U.S. Department of the Interior for protecting and preserving the observance of traditional Native American religions. The act requires that federal agencies evaluate their policies and procedures to ensure compliance with the act. This consultation process will be coordinated with compliance with Section 106 of the NHPA.

Indian Trust Assets

Indian Trust Assets are legal interests in property rights held by the United States for Indian Tribes or individuals. Trust status originates from rights imparted by treaties, statutes, or executive orders. Indian Trust Assets are lands (including reservations and public domain allotments), minerals, water rights, hunting and fishing rights, other natural resources, money, or claims. Assets include real property, physical assets, or intangible property rights. Indian Trust Assets cannot be sold, leased, or otherwise alienated without federal approval. They do not include things in which a tribe or individuals have no legal interest, such as off-reservation sacred lands or archeological sites in which a tribe has no legal property interest. Reclamation requires that NEPA documents include a determination of whether a project will have any impacts on Indian Trust Assets.

Executive Order 11990, Protection of Wetlands

Executive Order 11990 is an overall wetlands policy applicable to all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. It requires affected federal agencies to follow avoidance, mitigation, and preservation procedures and to obtain public input before proposing new construction in wetlands. Derived from Executive Order 11990 is

the Corps's "no net loss" policy for wetlands, which requires that any loss of wetlands be compensated for by creating wetlands with the same or similar value at a minimum one-to-one compensation-to-loss ratio.

The Restoration Project must be consistent with the overall wetlands policy contained in Executive Order 11990 because of the CWA Section 404 compliance requirements.

Executive Order 12898, Environmental Justice

Environmental justice refers to the fair treatment of people of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should shoulder a disproportionate share of negative environmental impacts resulting from the execution of environmental programs. Reclamation requires that NEPA documents include a determination of whether a project will have such negative impacts.

California Water Code

Title 14 of the California Water Code is a body of law that among other things controls the appropriation and use of California's surface waters and the protection of surface water and groundwater. A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, nonwasteful use. Water rights are property rights, but their holders do not own the water itself—they possess the right to use it. The exercise of some water rights requires a permit or license from the State Water Board.

California Environmental Quality Act

The Restoration Project is also subject to CEQA (Public Resources Code §21000 et seq.). State Water Board CEQA compliance is required as part of its responsibilities for implementing the provisions of the CWA (33 USC 1251 et seq.). Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities that may result in any discharge into the navigable waters shall provide the licensing or permitting agency a certification from the state in which the discharge originates.

Section 13160 of the California Water Code designates the State Water Board as the state water pollution control agency for all purposes stated in the Federal Water Pollution Control Act (33 USC 1251 et seq.) and any other federal act. The State Water Board's issuance of the water quality certification is a

"discretionary" project[3] subject to CEQA compliance. The State Water Board will use the EIS/EIR for CEQA compliance. Section 401 of the CWA is discussed in greater detail above under the section titled Clean Water Act.

California Endangered Species Act

The CESA (Fish and Game Code §§2050–2068) generally parallels the main provisions of the ESA (16 USC 1531–1544) and is administered by the DFG. A state lead agency is required to consult with the DFG to ensure that any action it undertakes is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of essential habitat.

The CESA prohibits the "taking" of listed species except as otherwise provided in state law. Unlike the ESA, CESA applies the take prohibitions to species under petition for listing (state candidates) in addition to listed species. Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

Section 2081 of the California Fish and Game Code expressly allows the DFG to authorize the incidental take of endangered, threatened, and candidate species if all of the following conditions are met:

- the take is incidental to an otherwise lawful activity;
- the impacts of the authorized take are minimized and fully mitigated;
- the permit is consistent with any regulations adopted in accordance with Sections 2112 and 2114 (legislature-funded recovery strategy pilot programs in the affected area) and
- the applicant ensures that adequate funding is provided for implementing mitigation measures and monitoring compliance with these measures and their effectiveness.

The CESA provides that an incidental take permit obtained under the ESA may authorize the taking of endangered or threatened species listed under the CESA, with no further CESA authorization or approval (Fish and Game Code Section 2080.1). The Restoration Project is complying with the CESA through the ASIP process under the NCCPA.

[3] *Project* means the whole of an action that has a potential to result in either a direct or a reasonably foreseeable indirect physical change in the environment and that involves the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies (CEQA Guidelines §15378).

Natural Community Conservation Planning Act

The NCCPA (Fish and Game Code Section 2800 et seq.) was passed in 1991 and added to the CESA. This act provides for voluntary cooperation among DFG, landowners, and other interested parties to develop natural community conservation plans (NCCPs) that provide for early coordination of efforts to conserve species listed under CESA and reduce the likelihood for new listings of species. The primary purpose of the act is to preserve species and their habitats while allowing reasonable and appropriate development to take place. In compliance with this act, the CALFED Program prepared the MSCS that served as a programmatic NCCP. In July 2000, DFG approved the MSCS through its issuance of an NCCP Determination. In 2002, a new NCCPA was signed into law that replaced the act of 1991. This new act included a clause that "grandfathered" all approved programmatic NCCPs (i.e., the CALFED Program MSCS and NCCP Determination) as continuing to be in effect (Section 2830[c]).

In compliance with the CESA and NCCPA, a draft ASIP and ASIP addendum were prepared to serve as the project-level NCCP for the Restoration Project. As described above in the section on the ESA, the ASIP is a means for entities implementing CALFED Program actions to simultaneously fulfill the requirements of the ESA, CESA, and NCCPA. The ASIP will evaluate California-listed and unlisted species that are covered in the CALFED programmatic NCCP determination. Although this was not the case for the Restoration Project, California-listed species that could be affected by project implementation, but which are not covered under the CALFED programmatic NCCP determination, would also have been evaluated in the ASIP and take authorization sought under CESA Section 2081.

Lake and Streambed Alteration Agreement Program

Sections 1601 and 1603 of the California Fish and Game Code address permitting requirements for any action that alters a streambed and has a related potential to adversely affect fish and wildlife resources. If construction activity could potentially have a substantial adverse effect on fish or wildlife resources, reasonable modifications or measures to protect these resources are required. The DFG is empowered under these code sections to propose modifications or measures to protect fish and wildlife resources.

California Regulations for Environmental Justice

Environmental justice is defined in statute as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (California Government Code Section 65040.12).

California State agencies are firmly committed to the achievement of environmental justice. Environmental justice for all Californians will be attained when all Californians, regardless of race, culture, or income, enjoy the same degree of protection from environmental and health hazards and equal access to decision-making processes.

California Clean Air Act

The purpose of the California Clean Air Act (Stats 1988, ch 1568), as administered by the California Air Resources Board and the regional air quality management districts, is to protect and enhance the quality of California's air resources and, thereby, to promote and protect ecological resources and public health and welfare through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on California's economy.

The California Clean Air Act of 1988 substantially added to the authority and responsibilities of air districts. The California Clean Air Act designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The California Clean Air Act focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The California Clean Air Act requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The California Clean Air Act also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for carbon monoxide, sulfur dioxide, nitrogen dioxide, or ozone. These Clean Air Plans are specifically designed to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. No locally prepared attainment plans are required for areas that violate the state PM10 standards.

The California Clean Air Act requires that the state air quality standards be met as expeditiously as practicable, but, unlike the federal Clean Air Act, does not set precise attainment deadlines. Instead, the act establishes increasingly stringent requirements for areas that will require more time to achieve the standards.

The California Clean Air Act emphasizes the control of "indirect and area-wide sources" of air pollutant emissions. The California Clean Air Act gives local air pollution control districts explicit authority to regulate indirect sources of air pollution and to establish traffic control measures (TCMs). The California Clean Air Act does not define indirect and area-wide sources. However, Section 110 of the federal Clean Air Act defines an indirect source as

> "A facility, building, structure, installation, real property, road, or highway which attracts, or may attract, mobile sources of pollution. Such term includes

> parking lots, parking garages, and other facilities subject to any measure for management of parking supply…"

TCMs are defined in the California Clean Air Act as "any strategy to reduce trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing vehicle emissions."

Recently enacted amendments to the California Clean Air act impose additional requirements designed to ensure an improvement in air quality within the next five years. More specifically, local districts with moderate air pollution that do not achieve "transitional nonattainment" status by December 31, 1997, must implement the more stringent measures applicable to districts with serious air pollution.

The effects of the Restoration Project on air quality must be considered during the EIR process. During construction, Reclamation may be required to consult with the California Air Resources Board or appropriate air quality management district to ensure that Restoration Project construction conforms to regulations contained in the federal Clean Air Act and California Clean Air Acts and their implementing regulations.

Shasta County Permits

Reclamation will obtain all of the required permits for the Restoration Project from the appropriate Shasta County offices. Zoning, administrative, and user permits will be obtained from the Department of Planning. Encroachment, transportation, and floodplain development permits will be obtained from the Department of Public Works. Grading and hazardous material permits will be obtained from the Department of Environmental Health. The permit to construct and operate, burning permit, and fugitive emission control permits will be obtained from the Air Quality Management District. Reclamation will submit device information sheets to the Air Quality Management District.

Tehama County Permits

Reclamation will obtain all of the required permits for the Restoration Project from the appropriate Tehama County offices. Demolition and building permits and the floodplain development permit will be obtained from the Department of Building and Safety. County road encroachment permits will be obtained from the Department of Public Works. Hazardous materials applications will be filed with the Department of Environmental Health. The air pollution control district permit, fugitive dust permit, and agricultural burn permit will be obtained from the Tehama County Air Pollution Control District. Reclamation will submit device information sheets to the Tehama County Air Pollution Control District.

Chapter 6
Related Projects

Introduction

This chapter identifies other projects that may influence or be influenced by the Restoration Project and discloses their specific relationships to the Restoration Project. These projects were addressed in the "Cumulative Impacts" analyses found at the end of each resource section in Chapter 4.

Several agreements, investigations, programs, studies, plans, and proposed projects relate to the Restoration Project in different ways. Within the Battle Creek watershed—both downstream and upstream of proposed Hydroelectric Project modifications—the Restoration Project could affect and be affected by:

- continued interim flow agreements;
- actions at the Coleman National Fish Hatchery;
- watershed activities, community strategies, studies, and stewardship programs implemented by the BCWC;
- potential upstream hydropower development;
- gravel removal or introduction activities;
- sediment reduction programs; and
- long-term operational strategies of private trout-rearing facilities in the watershed.

The Restoration Project would be directly supported by engineering investigations of fish passage, information from nearby reference watersheds, development of wildlife habitat areas, continuing operations of state-run hatcheries, and continuing development of conservation easements and water rights. Because the support of local landowners and stakeholders is important to Restoration Project success, the related project discussions emphasize stakeholder concerns and proposed strategies to address them.

On a broader scale that extends to the upper Sacramento River, the Central Valley, and the CALFED Program solution area, the Restoration Project will benefit from and contribute important technical information to several larger restoration efforts through monitoring programs, continuing habitat studies, and

other information generated through the adaptive management process. The Restoration Project could help meet the goals of the CVPIA (Title 34, PL 102-575); the CBDA ERP (CALFED Bay-Delta Program 2000b); the Comprehensive Monitoring, Assessment, and Research Program (CMARP)/CBDA Science Program; the Comprehensive Assessment Monitoring Program (CAMP); and other recovery, restoration, management, and enhancement plans for threatened and endangered species and their habitat. Figures 6-1 and 6-2 summarize these related projects and how they relate to the Restoration Project, beginning with those projects that could have the most direct and substantial effects on the Restoration Project in the Battle Creek watershed (Figure 6-1), followed by those related projects that support and will receive benefits from the Restoration Project (Figure 6-2).

Projects That Could Directly Affect or Be Affected by the Restoration Project

Interim Flow Agreement between the Bureau of Reclamation and Pacific Gas & Electric Company

In 1995, Reclamation and PG&E[1] entered into an Interim Flow Agreement designed to increase continuous minimum instream flows in several reaches of Battle Creek. The authority for this agreement is provided for under the FERC license as a temporary modification to operations. Under this authority, Reclamation and PG&E have modified and extended the terms of the agreement for three consecutive agreements, referred to as the 1995, 1998, and 2003 Interim Flow Agreements. These agreements have led PG&E to provide increased flows above the license-required flows of 3 cfs in North Fork Battle Creek and 5 cfs in South Fork Battle Creek. These agreements, representing a partnership among PG&E, federal and state fisheries agencies, and restoration funding entities (CVPIA and CBDA/CALFED), have allowed interim flow increases in the lower half of the Restoration Project affecting salmon and steelhead while a permanent or long-term arrangement is developed. Through the amendment process, the CBDA, CALFED ERP has approved of a portion of the existing 1999 CALFED Federal Restoration Project funds to be used for the 2003 Interim Flow Agreement, which is a continuation of the previous 1995 and 1998 agreements that were funded under CVPIA. The temporary flow increase specified in the Interim Flow Agreements is authorized by a FERC license article stating there can be short-term modifications of flow for purposes of fishery management or diversion maintenance upon mutual agreement of PG&E and DFG (Interim Flow Agreement Exhibit A Article G). In relation to fishery management, temporary closure of fish ladders on North Fork and South Fork Battle Creek have been authorized by the fish agencies (Appendix E).

[1] Pacific Gas and Electric Company, a utility regulated by the California Public Utility Commission, owned the Battle Creek Hydroelectric Project (FERC Project Number 1121) at the time this document was prepared

1 INTERIM FLOW AGREEMENTS BETWEEN RECLAMATION AND PACIFIC GAS & ELECTRIC COMPANY
CALFED-Funded project to continue interim flow of up to 30 cubic feet per second (cfs) to meet fish and wildlife needs in the North Fork of Battle Creek until the long-term Restoration Project implementation is completed.

2 **COLEMAN NATIONAL FISH HATCHERY (CNFH):**
- **CNFH reevaluation process studying hatchery management as it related to both current and estimated "restored" populations.**
- **Water treatment facility reduces CNFH disease threat with water filtration and disinfection, may redice fish mortality and disease survivorship.**
- **CNFH Intake Alternatives Study assessing facility upgrades to prevent entrainment of juvenile fish from Battle Creek and ensure compatibility with Restoration Project.**
- **Barrier weir and upstream ladder structural modification being evaluated for maximizing efficiency and integrating with Restoration Project.**
- **Biological Assessment of CNFH Operations describes fish propagation programs and assesses potential impacts to naturally produced salmonids. Revised Biological Assessment to be submitted by USFWS, after the Battle Creek Restoration Program is completed.**
- **USBR Intraspecific Competition Study assessed potential risk of hatchery fish to naturally spawned stocks, and evaluated the existence and relative intensity of competition among hatchery-reared and naturally produced juvenile Chinook salmon.**

3 BATTLE CREEK WATERSHED CONSERVANCY FORMATION
- CALFED-funded formation of conservancy, consistent with CALFED ERP Strategic Plan commitments for supporting a watershed conservancy.
- Community plan identifies factors affecting salmon and steelhead aquatic habitats, with emphasis on potential impacts of Restoration Project on private lands and interests.
- Active participant in the BCWG, and primary driver for conducting local public communications and outreach regarding the Restoration Project.
- Conducting watershed assessment to identify land use issues and develop information management system for adaptive management and monitoring data.

4 BATTLE CREEK SALMON AND STEELHEAD RESTORATION STUDY/RESTORATION PLAN
- CALFED-funded restoration planning process by the BCWG serves as the technical basis for the Restoration Project, containing essential biological criteria for salmon and steelhead restoration.

5 BATTLE CREEK WATERSHED COMMUNITY STRATEGY
CALFED-funded long-term community watershed strategy for the Battle Creek watershed, developed in response to the Restoration Project emphasizing "on-the-ground" strategies and best management practices to support chinook salmon and steelhead restoration and the continuation of a healthy, fully functioning watershed. The Battle Creek Watershed Community Strategy states the community issues and recommendations regarding water rights, economic threats, land use restrictions, increased Federal ownership and presence, invasive weed control, private stewardship, rural landscape preservation, and fuels management. The stragety suggests that local community participation in adaptive management monitoring and data management, will enhance its acceptance and sense of ownership in the outcome of the Restoration Project.

6 BATTLE CREEK WATERSHED STEWARDSHIP
- CALFED-funded watershed study by the Battle Creek Watershed Conservancy to implement a watershed strategy, address upper watershed processes, implement fuels management and fire defense improvements, conservation easements, and noxious weed control consistent with habitat and water quality protections needed to support the Restoration Project.

7 GREATER BATTLE CREEK WATERSHED WORKING GROUP (GBCWWG)
- The GBCWWG draft vision recognizes the value of coordinating the planning, implementation, and evaluation of all fisheries, restoration and watershed projects among public agencies, nonprofit organizations and private landowners within the Greater Battle Creek Watershed in order to maximize production of all natural anadromous fish runs and maintain, and restore as necessary, a healthy watershed and landscape.

8 LASSEN LODGE HYDROPOWER PROJECT
The Lassen Lodge Hydropower project is a proposed 7,000 kW hydroelectric generating station located along the south bank of the South Fork of Battle Creek located upstream of the existing Battle Creek Hydroelectric Project's South Diversion Dam. There is concern that its construction could limit or reduce the quality of upstream habitat available for salmon and steelhead restoration, and the amount and stability of South Fork Battle Creek flows for achieving downstream restoration.

9 GRAVEL REMOVAL AGREEMENTS:
Restoration Project flows and facility modifications are consistent with recent PG&E and CDFG agreements to removal gravel accumulated behind these diversion dams to mimic natural downstream sediment movement and enhance spawning gravel for salmon and steelhead.

10 GRAVEL INTRODUCTION AND NATURAL BARRIER MODIFICATIONS ON BALDWIN CREEK
This project would include improvement of a partial natural barrier and enhancement of existing spawning gravels supplies on a one-quarter mile stretch of Baldwin Creek. The project is in the early planning stages, and will likely be developed in cooperation with the CDFG. Improved steelhead habitat resulting from this project would be consistent with the Restoration Project.

11 U.S. FOREST SERVICE
U.S. Forest Service programs in the Battle Creek include several road restoration measures, such as culvert replacements that are intended to reduce sediment delivery to the stream. In the summer of 2000, Lassen National Forest assessed wildfire fuels in the Battle Creek watershed under a contract with BCWC. Although all national forest lands in the watershed are outside the Restoration Project area and outside the area that will be adaptively managed, the long-term success of the Restoration Project could be compromised if the U.S. Forest Service did not remain committed to reducing sediment delivery to Battle Creek.

12 BATTLE CREEK WATERSHED PRIVATE TROUT REARING FACILITIES
- Nine private trout-rearing facilities in the watershed are operated by Mt. Lassen Trout Farms, Incorporated. These facilities rear rainbow and brown trout for stocking in private ponds and lakes throughout California. Although these facilities do not interact with fish populations in the anadromous habitat of Battle Creek, some facilities, such as the main broodstock facility, are near Hydroelectric Project power canals. Infected juvenile salmon populations increased by the Restoration Project, and subsequently living in unscreened canals could serve as vectors for disease if borne by predators to hatchery facilities.

13 ENGINEERING INVESTIGATION OF ANADROMOUS FISH PASSAGE IN UPPER BATTLE CREEK
- CALFED-funded planning and design investigation by DWR of fish passage on upper Battle Creek supporting ladder and screen designs for Restoration Project action alternatives.

14 MONITORING OF ADULT JUVENILE SPRING-RUN AND WINTER-RUN CHINOOK SALMON IN BATTLE CREEK
- CALFED-funded study by USFWS to obtain life history information on spring-run and winter-run chinook salmon. Study elements consistent with the Restoration Project adaptive management process include sampling of potentially remnant spring-run population, assessment of winter-run propagation effectiveness, the feasibility of a winter-run chinook salmon population in Battle Creek, and evaluating the effectiveness of ongoing restoration actions.

15 BATTLE CREEK SPAWNING GRAVEL STUDY AND RESTORATION FOR WINTER-RUN AND FALL-RUN CHINOOK SALMON, LOWER BATTLE CREEK
- CALFED-funded study by DWR for placing spawning-sized gravel in the lower reaches of Battle Creek to double to triple the area available for salmon spawning.

16 BATTLE CREEK FISH SCREENS AND PASSAGE
CALFED-funded support for engineering investigations, construction cost data, water temperature and streamflow data needed to eliminate system stressors and facilitate the restoration of remnant populations of steelhead, spring-run chinook salmon, and winter-run salmon consistent with the Restoration Project.

17 BATTLE CREEK WILDLIFE AREA
- The Battle Creek Wildlife Area contains over 480 acres of riparian, freshwater marsh, and oak woodland wildlife habitat acquired by the Wildlife Conservation Board and managed by the CDFG. It is part of a plan developed to conserve property with outstanding riparian and wetland habitats consistent with the Restoration Project.

18 TEHAMA WILDLIFE AREA
- The Tehama Wildlife Area is located about three miles south of the town of Paynes Creek and south of the Restoration Project vicinity. It includes 46,900 acres of oak woodland, grasslands, and chaparral. Its goals to protect wildlife species and their habitat is consistent with the Restoration Project.

19 DARRAH SPRINGS HATCHERY
- Darrah Springs Hatchery is a state-run facility located at Darrah Springs on Baldwin Creek, a tributary to mainstem Battle Creek. It is a key hatchery of the CDFG inland fisheries program and raises catchable trout for sport fisheries using a wide variety of strains including Eagle Lake rainbow trout, Pit River rainbow trout, and Mt. Shasta-strain rainbow trout.

20 CONSERVATION EASEMENTS AND CONSERVATION WATER RIGHTS
Conservation easements preserve high-quality riparian habitat adjacent to wildlife-compatible agriculture and limit the future impacts of landscape fragmentation, instream physical disturbance, and new wells and septic systems. Recent easements secured include:
- The Nature Conservancy's Lassen Foothills Project has the goal of partnering with private landowners, local organizations, and the community to ensure the sustainability and economic viability of private land uses and the ongoing health of the area's plants and animals. As of May 2000, the Nature Conservancy has protected more than 83,000 acres. Approximately half of this land has been safeguarded through the use of conservation easements with private landowners, includng ranch land and streamside habitat.
- In 1999, The Nature Conservancy purchased a conservation easement on the 36,000-acre Denny Ranch. The property will continue to be operated as a privately owned working cattle ranch while its natural communities are permanently preserved from subdivision and development land uses.
- In 2000, the BLM acquired conservation easements on two properties in lower Battle Creek including land along the mouth of the stream, on the Gover Ranch, to conduct riparian restoration activities along Battle Creek and the Sacramento River and to maintain the agricultural nature of these properties.
- The Nature Conservancy and USFWS recently acquired conservation easements on Digger Creek, and on 1,800 acres north of Battle Creek with springs that feed Baldwin Creek.

21 BUTTE, DEER, AND MILL CREEK REFERENCE WATERSHEDS
- Data about fish populations, habitat, and water temperature and quality collected in these reference watersheds will be directly compared with similar data from Battle Creek as a means of measuring attainment of several objectives within the adaptive management strategy of the alternative ultimately selected for implementation.

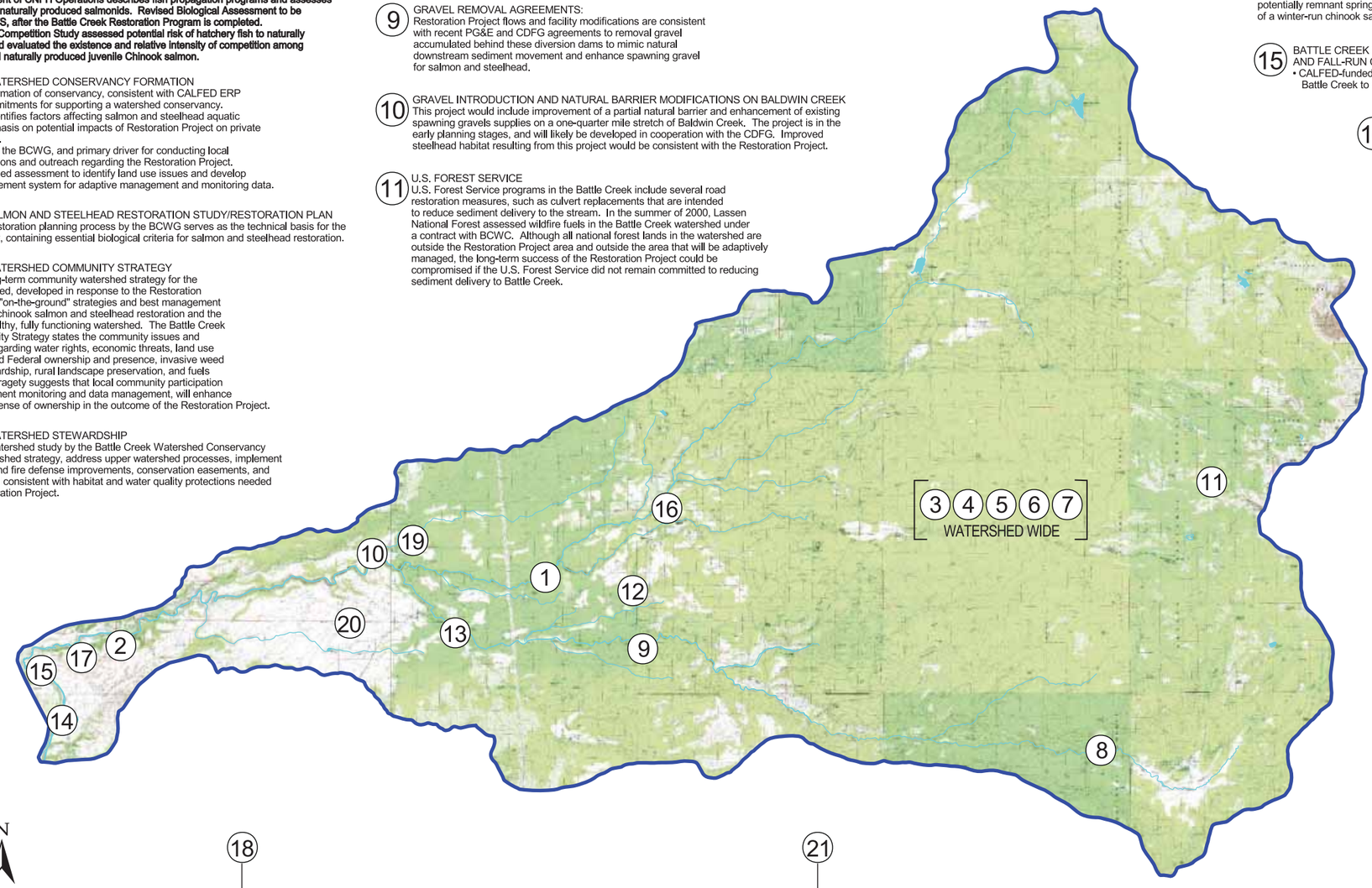

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Figure 6-1
Related Projects in and Near the Battle Creek Watershed

NOT TO SCALE

Central Valley Projects

CALFED ECOSYSTEM RESTORATION PROGRAM
Restoration Project is funded by CALFED, and is an action directed as part of the CALFED Programmatic EIS/EIR Preferred Alternative, which includes the Ecosystem Restoration Program (ERP) ecosystem restoration visions for restoring beneficial ecosystem processes associated with Central Valley streamflows, stream meander, natural floodplains and flood processes, coarse sediment supply, Central Valley stream temperatures, riparian and riverine aquatic habitats, freshwater fish habitats, essential fish habitats, winter-run, spring-run, fall-run, and late-fall-run chinook salmon, steelhead, lamprey, and native resident fish species.

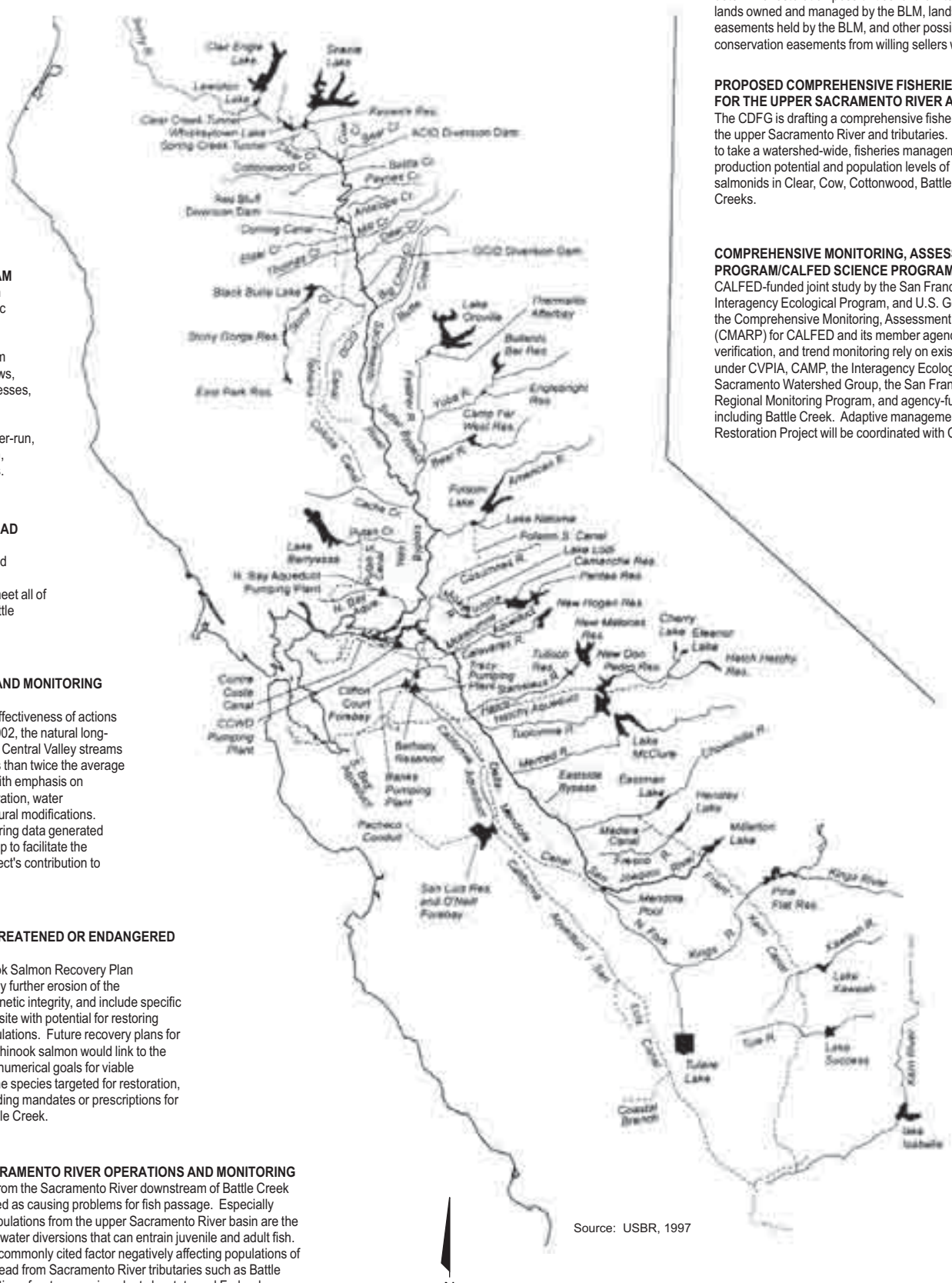
CENTRAL VALLEY SALMON AND STEELHEAD RESTORATION AND ENHANCEMENT PLAN
This plan called for increased instream flows and effective fish screens on Battle Creek. The implementation of the Restoration Project will meet all of the recommendations in this plan specific to Battle Creek.

COMPREHENSIVE ASSESSMENT AND MONITORING PROGRAM
CVPIA-funded study to evaluate the effectiveness of actions designed to ensure that by the year 2002, the natural long-term production of anadromous fish in Central Valley streams would be sustainable at levels not less than twice the average levels attained during 1967 to 1991, with emphasis on restoration categories of habitat restoration, water management, fish screens, and structural modifications. Applicable Restoration Project monitoring data generated through adaptive management will help to facilitate the understanding of the Restoration Project's contribution to reaching CVPIA goals.

RECOVERY PLANS FOR THREATENED OR ENDANGERED SPECIES
The NMFS Winter-Run Chinook Salmon Recovery Plan identified actions to prevent any further erosion of the population's viability and its genetic integrity, and include specific reference to Battle Creek as a site with potential for restoring self-sustaining winter-run populations. Future recovery plans for steelhead and spring-run Chinook salmon would link to the Restoration Project by setting numerical goals for viable population levels for three of the species targeted for restoration, but likely not including any binding mandates or prescriptions for specific implementation in Battle Creek.

DELTA AND SACRAMENTO RIVER OPERATIONS AND MONITORING
Water diversions from the Sacramento River downstream of Battle Creek have been identified as causing problems for fish passage. Especially harmful for fish populations from the upper Sacramento River basin are the many unscreened water diversions that can entrain juvenile and adult fish. Perhaps the most commonly cited factor negatively affecting populations of salmon and steelhead from Sacramento River tributaries such as Battle Creek is the operation of water pumping plants by state and Federal agencies, and smaller water diversions, within the Bay-Delta. The adaptive management studies will be capable of identifying those impacts on Battle Creek fish caused by the Hydroelectric Project and to determine when factors from outside the watershed are at play.

RESTORING CENTRAL VALLEY STREAMSA PLAN FOR ACTION
The CDFG's "Restoring Central Valley StreamsA Plan for Action" focused on the potential for restoring winter-run, spring-run, and steelhead to Battle Creek by the preparation and implementation of a comprehensive restoration plan for anadromous fish in Battle Creek, increasing instream flows, and revised management of the barrier dam at CNFH. The planning recommendations in this document have already been achieved with the development of the Restoration Plan and the MOU. Implementation of the Restoration Project and the Adaptive Management Plan will meet the goal of increasing instream flows found in "A Plan for Action."



Upper Sacramento River Projects

UPPER SACRAMENTO RIVER FISHERIES AND RIPARIAN HABITAT MANAGEMENT PLAN
The Upper Sacramento River Fisheries and Riparian Habitat Management Plan singled out Battle Creek as a key watershed for restoration. Goals of this plan will be achieved with the implementation of the Restoration Project and adaptive management.

SACRAMENTO CORRIDOR HABITAT RESTORATION ASSESSMENT
The CDFG, The Nature Conservancy, and the DWR will conduct a study, in cooperation with the BLM, of the geomorphic and riparian interactions occurring on an alluvial reach of the Sacramento River between the mouth of Cow Creek and Jellys Ferry bridge (river miles 280 to 267), including lower Battle Creek and Anderson Creek. This study will determine restoration possibilities for the integrated complex that includes lands owned and managed by the BLM, lands with conservation easements held by the BLM, and other possible acquisitions by fee or conservation easements from willing sellers within this reach.

PROPOSED COMPREHENSIVE FISHERIES MANAGEMENT PLAN FOR THE UPPER SACRAMENTO RIVER AND TRIBUTARIES
The CDFG is drafting a comprehensive fisheries management plan for the upper Sacramento River and tributaries. The objective of this plan is to take a watershed-wide, fisheries management-based view at production potential and population levels of all races of anadromous salmonids in Clear, Cow, Cottonwood, Battle, Deer, Mill, and Antelope Creeks.

COMPREHENSIVE MONITORING, ASSESSMENT, AND RESEARCH PROGRAM/CALFED SCIENCE PROGRAM
CALFED-funded joint study by the San Francisco Estuary Institute, Interagency Ecological Program, and U.S. Geological Survey to develop the Comprehensive Monitoring, Assessment, And Research Program (CMARP) for CALFED and its member agencies. Compliance, model verification, and trend monitoring rely on existing monitoring efforts under CVPIA, CAMP, the Interagency Ecological Program, the Sacramento Watershed Group, the San Francisco Estuary Institute's Regional Monitoring Program, and agency-funded tributary monitoring, including Battle Creek. Adaptive management monitoring from the Restoration Project will be coordinated with CMARP's larger aims.

STEELHEAD RESTORATION AND MANAGEMENT PLAN FOR CALIFORNIA
The Steelhead Restoration and Management Plan is a follow-up to the CDFG's "Restoring Central Valley StreamsA Plan for Action," stemming from the final recommendations of the California Advisory Committee on Salmon and Steelhead Trout. Several of the actions identified in this document that pertain to the Battle Creek watershed will be implemented through the Restoration Project.

CVPIA: Title 34, PL 102-575, Section 3406:

- (b)(1): Restoration Project is one of many efforts to double the natural production of anadromous fish in Central Valley Rivers and streams (Anadromous Fish Restoration Plan (AFRP)).
- (b)(3): Restoration Project Interim Flow Agreements, and water acquisition fund element of the Proposed Action consistent with this mandate to acquire water to supplement CVP water dedicated for fish and wildlife restoration.
- (b)(11): authorizes implementation of the USFWS' 1987 Station Development Plan.
- (b)(21): authorizes screening of water diversions.
- (e)(3): Restoration Project facility modifications consistent with this subsection that includes measures to eliminate barriers to salmonid migration.
- (e)(6): Restoration Project is consistent with this subsection that authorizes other measures to protect, restore, and enhance salmonid natural production.

Figure 6-2
Related Sacramento River and Central Valley Projects

The terms of the current Interim Flow Agreement (2003) partially pays PG&E for continuing to make temporary water supplies of up to 30 cfs available, primarily, to meet the fish and wildlife needs in both the South Fork and North Fork Battle Creek until implementation of the long-term Restoration Project has been completed. The agreement has been extended to December 2005 based on mutual agreement between Reclamation and PG&E with concurrence from DFG. PG&E is currently required under the Hydroelectric Project's license from FERC to provide the following minimum instream flow releases: 3 cfs at Eagle Canyon and Wildcat Diversion Dams on North Fork Battle Creek and 5 cfs on South Fork Battle Creek. Under the 2003 Interim Flow Agreement, PG&E increases instream flows to 30 cfs through reductions in its hydropower diversions. PG&E provides the first 12.5 cfs at no cost and is compensated to maintain flows above 12.5 cfs up to 30 cfs in either of the forks of the creek. The agreement maintains 30 cfs in North Fork Battle Creek but also maintains seasonal flow augmentations in each of the forks, based on environmental conditions and needs. The actual determination of seasonal flow augmentation in either fork is based on monitoring and adaptive management principles in accordance with consultations between PG&E, the resource agencies, and Reclamation. The intent of the 2003 Interim Flow Agreement is to provide immediate habitat improvement in the lower reaches of Battle Creek as implementation of the more comprehensive Restoration Project moves forward. When Battle Creek has been improved by the implementation of the long-term Restoration Project, the flows provided by this interim agreement will have helped improve conditions for anadromous fish runs, thereby assisting in the strengthening of foundation stocks of anadromous fish in Battle Creek.

Coleman National Fish Hatchery

Hatchery Operations

The Coleman National Fish Hatchery is located on the north side of Battle Creek about 6 miles upstream of the confluence of Battle Creek and the Sacramento River. Because of its location on Battle Creek, facility operations at the hatchery are intimately linked to the Battle Creek watershed.

The authorized purpose of the Coleman National Fish Hatchery is to mitigate for the effects of Shasta Dam on salmonid populations. Shasta Dam resulted in the loss of approximately 187 miles of spawning and rearing habitat for anadromous salmonids (approximately 50% of the Chinook salmon and steelhead spawning and rearing habitats) (Skinner 1958). To mitigate for habitat lost behind Shasta Dam, the federal government established the Shasta Salvage Plan, which contained several features, including the construction and operation of a fish hatchery (Moffett 1949).

The Coleman National Fish Hatchery was constructed on Battle Creek in 1942, and fish culture operations began in 1943 (Figure 6-3). The hatchery currently propagates three salmonid stocks: fall-run Chinook salmon, late-fall-run

Chinook salmon, and steelhead. Risks that hatchery operations may pose to natural populations of steelhead and Chinook salmon in Battle Creek include introduction, spread, or amplification of fish pathogens; deleterious genetic effects of hatchery fish on natural stocks; exceedance of the habitat carrying capacities; and fish migration blockage or delay (U.S. Fish and Wildlife Service 2001a). Operational and or physical modifications to address some of these issues are underway or being addressed in support of the Restoration Project (U.S. Fish and Wildlife Service 2001a).

Figure 6-3
Coleman National Fish Hatchery

As governed by federal law, principles and legislation, the Coleman National Fish Hatchery will (1) continue to operate to mitigate for the losses of anadromous salmonids associated with the construction of Shasta Dam, (2) participate in species restoration and recovery programs as necessary or appropriate, (3) continue to assess and modify its operations to reduce or avoid impacts on stocks listed as endangered species, and (4), in support of CVPIA and CVPIA's AFRP, continue to attempt to reduce impacts on natural populations basinwide.

The hatchery is managed under an interagency agreement between USFWS and Reclamation. The existing 1993 interagency agreement supercedes all previous agreements between USFWS and Reclamation pertaining to the operation and funding of the hatchery. The agreement stipulates that USFWS will continue to operate, maintain, and evaluate the facility "for the salvage, protection, and preservation of fish spawned in the upper Sacramento River Basin prior to the

construction of Shasta and Keswick Dams" (U.S. Fish and Wildlife Service 2001b, Attachment 3-1). Reclamation will reassume financial responsibility for the facility and arrange for recovery costs from project beneficiaries in accordance with federal reclamation law.

Endangered Species Act Requirements

The recently completed biological assessment for Coleman National Fish Hatchery operations (U.S. Fish and Wildlife Service 2001b) describes fish propagation programs at the Coleman National Fish Hatchery and assesses the potential impacts resulting from those artificial propagation programs on naturally produced salmonids. It fulfills USFWS's obligations for consultation with NOAA Fisheries under Section 7(2)(a) of the ESA of 1973 (16 USC 1531-1544).

The current biological assessment is intended to provide a single, comprehensive source of information to describe and assess the impacts of current or proposed operations of the Coleman and Livingston Stone National Fish Hatcheries on ESA-listed, Central Valley populations of anadromous salmonids. Within the biological assessment, USFWS acknowledges that incidental take of ESA-listed species of anadromous salmonids may occur during the course of conducting fish propagation activities and provides estimates of incidental take resulting from those activities. The ESA Section 7(2)(a) consultation process is specifically designed to determine whether proposed activities are likely to jeopardize the continued existence of listed species or to result in the destruction or adverse modification of their critical habitats.

In addition to filling this customary role as part of the ESA Section 7 consultation process, the biological assessment focuses on potential impacts of hatchery facilities and operations within the Battle Creek watershed and addresses many of the concerns raised during the Coleman National Fish Hatchery reevaluation process (for more information on the reevaluation process see the section entitled Reevaluation Processes and Hatchery Alternatives Analysis below). USFWS recognizes the importance of integrating hatchery operations with natural salmonid production in Battle Creek, especially in light of pending restoration activities within the watershed.

A draft of the Coleman National Fish Hatchery Section 7 biological assessment was distributed for review in October 2000. In response to comments on the document, several changes and additions were made, and a final biological assessment was sent to NOAA Fisheries in June 2001. NOAA Fisheries has not yet completed their biological opinion for this Section 7 consultation. As a result of the delay, NOAA Fisheries has authorized the USFWS to conduct fish propagation activities through extensions of the previous biological opinion, with several modifications to hatchery operations being covered under reconsultations between NOAA Fisheries and the USFWS. The forthcoming biological opinion will authorize incidental take of ESA-listed Central Valley salmonids affected by the described artificial propagation activities.

The biological opinion will be in effect over the short term (less than 10 years), and a new consultation will be triggered by its expiration date or by a change in the resource brought on by the completion of the Restoration Project. USFWS has committed to preparing a new biological assessment when the Restoration Project is complete (U.S. Fish and Wildlife Service pers. comm. 2001b).

Battle Creek Watershed Conservancy

In 1997, a group of local landowners organized to form the BCWC. In 1998, the BCWC received funding from the Western Shasta Resource Conservation District and USFWS to develop a watershed strategy/plan for the Battle Creek watershed. The conservancy's guiding watershed "community" plan was intended to supplement existing technical plans for hydropower, water flow, hatchery production, and water supply. The watershed-wide plan also provides an opportunity for the public to have a voice in long-term decision-making processes. The Battle Creek watershed plan addressed:

- identification of important factors affecting aquatic habitats of spring-run Chinook salmon, especially those on private lands or affecting private interests;
- recommended projects and programs to address these factors; and
- description of a monitoring program to evaluate current conditions and results from such projects and programs.

This community plan, when combined with the technical plan, would result in a two-tiered total plan for the watershed. The funding supported the following activities:

- conducting monthly conservancy meetings that focused on restoration efforts and technical planning in the watershed and semiannual public meetings that collected related public input on that planning;
- conducting educational tours of restoration or otherwise significant sites;
- developing articles for publication in local newspapers;
- arranging for on-site television coverage of restoration plans and activities;
- developing booklets, handouts, and brochures for use in meetings and for distribution to interested individuals;
- developing a watershed-wide database that listed private landowners, interested members of the general public, agency contacts, private businesses, environmental groups, and others; and
- assembling a library of published material about the watershed.

The benefits of the BCWC include its ability to bring all involved parties together to discuss watershed restoration efforts, to include community-related issues not found in other technical plans prepared by the agencies, and to provide

educational opportunities directed at developing a greater public appreciation and "buy-in" for the restoration efforts.

Battle Creek Watershed Assessment Report

In 1998, the BCWG received CBDA funding to complete a watershed assessment of Battle Creek. The final results were completed in August 2004 in the *Battle Creek Watershed Assessment: Characterization of stream conditions and an investigation of sediment source factors in 2001* (Terraqua, Inc. 2004b). The report describes the ecological state of the Battle Creek watershed and the historical roles it has played, particularly in the development of hydroelectric power and fish culture. It also describes several predecessor salmon restoration plans for Battle Creek that produced only modest results because of the lack of sufficient habitat information and restoration funding.

Because the Watershed Assessment Report contemplates a substantial reallocation of streamflow away from hydroelectric production, including the complete removal of some dams and their appurtenant facilities, it carefully spells out the steps taken to assign species priorities (e.g., winter-run Chinook salmon) to each stream reach. It also takes care to determine the factors of greatest concern (e.g., upstream migration, spawning, egg incubation) for the successful production of each priority species in each target reach. It defines the streamflow and temperature parameters needed to serve each priority species and target reach and to resolve each production-limiting factor. The report also sets out those physical actions and the monitoring and evaluation needed to achieve and sustain the restoration of salmon and steelhead in Battle Creek.

Overall, the Watershed Assessment Report provides the essential biological criteria and information on which negotiations between PG&E and the federal and state natural resource agencies were conducted to arrive at the MOU described in Chapter 3 of this EIS/EIR.

Battle Creek Watershed Community Strategy

The Battle Creek Watershed Community Strategy was prepared in 1999 for the BCWC (Paquin-Gilmore 1999). The Battle Creek Watershed Project is a cooperative project of the Tehama County Resource Conservation District and the BCWC. It is supported by grant funds from CVPIA (Title 34, PL 102-575) and CBDA.

The Battle Creek Watershed Community Strategy is a long-term plan developed as a response to the Restoration Project. The strategy is the result of extensive public input from many community meetings and reflects the concerns and goals of local stakeholders regarding the Battle Creek watershed. It emphasizes strategies and actions to support the restoration of Chinook salmon to Battle Creek and the continuation of a healthy, fully functioning watershed.

Recognizing the stewardship responsibilities that all landowners assume within the watershed, the strategies emphasize "on-the-ground" actions and Best Management Practices to ensure the continued health of the watershed.

The Battle Creek Watershed Community Strategy describes the watershed, private and public lands, their uses, the Coleman National Fish Hatchery, and the communities of Manton, Mineral, Shingletown, and Viola. It also describes the formation and ongoing work of the BCWG and BCWC in facilitating restoration efforts and progress in the watershed. Most importantly, it clearly states the community issues and recommendations regarding the following community concerns:

- protection of existing water rights,
- threats to local economic activities,
- restrictions on land use,
- increased federal ownership and presence,
- control of invasive weeds,
- private stewardship options in the future,
- preservation of the rural landscape, and
- fuels management.

The strategy offers several potential solutions and accompanying action items reflecting the position of those landowners, businesses, and residents that will be most directly affected in the long term by the changes caused by implementation of the Restoration Project.

Because of its insights regarding the concerns and likely responses of the local populace to Restoration Project implementation, several of the mitigation measures presented in the land use, water quality, public health and safety, and other sections of this EIS/EIR rely heavily on recommendations made in the Battle Creek Watershed Community Strategy. Most importantly, the BCWC is well suited to foster long-term acceptance of the Restoration Project by the local community, which will be a critical component to the success of adaptive management and the Restoration Project. The perception of the Restoration Project by local community members ranges from "it's a government-imposed burden" to "it's a worthy project that we want to help." If the BCWC and the MOU parties can work together to successfully implement the Restoration Project, the challenge will be to give members of the local community a reason to embrace the Restoration Project. The BCWC has suggested that if the local community is encouraged to participate in adaptive management monitoring and data management, community acceptance, a sense of ownership in the outcome of the Restoration Project, and the eventual success of the Restoration Project are far more probable than in the absence of such encouragement.

Suggested Water Quality Monitoring

Inasmuch as it is motivated and funded to do so, the BCWC, with participation from local schools, may be the organization most suited to monitoring certain aspects of the watershed that either fall within or are complementary to future adaptive management of the Restoration Project.

Sediment Quality Monitoring

One of the most easily measured symptoms of deleterious land use practices is an increase in sedimentation within Battle Creek. The BCWC could partner with local schools to initiate sediment quality monitoring. Using relatively simple scientific sampling regimens, young residents of the watershed could provide an early-warning system for the health of the Battle Creek uplands, while learning about and forming a connection with the unique populations of salmon and steelhead that will be restored in their watershed.

Ongoing Watershed Assessment

Sediment quality monitoring is useful in detecting erosion problems. The BCWC believes that a locally developed, long-term watershed assessment program would be able to prevent erosion problems before they occur or, at least, before they affect stream habitat in the Restoration Project. The BCWC could help landowners in the upper watershed implement appropriate land-use practices that would protect against ecological impacts and avoid the need for future regulatory actions.

Water Temperature and Climate Monitoring

Water temperature and climate monitoring will be elements of adaptive management and are activities that might be done efficiently and cost-effectively by the BCWC. Depending on the BCWC's interest, it may be possible for the resource agencies to train and fund the BCWC to collect this critical information. Some private landowners may not allow resource agency personnel to access Battle Creek for monitoring but would allow access to a member of the community. In these situations, it is possible that key adaptive management monitoring elements, such as temperature monitoring, would be feasible only with the support and participation of the local community.

Data Management and Dissemination

The BCWC operates and maintains an information system in which data collected as part of the Restoration Project can be stored and disseminated. This system enables the BCWC and local community members to monitor changes in

the watershed and to assess the effects of those changes on the fish populations and habitat in the Restoration Project area. This system complements and, in many respects, outperforms agency-maintained databases that have been designed for Central Valley–wide applications. The BCWC foresees using this information system as a critical way to assist in the adaptive management process.

Battle Creek Watershed Stewardship

The BCWC received CBDA funding for implementing tasks essential for the stewardship of the Battle Creek watershed. This BCWC project directed long-term protection of the public investment in the watershed through the following tasks:

- implementation of a watershed strategy,
- development of a workgroup to address upper watershed processes,
- implementation of fuels management and fire defense improvements,
- planning and implementation of conservation easements, and
- control of noxious weeds.

Five benefits from this stewardship effort were:

- reduced stressors on the anadromous fish in Battle Creek;
- protection, restoration, and maintenance of ecological processes and functions in the watershed;
- maintenance and restoration of riparian communities with local landowner cooperation;
- completion of a future work plan to further reduce stressors; and
- setting of the stage for further cooperation by landowners as restoration efforts continue, which will also further reduce stressors.

Battle Creek Watershed Stewardship, Phase II

The BCWC is conducting a series of initiatives under the program titled “Battle Creek Watershed Stewardship, Phase II.” This program is funded by AFRP and was approved for federal funding throughout the CALFED 2001 proposal solicitation process. It reflects the goal of integrating the CALFED Program and AFRP in habitat restoration in the Central Valley.

The specific objectives of the program are described below.

- Conduct an assessment of watershed conditions in the upper watershed and for the lands lying upslope and downstream of the Restoration Project reaches. The watershed assessment will (1) characterize the physical

condition of fish-bearing stream channels throughout the watershed, using state-of-the-art stream survey techniques developed and implemented by the U.S. Forest Service's Aquatic and Riparian Effectiveness Monitoring Program; (2) establish monitoring sites that will be used for long-term monitoring of in-channel stream conditions as indices of land use impacts to streams; and (3) characterize land use and upland conditions that could affect streams, using protocols established by the State of California's North Coast Watershed Assessment Program.

- Implement, in close cooperation with resource agencies and local schools, a watershed information system to assist the monitoring, assessment, and adaptive management of the Restoration Project. The system will include an updating of the KRIS (Klamath Resource Information System) Battle Creek watershed information management program that was developed to support the Restoration Plan. The updated watershed information system will be structured to store, display, and analyze spatial and nonspatial data collected as part of the watershed assessment, long-term stream monitoring, and the Adaptive Management Program specified under the MOU.
- Sustain implementation of the watershed strategy, through outreach by BCWC's board of directors and watershed coordinator, to the area's schools, communities, agencies, and landowners.

Battle Creek Working Group

The BCWG was created to recognize the value of coordinating the planning, implementation, and evaluation of all fish habitat restoration and watershed projects among public agencies, nonprofit organizations, and private landowners within the greater Battle Creek watershed in order to maximize restoration of all naturally produced anadromous fish and maintain, and restore, as necessary, a healthy watershed and landscape.

Various objectives for the greater Battle Creek watershed that were identified by the BCWG include:

- establishing a transparent, balanced, collaborative, respectful, and inclusive forum for communication that ensures activities within the watershed are synchronized and that goals, objectives, and evaluative processes of agencies and organizations are coordinated;
- taking necessary steps to develop a comprehensive greater watershed strategy to ensure that fish, habitat restoration, or watershed projects support and make important contributions to the recovery of, and have no long-term adverse effect on, listed species (i.e., winter-run and spring-run Chinook salmon and steelhead), the restoration of nonlisted naturally produced runs (i.e., fall-run and late fall–run Chinook salmon), production of Chinook salmon for sport and commercial uses, production of steelhead for in-river sport uses, and the continued health of the riparian and upland habitat;

- identifying specific needs for new projects based on the comprehensive greater watershed strategy and current or planned activities within the watershed;
- adopting and applying principles of science and, as appropriate, adaptive management processes to actions considered and undertaken in the comprehensive greater watershed strategy;
- engaging agencies, organizations and the public to provide information on the comprehensive greater watershed strategy and adaptive management processes, identifying and communicating issues and proposed projects, and maximizing compatibility of activities of the Coleman National Fish Hatchery, Livingston Stone National Fish Hatchery, Restoration Project, and agencies, private industries, and nonprofit organizations operating within the greater Battle Creek watershed;
- establishing and implementing a review process for fish, fish habitat restoration, and watershed projects undertaken within the greater Battle Creek watershed that may result in endorsement by members of the BCWG;
- defining and developing administrative processes to guide the BCWG in accomplishing its objectives effectively and efficiently; and
- reviewing and proposing communication and education programs for the Battle Creek community.

The BCWG has developed a draft MOU that memorializes/captures these objectives for the Battle Creek watershed. The BCWG seeks to encourage projects that are consistent with a community- and science-based greater watershed strategy and that incorporate the principles of adaptive management (to be adopted by the BCWG) and establish programmatic linkages between the major actions in the watershed, on the stream course, and with the Coleman and Livingston Stone National Fish Hatcheries. The BCWG provides an opportunity for stakeholders, agencies, and the public to participate in open coordinated discussions on various watershed activities in the greater Battle Creek watershed.

BCWG members will provide input on plans or projects reviewed by the BCWG. Members of the BCWG also seek to advance:

- the Multi-Species Conservation Strategy,
- CVPIA doubling goals of naturally produced salmonids pursuant to AFRP,
- FERC policy regarding hydroelectric project compatibility with comprehensive plans,
- CBDA ecosystem restoration goals to restore and enhance habitat, ecosystem functions and processes, and
- BCWC community strategy goals.

Lassen Lodge Hydropower Project

The Lassen Lodge Hydropower Project is a proposed 7,000-kilowatt hydroelectric generating station to be constructed on the western slopes of the Cascade Range near the town of Mineral, an unincorporated community in Tehama County, California. The project would be sited along the south bank of South Fork Battle Creek at elevations between 3,062 and 4,310 feet above mean sea level. At this site, South Fork Battle Creek drains an area of approximately 33 square miles south and west of Lassen Volcanic National Park.

The project would consist of a natural, grouted rock and boulder diversion approximately 80 feet long and 5 feet high with a concrete stem wall, a concrete intake, and approximately 19,200 feet of buried penstock from elevation 4,310 feet down to the powerhouse at elevation 3,062 feet. The intake would include fish screens and valves for sluicing silt from the intake. The powerhouse would be constructed of a reinforced concrete substructure, a superstructure of concrete block and metal, and an electrical substation adjacent to the powerhouse.

The Tehama County Power Authority previously licensed the Lassen Lodge Hydropower Project on January 30, 1986, under FERC Project 5350. It later surrendered the license because it was unable to negotiate site control for the powerhouse and other components of the project. The current applicant has obtained all required easements for the project and property access (Hagood 2001) and is now FERC Project number is 11894.

The proposed project is located upstream of South Diversion Dam and above Panther Creek. Previous studies have listed the natural streambed features near Panther Creek as the absolute upstream barrier for anadromous salmonids. Since 1998, the resource agencies' position has been that the natural features (a waterfall referred to as Panthers Grade) are not a total barrier to anadromous fish passage but appear to be a temporary or partial barrier under certain low flow conditions. The issue is currently being investigated.

Gravel Removal Agreements

Between 1988 and 1995, PG&E and DFG entered into and renewed a series of streambed alteration agreements that permitted PG&E to dispose of gravel and sand that had accumulated behind South, Inskip, and Coleman Diversion Dams. Disposal included placing the gravel and sand immediately downstream of the dam from which they were dredged. The cleaning became necessary when the gravel and sand restricted flow to the fish ladders and canal inlet. The intent of these agreements was to mimic natural downstream sediment movement and to enhance the spawning gravel for salmon and steelhead. Enhanced spawning habitat is consistent with the Restoration Project. Currently, DFG and PG&E are working to formalize this agreement and will include the final version as part of the FERC license amendment for the Hydroelectric Project.

U.S. Forest Service Sediment Reduction Programs

The U.S. Forest Service has been conducting a few limited programs in the Battle Creek watershed related to stream restoration. These programs have included several road restoration measures, such as culvert replacements, that are intended to reduce sediment delivery to the stream. In the summer of 2000, Lassen National Forest assessed wildfire fuels in the Battle Creek watershed under a contract with the BCWC. Although all national forest lands in the watershed are outside the Restoration Project and outside the area that will be adaptively managed, the long-term success of the Restoration Project could be compromised if the U.S. Forest Service does not remain committed to reducing sediment delivery to Battle Creek (Chapell pers. comm.).

Other Trout-Rearing Facilities

The watershed includes one state hatchery and nine private trout-rearing facilities operated by Mt. Lassen Trout Farms, Inc. These private facilities rear rainbow trout for stocking in private ponds and lakes throughout California (Mt. Lassen Trout Farms 1998). Mt. Lassen Trout Farms, Inc. is also permitted to raise brown trout, but does not currently do so due to poor market conditions for this species of trout. Although these facilities are located above the anadromous habitats of Battle Creek, some facilities, such as the main brood stock facility, are near Hydroelectric Project power canals. Concern has been expressed about possible disease transmission between the canals and these facilities (Mt. Lassen Trout Farms 2000). For example, pathogens from infected Chinook salmon and steelhead in Battle Creek could be conveyed with flow and fish diverted from Battle Creek. The pathogens could be transferred to fish farms through seepage of canal flow into the spring-water source for the hatchery operations or by birds and mammals that may eat infected fish and subsequently carry the pathogen to fish-rearing ponds. Potential socioeconomic impacts associated with these private trout-rearing facilities are analyzed in Section 4.16, Other NEPA Analyses.

DFG stocks put- and take- rainbow trout in the lakes, reservoirs, and stream reaches above the barriers on the two forks of Battle Creek outside of the Restoration Project area. Steelhead and rainbow trout are the same species, but rainbow trout is the resident form. Put-and-take rainbow trout stocking may risk outbreeding depression, loss of genetic fitness, and increased competition to the trout population in lower Battle Creek. Outbreeding depression and increased competition may occur if the strain of the stocked trout differs from the strain of trout in lower Battle Creek. A wide variety of nonnative strains are raised at Darrah Springs State Fish Hatchery, and they, at least, could accidentally co-mingle with Battle Creek–origin fish. If the two strains co-mingle via downstream or accidental release in areas occupied by trout of Battle Creek–Sacramento River origin, they may interbreed or compete.

Hybridization may lead to outbreeding depression. When genetically divergent populations interbreed, the progeny may be less fit because of a loss of local adaptation (Templeton 1986). Loss of local adaptation may produce divergent phenotypes. For example, crossbred steelhead juveniles risked exposure to predators more often than naturally produced steelhead (Johnson and Abrahams 1991). McEwan (pers. comm.) claims that rainbow trout and steelhead are considered one genetic "metapopulation" in California because they intermingle and breed with each other. The propagated trout may possess genotypes maladapted for Battle Creek, let alone the Sacramento River drainage. When mixed by interbreeding, these propagated trout could contribute to outbreeding depression. The extent of this potential problem has not been evaluated.

Darrah Springs Hatchery

Darrah Springs Hatchery is a state-run facility located at Darrah Springs on Baldwin Creek, a tributary to mainstem Battle Creek. It is a key hatchery of DFG's inland fisheries program and raises catchable trout for sport fisheries, using a wide variety of strains, including Eagle Lake and Mt. Shasta–strain rainbow trout.

Projects That Support the Restoration Project Purpose and Need

AFRP- and CVPIA-Related Improvements to the Coleman National Fish Hatchery

Changes have been under way at the hatchery to integrate hatchery operations with the Restoration Project. In the last 12 years, approximately $30 million has been spent renovating the hatchery (U.S. Fish and Wildlife Service 2001b). Much of the work completed or in progress includes three specific actions: constructing an ozonation water treatment plant and water filtration system, screening the hatchery's water intakes, and modifying the hatchery's barrier weir and upstream fish ladder. These actions are fully expected to support the current Restoration Project as described below (U.S. Fish and Wildlife Service 2001b).

- The newly constructed water treatment plant at the hatchery is capable of sand-filtering 45,000 gpm and ozonating 30,000 gpm of fish production water. The new system's water treatment capabilities will alleviate concerns that potentially disease-carrying fish will pass into upper Battle Creek, where the hatchery obtains its water (U.S. Fish and Wildlife Service 2001b).
- The hatchery's water intakes will be screened to avoid impacts to naturally produced fish in the system. The new fish screens will comply with screening criteria established by NOAA Fisheries and DFG.

- The proposed modifications to the hatchery's barrier weir and fish ladders will improve the management of fish passage and monitoring. Controlled passage and monitoring of Chinook salmon and steelhead into the upper Battle Creek watershed allows runs to be segregated and counted at that point, thus affording the capability to measure and maximize restoration benefits for "at-risk" priority stocks (U.S. Fish and Wildlife Service 2001b).

Expanded Water Treatment and Filtration at the Hatchery

To correct sediment and disease problems at the Coleman National Fish Hatchery, USFWS has expanded the water treatment system to a 45,000-gpm capacity and the ozonation water treatment system to a 30,000-gpm capacity. Increasing and improving the water filtration and treatment systems will minimize the risk of catastrophic hatchery events and will optimize the hatchery's production capabilities (U.S. Fish and Wildlife Service 1997a).

In 1985, whirling disease (*Myxobolos cerebralis*) infections at the hatchery triggered the destruction of the entire year-class of steelhead smolt production, consistent with hatchery policy, and punctuated the hatchery's need to develop a pathogen-free water supply. The *Coleman National Fish Hatchery Station Development Plan*, approved in 1987 by USFWS, includes a provision for a pathogen-free water supply to benefit hatchery fish production. Ozonation was the identified treatment alternative. An adequately treated water supply minimizes the risk of potential outbreaks of catastrophic diseases affecting hatchery production. It also enables the hatchery to produce healthier juvenile fish more capable of withstanding the rigors of out-migration. These fish also have a better chance of surviving to adulthood.

The complete treatment facility results in:

- potential for restoration of natural production in Battle Creek above the hatchery's water supply intakes by eliminating the hatchery's disease threat and minimizing potential catastrophic events through filtration and disinfection of the water supply;
- likely decrease the egg-incubation and fish-development mortality rate, thus increasing survivorship; and
- likely increase smolt-to-adult survivorship because potential decrease in fish mortality and sublethal effects caused by waterborne pathogens (U.S. Fish and Wildlife Service 1997a).

The background, previous treatment studies, objectives, water treatment alternatives considered for the Coleman National Fish Hatchery, environmental consequences, and related activities are discussed further in the environmental assessment for the Coleman National Fish Hatchery improvements (U.S. Fish and Wildlife Service 1997a). The environmental assessment explains the relationship between the improvements and natural fish restoration planning.

Water Intake Screening

A proposal for funding this project was submitted to CBDA's Ecosystem Restoration Program in 2001. Although not selected for funding at that time, the need and desire for the project is not diminished. Agency management (USFWS, NOAA Fisheries, Reclamation, and DFG) have all agreed that all Coleman National Fish Hatchery water intakes on the mainstem of Battle Creek require screens. Once funding has been secured, permitting, design, and construction are anticipated to take 3 years to complete. Completion of the project is expected to benefit fish in the upper Battle Creek watershed by eliminating any entrainment risks associated with the hatchery water-supply intakes. More detailed discussions of alternatives, their design elements and standards, and environmental consequences will be discussed in future meetings of the BCWG and environmental documentation associated with the intake modification process.

Modifications to the Hatchery Barrier Weir and Upstream Ladder

Currently the Coleman National Fish Hatchery operates a barrier weir to congregate and collect brood stock for the hatchery. The upstream fish ladder at the barrier weir is closed from August 1 through early March. The barrier weir also serves purposes unrelated to fish propagation at Coleman National Fish Hatchery, including monitoring fish movement into the Battle Creek watershed, temporally and spatially separating spring-run and fall-run salmon to maintain or manipulate stock identity; preventing fish from reaching habitat with insufficient flow and large, unscreened diversions; and preventing overpopulation of habitat by large numbers of adult fall-run hatchery Chinook salmon.

The present configuration and future operational strategy of the Coleman National Fish Hatchery barrier dam are currently under investigation by a multiagency team assembled by the BCWG. The physical structure and operational strategy of the barrier weir will be modified, as necessary, to accommodate the Restoration Project. Future operations of the barrier weir will be adapted to integrate with restoration activities in Battle Creek. As part of a successful integration strategy, upstream passage of anadromous salmonids will be blocked from August through early March for the purpose of collecting brood stock of fall-run and late fall–run Chinook salmon and steelhead. However, even during this period, fish can be afforded upstream passage via the Coleman National Fish Hatchery spawning building. In fact, this strategy is currently used for natural-origin late fall–run Chinook salmon and natural-origin steelhead adults. In general, the barrier weir and associated upstream fish ladder or other conveyance facilities will be operated in a manner such that passage opportunity for natural origin salmonids will be achieved in Battle Creek.

Management of the Coleman National Fish Hatchery barrier weir and upstream ladder is one of the factors controlling the abundance of salmon and steelhead in

Battle Creek and a concern for the restoration of anadromous salmonids in the watershed (Upper Sacramento River Fisheries and Riparian Habitat Advisory Council 1989; California Department of Fish and Game 1993, 1996a; U.S. Fish and Wildlife Service 1995a, 1997a; Bernard et al. 1996). However, restoration actions recently undertaken in the watershed and those proposed to take place in the near future alleviate much of the former concern that prompted prolonged closures of the upstream ladder. For example, the construction of ozonation water treatment facilities to disinfect water at the hatchery alleviated disease concerns for the upstream passage of salmon (U.S. Fish and Wildlife Service 1998b). Furthermore, anticipated flow and habitat restoration actions, including screening diversions, will alleviate concerns about altered quality and insufficient amount of habitat.

Anticipation of Restoration Project implementation and the need to allow recovering populations of salmon and steelhead to migrate upstream throughout the year have affected the management of the barrier weir. In the future, management of the barrier weir may accommodate the movement of naturally produced salmon and steelhead so they can access the best stream reaches at the right times. A panel was convened in light of commitments by USFWS and DFG to explore improvements to the barrier weir that complement or enhance restoration of natural spawners (U.S. Fish and Wildlife Service 1998b; California Department of Fish and Game 1998a). USFWS, with input from the panel, submitted a proposal that received CBDA funding in 1999. Specific objectives of the proposed modifications are designed to more effectively block the passage of fall-run and late fall–run Chinook salmon and to improve the upstream fish ladder to be consistent with the criteria for fish ladders designed for the hydropower diversions as part of the Restoration Project. USFWS is working with a subgroup of the BCWG to determine design of this facility. Environmental compliance documents are underway and the structural modifications are expected to be completed during the same time period as the implementation of the Restoration Project.

Barrier weir and upstream ladder operations or modification can further support or be affected by the Restoration Project because fish trapping and monitoring facilities at the upstream fish ladder will be used to support several adaptive management objectives. Adult anadromous salmonids returning to the Restoration Project area will be captured and sampled for such information as population estimates, run timing, stock, size, and condition. Future activities to monitor upstream migration of adults into the restored portion of the Battle Creek watershed can be modeled after the monitoring conducted at this site by the USFWS office in Red Bluff since 1995 (U.S. Fish and Wildlife Service 1996).

Reevaluation Process and Hatchery Management Alternatives Analysis

The Coleman National Fish Hatchery reevaluation process was formally initiated in 1999 in anticipation of the Restoration Project and other ongoing activities.

The primary goal of the reevaluation process was to objectively review all aspects of the hatchery facilities and operations to ensure their integration with AFRP-guided restoration efforts in Battle Creek. During a series of public meetings, participants in the reevaluation process, including stakeholders and agency personnel, forwarded more than 50 alternative operational strategies for conducting fish propagation activities at the Coleman National Fish Hatchery. Those alternatives are currently being analyzed.

The four major components of the reevaluation process are:

- compilation and analysis of historical hatchery operations and evaluation work,
- determination of mitigation responsibilities,
- analysis of potential impacts of current and proposed production programs on listed stocks of anadromous salmonids, and
- generation and analysis of potential management alternatives to minimize hatchery impacts on naturally produced salmonid populations.

The hatchery reevaluation process and hatchery management alternatives analysis have resulted in some significant efforts, most notably the finalization of the biological assessment (U.S. Fish and Wildlife Service 2001b). Many of the hatchery management alternatives that were generated throughout the process will now most appropriately be examined as the adaptive management plan for Coleman National Fish Hatchery is developed. The alternative hatchery operational and management strategies formulated during the reevaluation process were grouped based on similarities between alternatives, with some alternative groupings being analyzed by USFWS and others identified to be analyzed by an independent consultant (Harza Engineering Co. 2001). At this point in the analysis process, two reports have been completed by USFWS (U.S. Fish and Wildlife Service 2002a, 2002b), and a draft report has been completed by the independent consultant (Harza Engineering Co. 2001) to assess the feasibility and biological impacts of these alternative management strategies.

In May 2001, several local landowners and other stakeholders responded collectively to the Coleman National Fish Hatchery draft alternatives analysis produced by the independent consultants. Some stakeholders expressed concern that the contractors conducting the evaluation were constrained by the budget and might be unable to complete the robust assessment required by the stated scope of work. They were also concerned that limitations on the budget for the reevaluation could limit the ability of all involved to adequately address ESA restoration mandates for anadromous fishes. They expressed concern that without completion of the intended scope of work, other stakeholders, managers from the Coleman National Fish Hatchery, and Reclamation were unlikely to be equipped to make informed decisions on the compatibility of hatchery operations with Battle Creek restoration efforts. The stakeholders advocated further development and disclosure of conceptual models and proposed criteria to guide the reevaluation of the stated scope of work and corresponding tasks.

The Hatchery Reevaluation Process was precedent-setting in that it afforded substantial public involvement in the examination of operations at Coleman National Fish Hatchery. The reevaluation also contributed substantially to the completion of the biological assessment (U.S. Fish and Wildlife Service 2001b) and the development of more than 50 hatchery management alternatives. Many of the hatchery management alternatives generated will now be examined as part of the Coleman National Fish Hatchery adaptive management plan.

California Bay-Delta Authority Science Review Workshop of Battle Creek

In 2002 members of the BCWC requested that the CBDA Science Program provide an independent evaluation of some of the specific issues pertaining to Coleman National Fish Hatchery operations and potential impacts on Battle Creek restoration. On October 7 and 8, 2003, the CBDA Science Program convened a technical workshop to review some key issues involving the restoration of salmonid habitat in Battle Creek. An independent science panel, the Coleman Science Panel, was formed to provide an independent evaluation of scientific issues related to the Restoration Project and to assist in the decision-making process for the CBDA ERP. The five-member panel is composed of distinguished scientists who have not been involved in the Restoration Project, yet who have the necessary background in genetics, fish health, hatchery–wild fish interactions, population dynamics, and basic salmonid biology needed to assess the effects of hatcheries on naturally spawning salmonids.

The review focused on the role and impacts of facilities and operations of the Coleman National Fish Hatchery and the effects on Battle Creek restoration efforts. A summary of this workshop can be found in Brown and Kimmerer (2004). In addition to providing a summary of the technical workshop, the Coleman Science Panel prepared a report summarizing its findings from the October 2003 meeting in a report for the CBDA Science Program. (See Coleman Science Panel Identifies Need to Use an Adaptive Management Plan below.)

Coleman Science Panel Identifies Need to Use Adaptive Management—January 2004

The Coleman Science Panel findings from the October 2003 technical workshop are presented in a report entitled *Compatibility of Coleman National Fish Hatchery Operations and Restoration of Anadromous Salmonids in Battle Creek* (Busack et al. 2004).

The Coleman Science Panel concluded that the operation of Coleman National Fish Hatchery may pose significant risk to the recovery of anadromous salmonids in Battle Creek (Busack et al. 2004). The panel stated that adaptive management is essential on Battle Creek and that an adaptive process should be capable of

changing management priorities, including those at Coleman National Fish Hatchery, to ensure the success of the Restoration Project.

The principal message of the Coleman Science Panel's findings, and the main reason that adaptive management is needed, is that scientific uncertainties underlie all aspects of Battle Creek fisheries management, including the interactions between the Restoration Project and Coleman National Fish Hatchery. Adaptive management is recommended by the Restoration Project as the best strategy for incorporating scientific uncertainty into decision-making. The Restoration Project has developed a thorough AMP; however, this plan does not cover activities of the Coleman National Fish Hatchery. An adaptive management plan specifically for Coleman National Fish Hatchery operations is described below under Proposal to Develop a Coleman National Fish Hatchery Adaptive Management Plan.

Presentations Supporting an Adaptive Management Plan—February 2004

On February 5, 2004, the CBDA Science Program held a public meeting to report the Coleman Science Panel findings from the October 2003 technical workshop. Staff from Reclamation, the agency responsible for funding Coleman National Fish Hatchery, and staff from the USFWS, the agency responsible for operating Coleman National Fish Hatchery, publicly recognized the need for adaptive management at the hatchery at this meeting.

Following the February 2004 public meeting, the Battle Creek Watershed Conservancy prepared a letter report (dated February 23, 2004) that identified development and implementation of an adaptive management plan for Coleman National Fish Hatchery as one of four tasks necessary to formalize their support of the Restoration Project. The Conservancy's February 2004 report is entitled *Four Proposed Agency Actions for Securing Conservancy Support for the Battle Creek Salmon and Steelhead Restoration Project* (Battle Creek Watershed Conservancy 2004). As a result of this letter report, the Battle Creek PMT drafted the *Proposal to Facilitate and Develop an Adaptive Management Plan for Coleman National Fish Hatchery for Consideration by Greater Battle Creek Watershed Working Group* in April 2004 (Bureau of Reclamation 2004).

Proposal to Develop a Coleman National Fish Hatchery Adaptive Management Plan

The Restoration project PMT developed a proposal for CBDA to request funding for the development of an adaptive management plan for Coleman National Fish Hatchery. Included within the overall PMT proposal to CBDA, CALFED ERP for the Restoration Project is a related project proposal to develop an adaptive management plan for the Coleman National Fish Hatchery, that would:

- be inclusive of responsible agencies and interested stakeholders,
- conform to the "goals and objectives" of the Restoration Project and legally-managed hatchery-specific goals and objectives,
- be reviewed by the Coleman National Fish Hatchery Coleman Science Panel and other principal scientific bodies, and
- include the scoping and prioritization of diagnostic studies necessary for Coleman National Fish Hatchery adaptive management.

As described in the scientific literature, effective adaptive management requires making adjustments to a system in response to changing circumstances or new findings. In order to respond to these changes successfully, there must be an entity designated with the responsibility and authority to make the necessary adjustments. The AMP for the Restoration Project authorizes modifications to the Hydroelectric Project, which is licensed by FERC. Therefore, the Restoration Project AMP only allows the agencies responsible for implementing the AMP to modify operations of the Hydroelectric Project facilities. Because Shasta Dam is not licensed under the Hydroelectric Project, the Restoration Project AMP would not provide the necessary authority to adaptively manage the hatchery's operations. For these reasons, the Coleman National Fish Hatchery AMP is a separate component of the coordinated adaptive management program in Battle Creek watershed.

The Coleman National Fish Hatchery AMP would build on the founded Restoration Project AMP and monitor and assess hatchery operations that may affect the Restoration Project, so that the hatchery AMP would closely coordinate with the Restoration Project AMP, and Chinook salmon and steelhead restoration in Battle Creek and production of Chinook salmon and steelhead at the hatchery would be adaptively managed through a coordinated process. The Coleman National Fish Hatchery adaptive management plan would build on the founded Restoration Project AMP and fill in the gaps (i.e., hatchery operations), so that together the Restoration Project AMP and the hatchery adaptive management plan will form a single integrated framework for adaptive management in Battle Creek.

The proposal identified Reclamation as the logical lead agency for the Coleman National Fish Hatchery adaptive management plan because Reclamation has the ultimate funding responsibility for the hatchery, it is the federal lead agency for the Restoration Project, and it has a strong track record of funding and facilitating the development of adaptive management in Battle Creek.

The Coleman National Fish Hatchery adaptive management plan would be compatible with, and as rigorous as, the Restoration Project AMP and would be developed using a common framework and be organized in a manner similar to that document. The Coleman National Fish Hatchery adaptive management plan would include, at a minimum: goals, objectives, conceptual models, uncertainties, monitoring and data assessment approaches, specifications of focused studies, description of decision-making process, funding prioritization, and all other elements of formal adaptive management. Adaptive management

operating procedures would be well coordinated with those of the Restoration Project AMP. Together, the Restoration Project AMP and the Coleman National Fish Hatchery adaptive management plan would form a single integrated framework for adaptive management in Battle Creek.

Development of the Coleman National Fish Hatchery adaptive management plan would involve scientific input and public participation. A Technical Advisory Committee (TAC) would be established among members of the BCWG to guide and assist the facilitation and development of the Coleman National Fish Hatchery adaptive management plan. This TAC would include technical representatives from USFWS, DFG, NOAA Fisheries, and at least three non-agency members of the GBCWG. Public involvement would be encouraged during all phases of Coleman National Fish Hatchery adaptive management plan development, including regular meetings and reports to the GBCWG; contact with Battle Creek landowners and residents through the Battle Creek Watershed Conservancy; public meetings for scoping and reviewing the draft Coleman National Fish Hatchery adaptive management plan; and public participation in the implementation of the Coleman National Fish Hatchery adaptive management plan. The final draft version of the Coleman National Fish Hatchery adaptive management plan would be completed within 18 months of contract initiation.

The proposal identifies the following specific tasks to develop the Coleman National Fish Hatchery adaptive management plan and identifies a schedule and budget to accomplish the tasks:

1. Develop the Coleman National Fish Hatchery AMP including (a) scoping, (b) administrative draft, (c) public review draft, and (d) final draft plan within 18 months of contract initiation.
2. Facilitate scientific review of Coleman National Fish Hatchery adaptive management plan development. Reconvene the CBDA Coleman Science Panel on Coleman National Fish Hatchery to meet with and advise the TAC at two phases of the Coleman National Fish Hatchery adaptive management plan development, including scoping and administrative draft review. Invite the participation of the CBDA ERP Coleman Science Panel and the California Advisory Committee on Salmon and Steelhead Trout in scoping and administrative draft review.
3. Convene a TAC, which would include technical representatives from USFWS, DFG, NOAA Fisheries, and at least three non-agency members of the GBCWG.
4. Facilitate up to 30 meetings (approximately every 2 weeks, at least initially) of the TAC to assist Reclamation develop the Coleman National Fish Hatchery adaptive management plan.
5. Facilitate at least three public meetings to solicit and receive public comment on scoping, public draft, and final Coleman National Fish Hatchery adaptive management plan.

6. Perform community outreach related to development of the Coleman National Fish Hatchery adaptive management plan.
7. Report on Coleman National Fish Hatchery adaptive management plan to GBCWG on a regular basis and provide written progress reports to CBDA.

U.S. Fish and Wildlife Service Commitments for Steelhead Supplementation Activities—August 2004

The USFWS (1998) submitted a "Position Paper on Battle Creek Watershed" to the BCWG and others stating that "Coleman National Fish Hatchery operations need to be integrated with natural production in Battle Creek." Examples of this integration include: completion of the ozone water treatment plant, proposed modification to the barrier weir and associated fish ladders, and efforts to screen the facility's water delivery intakes. The completion of the ozone water treatment plant at the hatchery provides for upstream passage of anadromous fish at the upstream fish ladder of the barrier weir. Proposed modifications of the barrier weir are designed to more effectively block the passage of fall-run and late fall–run Chinook salmon, and improvements to the upstream fish ladder are necessary to be consistent with the criteria for fish ladders designed for the hydropower diversions as part of the Restoration Project. Screening the facilities' water supply intakes will prevent entrainment of juvenile fish from Battle Creek and ensure integration and compatibility with the Restoration Project.

Coleman National Fish hatchery programs are designed to avoid or reduce adverse effects of hatchery operations on natural-origin fish in Battle Creek. For example, one integrated program annually incorporates naturally spawned Chinook salmon and steelhead into the broodstock collected by the hatchery for fish propagation. The result is that a proportion of Chinook salmon and steelhead produced by the hatchery is derived in part from naturally spawned adults. The USFWS believes that this helps maintain a genetic similarity between hatchery-origin fish and naturally spawned fish, thus minimizing impacts of hatchery operations on naturally spawned fish. Additional information on Coleman National Fish Hatchery practices can be found in the Coleman National Fish Hatchery Biological Assessment (U.S. Fish and Wildlife Service 2001b).

Other actions demonstrating commitment to integrate hatchery operations and programs with the Restoration Project include cessation of the steelhead supplementation above the barrier weir, support of a Coleman National Fish Hatchery adaptive management plan, requirements under ESA Section 7, and undertaking of the Hatchery Reevaluation Process. These are further described below.

CBDA organized additional workshops, held on June 14 and August 4, 2004, to explore strategies for managing the adult hatchery-origin steelhead returning to Coleman National Fish Hatchery and proposed steelhead supplementation activities in Battle Creek. The Coleman Science Panel provided an independent

evaluation of scientific issues related to steelhead supplementation in Battle Creek and produced a report titled "Review of the Steelhead Supplementation Program in Battle Creek" (Coleman National Fish Hatchery Science Panel 2004), wherein the panel recommended the steelhead supplementation project be immediately terminated. Based on the recommendation from the steelhead supplementation workshop panel, the USFWS has reaffirmed its commitment to ensure hatchery operations will be consistent with Restoration Project activities by suspending supplementation of steelhead above the Coleman National Fish Hatchery barrier weir.

The USFWS has committed to support development of an adaptive management plan for the Coleman National Fish Hatchery to ensure hatchery operations are compatible with the Restoration Project (proposals for diagnostic studies and adaptive management were submitted to CBDA in May 2004). The Coleman National Fish Hatchery adaptive management plan, as well as the future fisheries management strategy to be developed by DFG and the GBCWWG, may contribute to decisions on future Coleman National Fish Hatchery operations.

Investigation of Anadromous Fish Passage Alternatives in Upper Battle Creek

The DWR received CBDA funding for a planning and design investigation of fish passage on upper Battle Creek. The study investigated fish ladders for upstream passage of adult salmon and steelhead and fish screen facilities for downstream passage of juveniles. The objective of the study was to provide data and acceptable designs for fish passage facilities to restore the use of Battle Creek salmonid habitat. The scope of work included:

- collection of necessary field data,
- preparation of preliminary designs for three diversion sites (Wildcat, Coleman, and Inskip),
- preliminary engineering investigation for Eagle Canyon diversion,
- reconnaissance-level engineering investigations at the Coleman, Inskip, Wildcat, South Battle Creek, and North Battle Creek Feeder diversions,
- prereconnaissance work for alternative screen sites, and
- preparation of draft CEQA documents for the five diversion sites.

The resulting reconnaissance-level engineering investigation report for improving fish passage facilities on Battle Creek established a baseline from which planning could be conducted to formulate the passage elements of the Restoration Plan. Passage was investigated at the Coleman, Inskip, South, Wildcat, and North Battle Creek Feeder diversions. The report describes the project and its location and then focuses on improving fish passage on Battle Creek through the use of feasible methods that conform to regulations set forth by fish management agencies. Limited by its reconnaissance level of

investigation, the report identifies the engineering, operational, and economic issues associated with the fish passage alternatives at each of the five diversion dams studied. The study was intended to allow members of the BCWG to evaluate the feasibility of and maximize the potential for identifying and moving forward with practical passage elements of the alternatives.

The Restoration Project fish passage design technical team considered passage behaviors and biological needs for all anadromous salmonids in Battle Creek. Fish screen and ladder design criteria, including a description for the "fail-safe" criteria, have been defined in the MOU. Additional information on the specific factors considered in the investigation, and how they translated into fish passage design for the Restoration Project, is located in the MOU and in the Department of Water Resources Technical Report *Battle Creek Salmon and Steelhead Restoration Project Fish Ladder and Screen Features: Inskip Diversion, North Battle Creek Feeder Diversion, Eagle Canyon Diversion* (California Department of Water Resources 2000). Maintenance of the fish screens and ladders is discussed in further detail in the project description (Chapter 2).

Monitoring of Adult and Juvenile Spring-Run and Winter-Run Chinook Salmon and Steelhead in Battle Creek

In 2001, USFWS was funded by CBDA to conduct 3 years of fisheries monitoring related to the Restoration Project. It was anticipated that the Restoration Project would be implemented during those 3 years and that the monitoring would provide both baseline and postproject information. The monitoring meets the requirements of part or all of the five monitoring elements identified in the Restoration Project MOU. At the time of the funding, the AMP addressed nine different objectives and 11 related hypotheses. The three funded monitoring activities (adult fish counting and trapping at barrier dam, adult distribution [snorkel surveys], and juvenile monitoring [by the upper Battle Creek rotary screw trap]) provided part of the basis for evaluating eight of the nine objectives. Subsequent amendments to the contract served to extend the monitoring through 2006 and to: (1) study the impact of daily barrier weir closure and to reduce these potential impacts by increasing hours of trap operation; (2) extend snorkel surveys through the winter and spring by using kayaks; (3) study the effectiveness of the Coleman National Fish Hatchery barrier weir in blocking Chinook salmon passage while the fish ladder is closed; and (4) collect data at the 22 temperature monitoring sites used to evaluate the benefits of the Battle Creek Interim Flow Program and to model Restoration Project future conditions.

Sacramento River–Wide Focused Study

Reclamation's Sacramento River–Wide Focused Study, which has been funded by CBDA, will identify and implement additional fish passage projects at locations such as the Coleman National Fish Hatchery on Battle Creek. It will provide construction cost data, feasibility information, draft CEQA documentation, and basic water temperature and streamflow data for the Restoration Project. This information will be used to quantify the costs and prioritize measures to eliminate the identified system stressors and facilitate the restoration of remnant populations of steelhead, spring-run Chinook salmon, and, perhaps, winter-run Chinook salmon.

The objectives of this program are to provide data and acceptable designs for fish passage facilities and to restore the use of this prime salmonid habitat; its goal is to develop preliminary designs and environmental work in coordination with CBDA staff, USFWS, NOAA Fisheries, and other interested agencies or private entities. The final design will be completed by the DWR, and construction will proceed as part of the alternative selected for implementation of the Restoration Project.

Battle Creek Wildlife Area

The Battle Creek Wildlife Area contains more than 480 acres of riparian, freshwater marsh, and oak woodland wildlife habitat that were acquired by the Wildlife Conservation Board and are managed by DFG. The wildlife area includes land on both sides of lower Battle Creek approximately 3 miles upstream of its confluence with the Sacramento River. The area is a climax community that includes cottonwoods, sycamores, oaks, willows, maples, wild grapes, and blackberries and an abundance of perennial grasses and wildflowers. It is home to diverse wildlife, including wood ducks and other waterfowl, deer, coyotes, bald eagles, osprey, egrets, and otters. The Battle Creek Wildlife Area is part of a plan developed to conserve property with outstanding riparian and wetland habitats. Its goals are to protect wildlife species and their habitat and to improve this habitat with a balance of riparian restoration, wetland enhancement and development, salmon and steelhead spawning area preservation, fish habitat development, and public access for bird watching, nature study, and fishing (California Department of Fish and Game 1995).

The Battle Creek Wildlife Area has two distinct units: a western unit that includes the western curve of Battle Creek and the eastern unit adjacent to the Coleman National Fish Hatchery, which is divided by Battle Creek into northern and southern sections. The Battle Creek Wildlife Area also serves Redding area developers who have indicated a willingness to finance the enhancement of off-site lands for riparian and wetland values if they would be allowed to develop residential properties on similar lands near Redding. Other local governments have also strongly supported an area where lands would be enhanced to offset losses caused by development projects (Aumack and Paquin-Gilmore 1999).

Tehama Wildlife Area

The Tehama Wildlife Area is located approximately 3 miles south of the town of Paynes Creek and south of the Restoration Project. It includes 46,900 acres of oak woodland, grasslands, and chaparral. There are also rugged canyons throughout the area, and it is a winter range for black-tailed deer. Camping, hunting, and fishing are allowed in the Tehama Wildlife Area.

Conservation Easements and Conservation Water Rights

The intended goals of conservation easements are to preserve high-quality riparian habitat adjacent to wildlife-compatible agriculture and to limit the future impacts of landscape fragmentation, instream physical disturbance, and new wells and septic systems. TNC hypothesizes that the purchase of conservation easements in a watershed with at-risk native species will help maintain and enhance functional riparian habitat and streambank conditions and will help minimize threats that stem from extensive human impacts, including water use.

The goal of TNC's Lassen Foothills Project is to partner with private landowners, local organizations, and the community to ensure the sustainability and economic viability of private land uses and the ongoing health of the area's plants and animals. As of May 2000, TNC has protected more than 830,000 acres in the eastern Sacramento Valley. Approximately half of this land, which includes ranch land and streamside habitat, has been safeguarded through the use of conservation easements with private landowners. The other half includes two preserves that TNC owns or manages. The Vina Plains Preserve is a 4,600-acre nature preserve with native grassland and vernal pools that support a wide variety of native species, many of which are rare or endangered. The Gray Davis Dye Creek Preserve is a 37,450-acre nature preserve, working cattle ranch, and outdoor laboratory. These two preserves run demonstration projects that include habitat restoration, rotational grazing, prescribed burning, and other range management techniques that are both economically viable and compatible with a healthy ecosystem.

TNC has established one conservation easement within the Battle Creek watershed and is negotiating with several landowners about possibly acquiring others. In 1999, it purchased a conservation easement on the 36,000-acre Denny Ranch, which is located on both the north and south sides of Highway 36 about 7 miles northeast of the intersection of Highway 36 and Highway 99. The easement is the largest in California history. The property will continue to be operated as a privately owned working cattle ranch, while its natural communities are permanently preserved from subdivision and development land uses. Important components of this property are its increasingly rare natural grassland communities with native bunchgrasses and wildflowers, numerous vernal pools, and blue oak woodlands. The Denny Ranch is also important

because it links protected BLM lands on its western borders with the Tehama National Wildlife Refuge to the east. In turn, the wildlife refuge adjoins Lassen National Forest and TNC's Gray Davis Dye Creek Preserve. Linking easement properties to protected lands is one of TNC's key strategies.

TNC believes that the next important step in protecting salmon and steelhead along Battle Creek is protecting the relatively pristine riparian habitat along the stream from alteration and preventing the loss or alteration of its cold spring water by well development. In this project, TNC, working in partnership with the BCWC, plans to acquire conservation easement interests from willing landowners on resource-rich Battle Creek properties with the potential for future development. These easements will provide conservation protection of natural processes while maintaining the land in private agricultural use and ownership. It is intended that the terms of the easements, although they may vary slightly to fit a particular property, will help ensure protection of the riparian habitat, prevent excessive water extraction and use, and ensure connectivity of the stream to the surrounding land.

The BLM has also acquired conservation easements on two properties in lower Battle Creek, including land along the mouth of the stream. The purpose of these easements, acquired in October 2000 on the Gover Ranch, is to conduct riparian restoration activities along Battle Creek and the Sacramento River and to maintain the agricultural nature of these properties. The BLM will be developing a conservation plan for these properties and anticipates implementing restoration activities during the next 15–20 years. Although the BLM is not actively seeking other conservation easements or land acquisitions in the Battle Creek watershed at this time, it will entertain proposals by willing sellers for new acquisitions or easements in the future (Schultz pers. comm.). The BCWC and local landowners have predicted that BLM land acquisition would increase public access to Battle Creek and likely heighten human impacts on sensitive populations of salmon and steelhead (Lee and McCampbell 1998).

USFWS and TNC have obtained a conservation easement on Digger Creek in Shasta and Tehama Counties. In late September 2001, the TNC acquired the 1,844-acre Wildcat Ranch, which has approximately 2 miles of frontage along North Fork Battle Creek (The Nature Conservancy 2002). The ranch is just downstream from the 990-acre Canyon Ranch, which TNC previously had protected with a conservation easement. TNC will hold Wildcat Ranch for about 2 years to carry out studies and land stewardship work. It then will place a conservation easement on it and sell it to a private buyer (The Nature Conservancy 2002). TNC will hold and monitor the conservation easement to ensure compliance with its terms.

Butte, Deer, and Mill Creek Reference Watersheds

Reference watersheds are other watersheds resembling Battle Creek in geology, morphology, hydrology, and fish species diversity and distribution that are located close to Battle Creek. Knowledge of population trends in reference

watersheds would be useful when evaluating population trends in Battle Creek to perhaps tease out within-watershed versus regional effects. In many cases, the AMP intends to employ such comparisons when they would be statistically valid.

However, finding watersheds that are directly comparable may be problematic because of the unique nature of Battle Creek and the scarcity of current statistically valid data in nearby watersheds. For example, there is no other tributary to the Sacramento River that supports populations of winter-run Chinook salmon, has constantly flowing cool springs at relatively low elevations, or currently estimates juvenile Chinook salmon production.

Reference watersheds would need to meet the following criteria to be considered comparable to Battle Creek:

- Any current information from proposed referenced watersheds must be statistically valid for comparative analysis.
- If studies are recommended in reference watersheds, the study proposal will need to be coordinated with personnel responsible for fisheries management in the proposed watershed.
- The recommended future studies must have statistically valid data comparable to the target question.
- Recommended future studies in reference watersheds will need to be adequately funded.
- Recommended future studies in reference watersheds will need to be technically feasible.

Monitoring relevant to adaptive management of Battle Creek is routinely conducted in the Butte, Deer, and Mill Creek reference watersheds. With some variations in specific methodologies, population estimates of adult fall-run and spring-run Chinook salmon and estimates of juvenile Chinook salmon production are generated annually in each of these watersheds. From these estimates, cohort replacement rates are calculated. Other fish population data, either recently collected or anticipated in the near future, include genetic sampling of spring-run and fall-run Chinook salmon, life history details of juvenile Chinook salmon, and age and growth information from otolith sampling.

Fish habitat is monitored in Butte, Deer, and Mill Creeks, especially in the high-elevation habitat of spring-run Chinook salmon. Also, water temperature and water quality monitoring is routinely conducted in these streams.

The data collection of both adult counts and juvenile production is part of long-term federal and state programs expected to continue well into the future. However, other fish population data collection has received direct funding that may be unavailable in the future. Data about fish populations, habitat, and water temperature and quality collected in these reference watersheds will be directly compared with similar data from Battle Creek as a means of measuring attainment of several adaptive management objectives.

Red Bluff Diversion Dam Fish Passage Improvement Project

Originally constructed in 1964, the RBDD is located on the Sacramento River about 2 miles southeast of Red Bluff, California. The dam is 52 feet high and approximately 5,985 feet long and diverts water into the Corning and Tehama-Colusa Canals mainly for agricultural irrigation. The dam has been identified by Reclamation and cooperating fishery agencies, including DFG, USFWS, and NOAA Fisheries, as one of the major causes of the decline in salmon and steelhead in the upper Sacramento River (Koch pers. comm.). Approximately 30% of the naturally spawning fall-run Chinook salmon in the Central Valley spawn upstream of RBDD. Typically 5% to 10% of spring-run Chinook salmon in the Sacramento River spawn in tributaries upstream of RBDD, current operation of the dam allows a high percent of these salmon past the dam prior to lowering the dam gates. Virtually the entire population of winter-run Chinook salmon spawns upstream of RBDD, but under the current operations approximately 85% pass the dam before gates are lowered.

After its completion, the dam began operating in 1966. The dam remained closed year-round until 1986 when the gates were raised during the nonirrigation season to improve upstream fish passage. This action was taken because the fish ladders, included in the original design, were proving ineffective at certain flows. Movement of fish upstream was being adversely affected because the fish were either delayed in their passage or blocked entirely. In addition, safe downstream migration of juveniles was threatened because the design of the dam spillway resulted in churning water below the dam, disorienting the migrating juveniles and making them susceptible to predation below the dam.

To explore alternate means of water diversion, the Red Bluff Research Pumping Plant was installed on the river in 1995. The pumps were designed to take both water and fish out of the river, but to screen the fish out after pumping. Testing of the pumps concluded in 2001.

Several mandates have been identified with respect to improving fish passage at the RBDD. These include:

- congressional mandates requiring RBDD to “minimize fish passage problems” in the CVPIA action specific to the RBDD (CVPIA section 3406(b)(10)) and to restore the fishery and double populations of anadromous fish (CVPIA 3406 (B)(1));
- elements in the ROD for the CALFED Programmatic EIS/EIR pertinent to minimizing fish passage problems at the RBDD, improving species recovery, and restoring ecosystem function in the upper Sacramento River (enumerated in USFWS Draft Coordination Act Report for the Fish Passage Improvement Project); and
- support of the timely recovery of species listed under state and federal endangered species acts as threatened or endangered as well as species of special concern as developed in the CALFED Program Multi-Species

Conservation Plan and NOAA Fisheries Sacramento River Winter-Run Chinook Recovery Plan (CALFED Bay-Delta Program 2000b; National Marine Fisheries Service 1997).

In support of these mandates, Reclamation along with the Tehama-Colusa Canal Authority (TCCA), has undertaken the task of identifying the best alternative to improve both fish passage and water supply in the area. To this end, Reclamation and TCCA, along with CVPIA and Proposition 204 funds, are jointly funding the RBDD Fish Passage Improvement project. The goal of this project is to identify and implement the best alternative to improve the reliability of upstream and downstream migration of juvenile and adult anadromous fish, while improving the reliability of agricultural water supply to the Tehama-Colusa and Corning Canal systems.

Phase II of the project, Preliminary Design and Environmental Documentation, is currently on hold pending completion of the Central Valley Project Operations Criteria and Plan (CVP OCAP). At this time, no preferred alternative has been selected, and baseline conditions prevail. Under these conditions, the gates are down between May 15 and September 15, at which time the current Red Bluff Research Pumping Plant withdraws water from the river for the canal system. Once the ROD is completed, Phase III, Final design and Permit Coordination, will begin followed by Phase IV, Construction, and finally, Phase V, Monitoring.

Potential Future Habitat Improvement Projects in the Battle Creek Watershed

As major habitat restoration in Battle Creek is achieved through environmental improvements to the Hydroelectric Project and the Coleman National Fish Hatchery, it will be practical to consider a number of smaller-scale habitat improvement projects. These potential projects include placement of spawning gravel in lower Battle Creek downstream of the Coleman National Fish Hatchery and in lower Baldwin Creek. These habitat improvement projects will require the development of proposals, funding sources, and landowner permissions. Other opportunities to improve habitat may be developed throughout the watershed.

Battle Creek Spawning Gravel Study and Restoration for Fall-Run Chinook Salmon and Rearing Habitat Study for Winter-Run Chinook Salmon on Lower Battle Creek

In the future, the DWR would like to place spawning-sized gravel in the lower reaches of Battle Creek to double or triple the area available for salmon spawning. The lower reaches of Battle Creek downstream of the Coleman

National Fish Hatchery have been diverted in two places, resulting in a minimal loss of spawning gravel recruitment. Only about 3 miles of the lower part of the creek are available for fall-run Chinook salmon spawning. In 1996, as many as 80,000 salmon ascended Battle Creek; however, the Coleman National Fish Hatchery could use only about 11,000. The remaining salmon either spawned in the limited riffle areas on top of other redds or died.

Gravel Introduction and Natural Barrier Modifications on Baldwin Creek

The proposed gravel introduction and natural barrier modifications on Baldwin Creek would include the improvement of a partial natural barrier and enhancement of existing spawning gravel supplies on a ¼-mile stretch of Baldwin Creek. The project is in the early planning stages and will likely be developed in cooperation with DFG. Improved steelhead habitat resulting from this project would be consistent with the Restoration Project.

Related Sacramento River and Central Valley Projects and Plans

Upper Sacramento River Fisheries and Riparian Habitat Management Plan

The Upper Sacramento River Fisheries and Riparian Habitat Management Plan (Upper Sacramento River Fisheries and Riparian Habitat Advisory Council 1989) singled out Battle Creek as a key watershed for restoration. Goals of this plan will be achieved with the implementation of the Restoration Project and adaptive management process.

Central Valley Project Improvement Act

CVPIA (Title 34, PL 102-575) amends the previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses and to include fish and wildlife enhancement as a project purpose equal to power generation. CVPIA identifies a number of specific measures to meet these new purposes. To comply with the purposes and goals of CVPIA and the revised purposes of the CVP, the Department of the Interior is developing programs to improve environmental conditions and modify the CVP's operations, management, and physical facilities and thus its associated environmental conditions. A complete description of CVPIA can be found in the Programmatic EIS for CVPIA (Bureau of Reclamation and U.S. Fish and Wildlife Service 1999b) and the agencies'

ROD for the Programmatic EIS (Bureau of Reclamation and U.S. Fish and Wildlife Service 2001).

Section 3406 of CVPIA focuses on fish, wildlife, and habitat restoration. Several subsections of this act are specific to activities in the Battle Creek watershed.

- Section 3406(b)(1) includes developing a program that makes all reasonable efforts to double natural production of anadromous fish in Central Valley rivers and streams.
- Section 3406(b)(3) mandates a water acquisition program to supplement the amount of CVP water dedicated for fish and wildlife restoration by the act.
- Section 3406(b)(11) authorizes the implementation of USFWS's 1987 Coleman National Fish Hatchery Station Development Plan.
- Section 3406(b)(21) authorizes screening of water diversions.
- Section 3406(e)(3) includes measures to eliminate barriers to salmonid migration.
- Section 3406(e)(6) authorizes "other measures" to protect, restore, and enhance salmonid natural production.

Anadromous Fish Restoration Program

To meet certain provisions of CVPIA (Title 34, PL 102-575), USFWS developed AFRP, which identified 12 actions or evaluations specific to salmon and steelhead restoration in Battle Creek (U.S. Fish and Wildlife Service 2001a) (Figure 6-4). Of the 12, three are associated with the Coleman National Fish Hatchery and four are elements of the Restoration Project. AFRP actions under way at the Coleman National Fish Hatchery are:

- improving the water intakes,
- improving the barrier weir and upstream ladder, and
- developing a disease-safe water supply.

The Restoration Project–related actions pertain to facilitating anadromous fish passage (i.e., providing fish screens and fish ladders) and improving fish habitat (i.e., increasing instream flows), which constitute the backbone of the Restoration Project.

Comprehensive Assessment and Monitoring Program

CAMP was established in response to CVPIA (Title 34, PL 102-575). CVPIA directed the Secretary of the Interior to develop a program to evaluate the effectiveness of actions designed to ensure that the natural long-term production of anadromous fish in Central Valley streams would be sustainable by 2002 at levels not less than twice the average levels attained during 1967–1991. The

1. Continue to allow adult spring-run Chinook and steelhead passage above the Coleman National Fish Hatchery weir. Allow passage of fall and late fall–run Chinook and steelhead above the Coleman National Fish Hatchery weir after a disease-safe water supply becomes available to the Coleman National Fish Hatchery.
2. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to increase flows past PG&E's hydropower diversions in two phases to provide adequate holding, spawning, and rearing habitat for anadromous salmonids. The following suggested flows are indicators of magnitude and subject to revision based on additional analyses:

Diversion	Month	Flow (cfs)
Keswick[a]	All year	30
North Battle Creek Feeder[a]	Sept.–Nov.[b]	40
	Jan.–Apr.	40
	May–Aug.	30
Eagle Canyon[a]	May–Nov.	30
	Dec.–Apr.	50
Wildcat[c]	May–Nov.	30
	Dec.–Apr.	50
South[a]	May–Nov.	20
	Dec.–Apr.	30
Inskip[a]	May–Nov.	30
	Dec.–Apr.	40
Coleman[c]	Spet.–Apr.	50
	May–Aug.	30

[a] Second phase flows required to support fall-run Chinook salmon and steelhead above the Coleman National Fish Hatchery weir, Coleman Powerhouse, and Eagle Canyon Dam, after a disease-safe water supply is available to the Coleman National Fish Hatchery.

[b] The original table of flows in the AFRP document neglected to specify flows at North Battle Creek Feeder in December.

[c] First phase flows required to support winter- and spring-run Chinook salmon between the Coleman Powerhouse and Eagle Canyon Diversion Dam while a disease-safe water supply is being developed for the Coleman National Fish Hatchery.

3. Construct barrier racks at the Gover Diversion dam and waste gates from the Gover Canal to prevent adult Chinook salmon from entering Gover Diversion.
4. Screen Orwick Diversion to prevent entrainment of juvenile salmonids and straying of adult Chinook salmon.
5. Screen tailrace of the Coleman Powerhouse to eliminate attraction of adult Chinook salmon and steelhead into an area with little spawning habitat and contamination of the Coleman National Fish Hatchery water supply.
6. Construct fish screens on all PG&E diversions, as appropriate, after both phases of upstream flow actions (see Action 1) are completed and fish ladders on Coleman and Eagle Canyon Diversion Dams are opened.
7. Improve fish passage in Eagle Canyon by modifying a bedrock ledge and boulders that are potential barriers to adult salmonids, and rebuild fish ladders on Wildcat and Eagle Canyon Diversion Dams.
8. Screen Coleman National Fish Hatchery intakes 2 and 3 to prevent entrainment of juvenile Chinook and steelhead.
9. Evaluate the effectiveness of fish ladders at PG&E diversion.
10. Evaluate the feasibility of establishing naturally spawning populations of winter-run and spring-run Chinook salmon and steelhead through a comprehensive plan to restore Battle Creek.
11. Evaluate alternatives for providing a disease safe water supply to Coleman National Fish Hatchery so that winter-, spring-, and fall-run Chinook salmon and steelhead would have access to an additional 41 miles of Battle Creek habitat.

Figure 6-4
Actions Identified by the AFRP that Would Help Restore Anadromous Fish to Battle Creek

anadromous species included in CAMP are fall-run, late fall-run, winter-run, and spring-run Chinook salmon, steelhead, American shad, striped bass, white sturgeon, and green sturgeon. The categories of anadromous fish restoration actions evaluated by CAMP are habitat restoration, water management, fish screens, and structural modifications.

CAMP assesses both the cumulative and relative effectiveness of restoration actions on anadromous fish production. The cumulative effectiveness is evaluated by monitoring adult production of each species and comparing the estimated natural adult production to the target natural adult production (i.e., the anadromous fish doubling goals). The relative effectiveness is evaluated by monitoring the abundance of juvenile Chinook salmon in relation to when and where restoration actions have been implemented. Data on adult and juvenile Chinook salmon are compiled regularly and made available on the Internet and in published reports.

CAMP monitoring focuses on estimating juvenile production and counts of adults. While CAMP does fund some monitoring projects, it acts primarily as a guide to other studies by maintaining protocols for fish research that facilitate the development of a Central Valley–wide understanding of anadromous fish restoration. Applicable data collected as part of the Restoration Project and adaptive management process will follow CAMP protocols to facilitate the understanding of the Restoration Project's contribution to reaching CVPIA goals.

Proposed Comprehensive Fisheries Management Plan for the Upper Sacramento River and Its Tributaries

DFG is drafting a series of comprehensive fisheries management strategies for the upper Sacramento River and tributaries as part of a comprehensive fisheries management plan. The objective of this plan is to take a watershed-wide view at production potential and population levels of all runs of anadromous salmonids and best management practices to restore or sustain viable populations. Specific goals will be set for each upper Sacramento River tributary that will integrate the production potential of each stream, as well as the main river, from a system perspective. Perennial anadromous salmonid-producing tributaries that will be addressed in these plans include Clear, Cow, Cottonwood, Battle, Deer, Mill, and Antelope Creeks, while other streams that occasionally produce anadromous salmonids in good water years include Sulfur, Churn, and Bear Creeks. The Battle Creek strategy is currently being developed as a group effort within the BCWG as part of an open planning process. Each of these watershed strategies will be developed within their respective watershed groups and will be completed in a priority order as time allows. Questions regarding Battle Creek will be developed during this open planning process.

Sacramento Corridor Habitat Restoration Assessment

DFG, TNC, and DWR, in cooperation with the BLM, will study the geomorphic and riparian interactions occurring on an alluvial reach of the Sacramento River between the mouth of Cow Creek and Jellys Ferry Bridge (RMs 280–267), including lower Battle Creek and Anderson Creek. This study will determine restoration possibilities for the integrated complex that includes lands owned and managed by the BLM, lands with conservation easements held by the BLM, and other possible acquisitions by fee or conservation easements from willing sellers within this reach. This work will establish the existing conditions in the river reach for quantifiable attributes that could be monitored to evaluate the effects of land use improvements.

Recovery Plans for Threatened or Endangered Salmonids

NOAA Fisheries has or is developing recovery plans for winter-run Chinook salmon, steelhead, and spring-run Chinook salmon.

The NOAA Fisheries' recovery plan for winter-run Chinook salmon identified and set priorities for actions necessary to ultimately restore the Sacramento River winter-run Chinook salmon as a naturally sustaining population throughout its present range. More immediately, the plan identified actions to prevent any further erosion of the population's viability and its genetic integrity. The plan also included:

- a description of site-specific management actions necessary for recovery;
- objective, measurable criteria that, when met, will allow delisting of the species; and
- estimates of the time and cost to carry out the recommended recovery measures.

Finally, the plan specified Battle Creek as a site for the potential restoration of self-sustaining populations of winter-run Chinook salmon.

NOAA Fisheries is currently preparing a recovery plan for steelhead and plans to prepare a recovery plan for spring-run Chinook salmon that would likely be prepared jointly with DFG. Much of these plans would likely be based on the CALFED Program's EIS/EIR, their Multi-Species Conservation Plan, and the ERP. No timeline has been set for the completion of these plans.

These recovery plans would link to the Restoration Project by setting numerical goals for viable population levels for three of the species targeted for restoration.

They would likely not include any binding mandates or prescriptions to be specifically implemented in Battle Creek.

Restoring Central Valley Streams: A Plan for Action

DFG's *Restoring Central Valley Streams: A Plan for Action* (California Department of Fish and Game 1993) focused on the potential of the following actions for restoring winter-run Chinook salmon, spring-run Chinook salmon, and steelhead to Battle Creek:

- preparing and implementing a comprehensive restoration plan for anadromous fish in Battle Creek,
- increasing instream flows, and
- revising management of the barrier weir at the Coleman National Fish Hatchery.

The planning recommendations in this plan for action have already been achieved with the development of the Restoration Plan (Kier Associates 1999a) and the MOU. Implementation of the Restoration Project and adaptive management will meet the goal of increasing instream flows found in the document.

Central Valley Salmon and Steelhead Restoration and Enhancement Plan

Developed in the early 1990s, the Central Valley Salmon and Steelhead Restoration and Enhancement Plan (California Department of Fish and Game 1990a) called for increased instream flows and effective fish screens on Battle Creek. The implementation of the Restoration Project will meet all of the recommendations in this plan specific to Battle Creek.

Steelhead Restoration and Management Plan for California

The Steelhead Restoration and Management Plan (California Department of Fish and Game 1996a) is a follow-up to DFG's *Restoring Central Valley Streams: A Plan for Action* (California Department of Fish and Game 1993), stemming from the final recommendations of the California Advisory Committee on Salmon and Steelhead Trout. The Restoration Project would implement several of the actions pertaining to the Battle Creek watershed that were identified in the plan for action.

California Bay-Delta Authority Ecosystem Restoration Program

The Restoration Project is funded in large part by funds allocated as part of the implementation phase of CALFED Program's ERP. The ERP is organized into a matrix of vision statements that identify what the ERP will accomplish with its stated objectives, targets, and programmatic actions for an ecological process, habitat, species or species group, stressor, or geographical unit. The vision statements provide technical background to increase understanding of the ecosystem and its elements. ERP vision statements about species or processes relevant to the Restoration Project are presented in Table 6-1. The adaptive management actions that will meet ERP visions will be identified later.

Table 6-1. California Bay-Delta Authority Ecosystem Restoration Program Visions for Ecosystem Elements and How the Restoration Project and Adaptive Management Achieve These Visions

Element	ERP Vision	Achievement Method
Central Valley streamflows	To protect and enhance the ecological functions that are achieved through the physical and biological processes that operate within the stream channel and associated riparian and floodplain areas in order to contribute to the recovery of species and the overall health of the San Francisco Bay and Sacramento–San Joaquin River Delta area (Bay-Delta).	The Restoration Project will substantially increase streamflows to meet the needs of ERP priority 1 fish species, Chinook salmon and steelhead. The Restoration Project's adaptive process contains protocols for changing these streamflows if necessary to increase Chinook salmon and steelhead populations or habitat or to assist Chinook salmon and steelhead passage.
Stream meander	To conserve and reestablish areas of active stream meander, where feasible, by implementing stream conservation programs, setting levees back, and reestablishing natural sediment supply to restore riverine and floodplain habitats for fish, wildlife, and plant communities.	By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of active stream meanders to the extent that Battle Creek and its tributaries meander naturally. Furthermore, agreements between PG&E and DFG regarding enhancing the natural sediment supply and sediment routing in Battle Creek have been formalized in the past and will be pursued in the future.
Natural floodplains and flood processes	To conserve existing and intact floodplains and modify or remove barriers to over-bank flooding to reestablish aquatic, wetland, and riparian floodplain habitats.	By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of natural floodplains and flood processes, even though the Hydroelectric Project has historically had a relatively minor effect on natural flood flows.
Coarse sediment supply	To provide a sustained supply of alluvial sediments that are transported by rivers and streams and distributed to riverbed deposits, floodplains, channel bars, riffles, shallow shoals, and mudflats, throughout the Central Valley, Sacramento–San Joaquin River delta (Delta), and San Francisco Bay regions. This would contribute to habitat structure, function, and foodweb production throughout the ecosystem.	By removing several diversion dams from Battle Creek, the Restoration Project will prevent the loss of naturally supplied sediment that can be stored in reservoir impoundments or removed from the system by reservoir dredging operations. On dams that remain, course sediments will be passed downstream during high flow conditions using low-level gates at the dam.

Element	ERP Vision	Achievement Method
Central Valley stream temperatures	To restore natural seasonal patterns of water temperature in streams, rivers, and the Delta to benefit aquatic species by protecting and improving ecological processes that regulate water.	The Restoration Project will substantially increase instream flows, increase spring releases from Hydroelectric Project water collection facilities, and remove interbasin transfers of water to restore natural seasonal patterns of water temperatures in Battle Creek by protecting and improving ecological processes that regulate water. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to meet appropriate water temperature criteria.
Riparian and riverine aquatic habitats	To increase their area and protect and improve their quality. Achieving this vision will assist in the recovery of special-status fish and wildlife populations and provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta. The ERP vision includes restoring native riparian communities ranging from valley oak woodland, which is associated with higher, less frequently inundated floodplain elevations, to willow scrub, which is associated with low, frequently inundated floodplain elevation sites such as stream banks, point bars, and in-channel bars.	By removing several diversion dams from Battle Creek, increasing instream flows, and increasing cold-water spring releases from Hydroelectric Project water collection facilities, the Restoration Project will improve riparian and riverine aquatic habitats. It is believed that higher instream flows will aid in the distribution of seeds from riparian plant species and elevate the dry-season water table in the riparian area, fostering an expansion of riparian communities such as willow scrub.
Freshwater fish habitats	To protect existing habitat from alteration or loss, to restore altered habitats, and restore areas to a more natural state. Freshwater fish habitat will be increased to assist in the recovery of special-status plant, fish, and wildlife populations. Restoration will provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of special-status plant, fish, and wildlife populations.
Essential fish habitats	To maintain and improve the quality of existing habitats and to restore former habitats in order to support self-sustaining populations of Chinook salmon.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing cold water spring releases from Hydroelectric Project water collection facilities, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining Chinook salmon populations.

Element	ERP Vision	Achievement Method
Winter-run Chinook salmon	To recover this federally and state-listed endangered species, achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of winter-run Chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of winter-run Chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of winter-run Chinook salmon.
Spring-run Chinook salmon	To recover this federally and state- listed threatened species, achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of spring-run Chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of spring-run Chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of spring-run Chinook salmon.
Lat fall–run Chinook salmon	To recover this stock, which is presently a candidate for listing under the ESA (it is included in the fall-run Chinook salmon evolutionarily significant unit), achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of late-fall-run Chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of late-fall-run Chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of late-fall-run Chinook salmon.

Element	ERP Vision	Achievement Method
Fall-run Chinook salmon	To recover all stocks presently a candidate for listing under the federal ESA to achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of fall-run Chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of fall-run Chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of fall-run Chinook salmon.
Steelhead	To recover this species listed as threatened under ESA and achieve naturally spawning populations of sufficient size to support inland recreational fishing that fully use existing and restored habitat areas.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of steelhead. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of steelhead. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of steelhead.
Anadromous lampreys	To maintain and restore population distribution and abundance to higher levels than at present. The ERP vision is also to better understand life history and identify factors that influence abundance. Better knowledge of these species and restoration would ensure their long-term population sustainability.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of anadromous lamprey. Furthermore, monitoring approaches within the adaptive management process will contribute to a better understanding of the life history and will identify factors that influence the abundance of anadromous lamprey.
Native resident fish species	To maintain and restore the distribution and abundance of native species, such as Sacramento blackfish, hardhead, and tule perch to contribute to the overall species richness and diversity. Achieving this vision will reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats and should assist the restoration of the distribution and abundance of native fish species in Battle Creek.

Comprehensive Monitoring, Assessment, and Research Program/California Bay-Delta Authority Science Program

In 1998, CALFED Program approved and funded a joint proposal from the San Francisco Estuary Institute, Interagency Ecological Program, and USGS to develop the CMARP (recently renamed the CBDA Science Program) for CALFED Program and its member agencies. The proposed program addresses eight CALFED Program elements and actions to be implemented over the next 30 years:

- long-term levee protection,
- water quality,
- ecosystem restoration,
- water use efficiency,
- water transfer framework,
- watershed management coordination,
- Delta conveyance, and
- Delta storage.

One of the primary goals of CMARP has been the design and implementation of a monitoring program with several modules that overlap with the Restoration Project. Compliance monitoring provides information needed to determine whether activities are meeting permit or other regulatory requirements. Model verification monitoring provides information to evaluate management alternatives (e.g., for adaptive management). Trend monitoring helps identify long-term changes caused by human and natural factors. The following components are part of the CMARP monitoring program: inventorying existing monitoring programs, developing specific monitoring elements, developing a process for data management, and developing a process for data assessment and reporting.

CMARP is currently developing aquatic and terrestrial baseline monitoring programs. These programs will provide information needed by CALFED Program managers and scientists to follow the status of and trends in key indicators for ecosystems and several sensitive plant and animals in the Bay-Delta and Central Valley. Geographically, the recommended baseline program for aquatic resources will extend from the bases of the major dams through the Bay-Delta and into the nearshore ocean. The program will include ecosystem processes, as well as specific elements directed to listed and special-status fish species, such as Chinook salmon, steelhead, delta smelt, splittail, and green and white sturgeon.

The foundation of the proposed baseline will be built on many of the existing monitoring efforts being conducted under the auspices of CVPIA, CAMP, the Interagency Ecological Program, the Sacramento Watershed Group, the San Francisco Estuary Institute's Regional Monitoring Program, and agency-funded tributary monitoring on the Feather, American, and Tuolumne Rivers and on Battle, Deer, Mill, and Butte Creeks. The monitoring program report will identify data gaps and recommend new elements to fill those gaps.

Monitoring and data assessment results from the Battle Creek adaptive management program will be shared with CMARP. Data collections and analyses as part of the adaptive management process (Appendix C) will be coordinated with CMARP's larger aims.

Delta and Sacramento River Operations and Monitoring

Water diversions from the Sacramento River downstream of Battle Creek, including those at the Red Bluff Diversion Dam and approximately 300 other locations, have been identified as causing problems for fish passage (California Department of Fish and Game 1990a). Especially harmful for fish populations from the upper Sacramento River basin are the many unscreened water diversions that can entrain juvenile and adult fish (California Department of Fish and Game 1990a). Perhaps the most commonly cited factor negatively affecting populations of salmon and steelhead from Sacramento River tributaries such as Battle Creek is the operation of water pumping plants by federal and state agencies and smaller water diversions within the Bay-Delta (California Department of Fish and Game 1990a). These pumps affect the magnitude and direction of flow, tidal cycles, fish entrainment, salinity, water quality, and fish migration (California Department of Fish and Game 1990a).

Seeking solutions to the resource problems in the Bay-Delta, federal and state agencies signed a framework agreement in June 1994 that provided increased coordination and communication for environmental protection and water supply dependability. The framework agreement laid the foundation for the Bay-Delta Plan Accord and the CALFED Program. A programmatic EIS/EIR (CALFED Bay-Delta Program 2000a) released in June 2000 detailed specific actions regarding how water supply operations will be coordinated with endangered species protection and water quality. It also developed long-term solutions to fish and wildlife, water supply reliability, flood control, and water quality problems in the Bay-Delta.

The well-intended steps proposed in these planning documents may have beneficial effects on fish populations from Battle Creek and should aid the Restoration Project in restoring anadromous fish to Battle Creek. However, it is possible that diversions in the Bay-Delta and Sacramento River will continue to harm fish populations from upper Sacramento River tributaries. If that happens, salmon and steelhead restoration in Battle Creek could be adversely affected.

The adaptive management studies in the adaptive management process have been designed to identify those impacts on Battle Creek fish caused by the Hydroelectric Project and to determine when factors from outside the watershed are at play. However, the adaptive management process will not be able to rectify limiting factors outside the watershed.

Chapter 7
Summary

Summary of Impacts

The impacts associated with the action alternatives (Five Dam Removal, No Dam Removal, Six Dam Removal, and Three Dam Removal Alternatives) and the No Action Alternative, which are presented in Chapter 3, are identified in Table 7-1. Most significant impacts would be considered less than significant after implementing the appropriate mitigation measures for the specific resource area identified in Table 7-1. These impacts and their mitigation measures are described in more detail in the appropriate resource sections in Chapter 4, "Affected Environment and Environmental Consequences."

Comparison of Alternatives

A comparison between the Proposed Action and each of the action alternatives (including the No Action Alternative) is provided below to summarize the relative differences in Chinook salmon and steelhead benefits and significant impacts that would be expected under each alternative. Table 7-2 presents how the environmental benefits and impacts of the action alternatives differ. Only impacts that are different among the alternatives are listed in Table 7-2; those impacts that are shared by all alternatives are not listed in this table.

Proposed Action (Five Dam Removal Alternative) and No Action Alternative

The No Action Alternative would avoid environmental impacts associated with Restoration Project activities but would not offer substantial benefits to fish that would occur under the Proposed Action. The No Action Alternative would result in the continuation of the effects associated with the operation, maintenance, and upgrades of Hydroelectric Project facilities. The main differences between the No Action Alternative and the Proposed Action are discussed below by resource area.

Fish

The No Action Alternative would continue the flow and fish-passage conditions that were established under PG&E's original FERC license agreement. Compared with the Proposed Action, instream flow rates would be much lower under the No Action Alternative (i.e., 3 cfs minimum instream flow releases required under the original FERC license agreement compared to 35 cfs minimum instream flow releases required under the Proposed Action for North Fork Battle Creek, and 5 cfs minimum instream flow releases required under the original FERC license agreement compared to 40 csf minimum instream flow releases required under the Proposed Action for South Fork Battle Creek; see also Tables 3-1 and 3-2 and Figures 3-1 and 3-2 in Chapter 3 of this report). Therefore, compared with the Proposed Action, the No Action Alternative would not have the degree of beneficial effects for Chinook salmon and steelhead that would occur as a result of increased minimum creek flows, increased spawning and rearing habitat availability, more beneficial water temperatures, and improved fish passage.

Botanical, Wetland, and Wildlife Resources

The No Action Alternative would avoid short-term, constructed-related impacts on terrestrial biological resources near Hydroelectric Project facilities (e.g., potential disturbance or loss of special-status species habitat, potential disturbance or loss of waters of the United States). However, there would also be no long-term riparian and wildlife benefits along Battle Creek that would occur under the Proposed Action.

Hydrology

Under the No Action Alternative, Battle Creek hydrology would not change from the baseline conditions. Instream flow releases below the diversion dams would be the minimum flows required by PG&E's FERC license agreement (i.e., 3 cfs minimum instream flow releases in North Fork Battle Creek and 5 cfs minimum instream flow releases in South Fork Battle Creek). Additionally, the No Action Alternative would not reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse because Coleman Diversion Dam would not be removed, as it would be under the Proposed Action.

Water Quality

Compared with the Proposed Action, the No Action Alternative would avoid the potential impacts on water quality from construction-related activities. However, the temperature regime of Battle Creek under the No Action Alternative likely would not support anything more than remnant populations of coldwater habitat users except for fall-run Chinook salmon. In contrast, the Proposed Action

would improve coldwater habitat and fish passage conditions and thereby support steelhead, spring-run Chinook salmon, and winter-run Chinook salmon.

Groundwater

The No Action Alternative would not result in any effects on groundwater. Groundwater conditions would continue as they have historically. The No Action Alternative would avoid the potential for hazardous spills that could potentially occur from construction under the Proposed Action.

Land Use

Similar to the Proposed Action, the No Action Alternative would not result in the conversion of land from open space and other current uses.

Geology and Soils

The No Action Alternative would not result in changes to geology or soils. Therefore, the No Action Alternative would avoid the potential impacts from erosion or falling rock hazards that could occur under the Proposed Action.

Aesthetics and Visual Resources

Compared with the Proposed Action, the No Action Alternative would avoid the visual impacts associated with construction of the fish facilities, removal of diversion dams, construction of the Eagle Canyon pipeline, and closure of the Wildcat and South Canals. The No Action Alternative would also avoid the significant and unavoidable aesthetic impacts on Oasis Springs Lodge associated with the improvements at the Inskip Diversion Dam/South Powerhouse site.

Transportation

Compared with the Proposed Action, the No Action Alternative would not result in changes to current transportation facilities. The No Action alternative would avoid the impacts on traffic, roads, and emergency vehicle passage that would occur under the Proposed Action.

Noise

The No Action Alternative would avoid significant noise and vibration impacts associated with short-term construction-related activities and truck traffic that would occur under the Proposed Action.

Air Quality

The No Action Alternative would avoid air quality impacts associated with construction equipment and construction activities that would occur under the Proposed Action.

Public Health and Safety

The No Action Alternative would not result in impacts on public health and safety beyond those already anticipated as part of the current operations of the existing facilities. The No Action Alternative would avoid the following impacts that would occur under the Proposed Action:

- on construction workers and the general public from increased risk of exposure to hazardous materials from construction-related activities,
- on the public from increased vehicle traffic along access roads, and
- on the public from potentially increased mosquito breeding grounds created as a result of dewatering at various restoration sites.

Public Services and Utilities

The No Action Alternative would avoid impacts on public services and utilities associated with temporary, construction-related increase in the demands on police, fire, and emergency vehicle operators that would occur under the Proposed Action.

Recreation

The No Action Alternative would avoid the significant and unavoidable impact on the short-term loss of recreational activities at the Oasis Springs Lodge. In addition, the No Action Alternative would generally avoid the temporary construction-related impacts on recreational opportunities along Battle Creek. However, similar to the Proposed Action, stocking farmed trout would not be allowed in South Fork Battle Creek.

Cultural Resources

The No Action Alternative would avoid the significant and unavoidable impact associated with the removal of historic dams, including Wildcat and Coleman Diversion Dams. In addition, the No Action Alternative would avoid impacts on the cultural resources at Eagle Canyon and Inskip Diversion Dam and would avoid the potential to damage archeological deposits as a result of vehicular traffic during construction.

Other NEPA Analyses

Power Generation and Economics

The No Action Alternative would not result in any changes in the production of hydroelectric power by the Hydroelectric Project. The Proposed Action, however, would result in a power production loss of approximately 30%, which may be replaced by a renewable resource such as wind power. Environmental impacts typically associated with wind power production include impacts on biological resources (particularly raptors), aesthetics and visual resources, and noise. The No Action Alternative would not result in any of the indirect environmental impacts that might occur from securing replacement energy under the Proposed Action.

Socioeconomics

The No Action Alternative would likely result in reduced potential for the socioeconomic effects on the MLTF's fish marketing program caused by the potential spread of the IHN virus and would avoid effects on the Oasis Springs Lodge caused by short-term, construction-related activity that would occur under the Proposed Action. In addition, the No Action Alternative would not result in the slight socioeconomic benefits associated with increased sales and construction jobs in the region.

Proposed Action (Five Dam Removal Alternative) and No Dam Removal Alternative

Under the No Dam Removal Alternative, fish screens and fish ladders would be constructed at North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams. No modifications would take place at Soap Creek Feeder and Lower Ripley Creek Feeder Diversion Dams under this alternative and instream flow requirements would not be required at Asbury Diversion Dam for Baldwin Creek. While the No Dam Removal Alternative would offer greater benefits for fish than the No Action Alternative, it would not offer greater benefits than the Five Dam Removal Alternative. The minimum instream flow

requirements under the No Dam Removal Alternative (i.e., AFRP minimum flow requirements) below the diversion dams would be less than under the Proposed Action (i.e., MOU minimum flow requirements). The differences between the No Dam Removal Alternative and the Proposed Action are discussed in greater detail below.

Fish

The No Dam Removal Alternative would provide new fish screens and fish ladders at North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams, which would provide improved fish passage conditions similar to those under the Proposed Action. However, under the No Dam Removal Alternative there would be fewer passage benefits and greater diversion-related effects as a result of not removing Wildcat, South, and Coleman Diversion Dams as would occur under the Proposed Action. In addition, the No Dam Removal Alternative would maintain No Action conditions at Soap Creek Feeder and Lower Ripley Creek Feeder Diversion Dams, which means that this alternative would not provide Battle Creek with additional spawning and rearing habitat as a result of increased instream flows from Soap, Ripley, and Baldwin Creeks, which would occur under the Proposed Action.

The minimum instream flow requirements under the No Dam Removal Alternative (i.e., AFRP minimum flow requirements) below the diversion dams would be less than under the Proposed Action (i.e., MOU minimum flow requirements) (see Tables 3-2 and 3-3 and Figures 3-2 and 3-3 in Chapter 3 of this report). Substantially greater production of Chinook salmon and steelhead would be expected under the No Dam Removal Alternative relative to the No Action Alternative; however, the No Dam Removal Alternative would not incorporate the additional flexibility provided by the higher flow requirements for the Proposed Action and future adaptive management of flow targets for habitat, fish passage, and water temperature considerations. Powerhouse tailrace connectors and penstock bypass facilities would not be constructed to prevent the mixing of North Fork and South Fork Battle Creek flows.

Botanical, Wetland, and Wildlife Resources

Although the same construction impacts on biological resources would occur under either alternative, the No Dam Removal Alternative would generally result in a lesser degree of impact on biological resources from construction than the Proposed Action because the existing facilities would be upgraded with fish screens and fish ladders rather than removed. The No Dam Removal Alternative would also avoid the loss of riparian habitat along Wildcat Canal and the loss of live oak woodland/savanna and blue oak woodland along South Canal that would be caused by cessation of flows in these canals under the Proposed Action. The No Dam Removal Alternative would also result in less loss of waters of the United States (approximately 14 acres) compared to the Proposed Action

(approximately 18 acres). However, the No Dam Removal Alternative would not provide the additional biological benefits associated with increased amphibian habitat from increased minimum instream flows or increased bat habitat from dewatering South Canal.

Hydrology

Under the No Dam Removal Alternative, the minimum flow requirements (i.e., AFRP minimum flow requirements) below the diversion dams would be higher than the instream flows recommended for the No Action Alternative (i.e., FERC minimum flow requirements) but would be generally less than the instream flows recommended under the Proposed Action (i.e., MOU minimum flow requirements) (see Section 4.3, Hydrology). The No Dam Removal Alternative also would not achieve the potential benefits of minimized flow fluctuations during canal and powerhouse outages that would be provided by connectors at South and Inskip Powerhouses and in the channel below Wildcat, South, and Coleman Diversion Dams under the Proposed Action.

Water Quality

Both the No Dam Alternative and Proposed Action would have short-term, construction-related sedimentation and erosion impacts, which would be mitigated to less-than-significant levels. The No Dam Removal Alternative would generally have a slightly less impact on water quality because no dams would be removed under this alternative. In addition, the No Dam Removal Alternative would not have the benefits associated with reducing the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse because the Coleman Diversion Dam would not be removed.

Groundwater

The No Dam Removal Alternative and the Proposed Action would have similar impacts on groundwater, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Land Use

The No Dam Removal Alternative and the Proposed Action would have similar impacts on land use, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences could occur on a temporary basis.

Geology and Soils

The No Dam Removal Alternative and the Proposed Action would have similar impacts on geology and soils, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Aesthetics and Visual Resources

In general, the No Dam Removal Alternative and the Proposed Action would have similar impacts on aesthetics and visual resources; however, the No Dam Removal Alternative would avoid the visual impacts associated with ceasing flows in Wildcat and South Canals.

Transportation

The No Dam Removal Alternative and the Proposed Action would have similar impacts on transportation, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Noise

The No Dam Removal Alternative and the Proposed Action would have similar impacts on noise, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Air Quality

The No Dam Removal Alternative and the Proposed Action would have similar impacts on air quality, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Public Health and Safety

The No Dam Removal Alternative and the Proposed Action would have similar impacts on public health and safety, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Public Services and Utilities

The No Dam Removal Alternative and the Proposed Action would have similar impacts on public services and utilities, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Recreation

The No Dam Removal Alternative and the Proposed Action would have similar impacts on recreation, although impacts would occur only at the facilities proposed to be improved under the No Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Cultural Resource

The No Dam Removal Alternative would avoid the significant and unavoidable impact associated with the removal of historic dams, including Wildcat and Coleman Diversion Dams as compared to the Proposed Action.

Other NEPA Analyses

Power Generation and Economics

The No Dam Removal Alternative would reduce hydropower produced by the Hydroelectric Project approximately 17%, whereas the Proposed Action would reduce it approximately 30%.

Similar to the Proposed Action, the No Dam Removal Alternative would require the replacement of lost hydropower; however, the Proposed Action is the only action alternative where the annual cost of Hydroelectric Project power production is less than the annual power benefits because the Proposed Action includes a cost-sharing agreement as defined in the 1999 MOU (Appendix A). In other words, the power production benefits achieved under the No Dam Removal Alternative would not be sufficient to cover the applicable operating costs and replacement power cost under this alternative.

The likely renewable resource to replace lost hydropower would be wind power. Environmental impacts typically associated with wind power production include impacts on biological resources (particularly raptors), aesthetics and visual resources, and noise. Compared to existing conditions, the No Dam Removal Alternative would require replacing less energy (approximately 40,000 MWh annually) than the Proposed Action (approximately 69,000 MWh annually). Therefore, although the indirect effects of securing replacement energy would be

similar to the Proposed Action, it is likely that the magnitude of these effects would be less under the No Dam Removal Alternative.

Socioeconomics

The No Dam Removal Alternative and the Proposed Action would have similar impacts on socioeconomics.

Proposed Action (Five Dam Removal Alternative) and Six Dam Removal Alternative

The Six Dam Removal Alternative would offer benefits for fish similar to the Proposed Action. The main difference between these two alternatives is that under the Six Dam Removal Alternative, the Eagle Canyon Diversion Dam would be removed in addition to the other five diversion dams that would be removed under the Proposed Action. Because Eagle Canyon Canal would also be decommissioned under the Six Dam Removal Alternative, there would be no need to construct the Eagle Canyon Pipeline at the Jeffcoat mitigation site. The differences between the Six Dam Removal Alternative and the Proposed Action are discussed in greater detail below.

Fish

The Six Dam Removal Alternative and the Proposed Action would generally result in similar Chinook salmon and steelhead production and overall benefits to fish and fish habitat. Both alternatives would substantially improve habitat and result in increased Chinook salmon and steelhead production over the No Action Alternative, although the Six Dam Removal Alternative would potentially provide more secure passage benefits because of the complete absence of diversion-related effects at Eagle Canyon Diversion Dam. However, removal of the Eagle Canyon Diversion Dam would also result in a slightly greater impact on fish egg and larvae mortality than the Proposed Action because of the release of fine sediment from behind the dam. Furthermore, by leaving Eagle Canyon Diversion Dam in place (under the Proposed Action), there would be a greater ability to adaptively manage instream flows for the benefit of Chinook salmon and steelhead.

Botanical, Wetland, and Wildlife Resources

Because construction of the pipeline along a portion of the Eagle Canyon Canal would not be required under the Six Dam Removal Alternative, this alternative would generally result in slightly fewer construction-related biological impacts than the Proposed Action. However, the Six Dam Removal Alternative would

result in greater impacts from the loss of seasonal wetland along the Eagle Canyon Canal as the result of ceasing flows in the canal compared to the Proposed Action. The loss of waters of the United States would be less under the Six Dam Removal Alternative (approximately 16 acres) compared to the Proposed Action (approximately 18 acres).

Hydrology

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on hydrology, although there would be an additional impact associated with the removal of Eagle Canyon Dam from minor increases in downstream bed elevations under the Six Dam Removal Alternative. However, this impact is considered less than significant.

Water Quality

The Six Dam Removal Alternative and the Proposed Action would result in similar short-term, construction-related sedimentation and erosion impacts, which would be mitigated to less-than-significant levels. However, the Six Dam Removal Alternative would result in a slightly greater impact on water quality because removing Eagle Canyon Diversion Dam would release sediment that has built up behind the dam. The Six Dam Removal Alternative would also not result in potential long-term reduction in beneficial uses of waters used at MLTF's Jeffcoat aquaculture facilities as compared to the Proposed Action because flows along Eagle Canyon Canal would cease under this alternative.

Groundwater

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on groundwater.

Land Use

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on land use.

Geology and Soils

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on geology and soils.

Aesthetics and Visual Resources

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on aesthetics and visual resources. The Six Dam Removal Alternative would avoid the temporary visual impact from constructing the Eagle Canyon pipeline at the Jeffcoat mitigation site; this impact, however, is considered less than significant under the Proposed Action.

Transportation

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on transportation.

Noise

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on noise, although potentially greater noise impacts could result from the blasting and removal of Eagle Canyon Diversion Dam under the Six Dam Removal Alternative.

Air Quality

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on air quality, although potentially greater air quality impacts could result from the removal of Eagle Canyon Diversion Dam under the Six Dam Removal Alternative.

Public Health and Safety

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on public health and safety.

Public Services and Utilities

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on public services and utilities.

Recreation

The Six Dam Removal Alternative and the Proposed Action would result in similar impacts on recreation.

Cultural Resource

The Six Dam Removal Alternative would have greater impacts on historic dams on Battle Creek than the Proposed Action because Eagle Canyon Diversion Dam would be removed, in addition to Wildcat and Coleman Diversion Dams. Eagle Canyon, Wildcat, and Coleman Diversion Dams are each considered eligible for listing in the NRHP and CRHR.

Other NEPA Analyses

Power Generation and Economics

The Six Dam Removal Alternative would result in a reduction of hydropower produced by the Hydroelectric Project of approximately 41%, whereas the Proposed Action would result in reduction of approximately 30%.

As with the Proposed Action, the Six Dam Removal Alternative would require the replacement of lost hydropower; however, the Proposed Action is the only action alternative where the annual cost of Hydroelectric Project power production is less than the annual power benefits because the Proposed Action includes a cost-sharing agreement as defined in the 1999 MOU (Appendix A). In other words, the power production benefits achieved under the Six Dam Removal Alternative, which are substantially less than the Proposed Action, would not be sufficient to cover the applicable operating costs and replacement power cost under this alternative.

The likely renewable resource to replace lost hydropower would be wind power. Environmental impacts typically associated with wind power production include impacts on biological resources (particularly raptors), aesthetics and visual resources, and noise. Because the Six Dam Removal Alternative would require replacing more energy (approximately 94,000 MWh annually) than the Proposed Action (approximately 69,000 MWh annually) compared to existing conditions, although the indirect effects of securing replacement energy would be similar to the Proposed Action, it is likely that the magnitude of these effects would be greater under the Six Dam Removal Alternative.

Socioeconomics

Although the mitigation measure proposed at the Jeffcoat aquaculture facility would not be needed because flows in Eagle Canyon Canal would cease, the Six Dam Removal Alternative would nevertheless result in a socioeconomic effect on MLTF because of the risk to their fish marketing program from the potential spread of catastrophic anadromous fish diseases at the Willow Springs facility. Otherwise, socioeconomic effects associated with the Six Dam Removal Alternative and the Proposed Action are similar.

Proposed Action (Five Dam Removal Alternative) and Three Dam Removal Alternative

The Three Dam Removal Alternative would provide new fish screens and fish ladders at North Battle Creek Feeder, South, and Inskip Diversion Dams and would remove Eagle Canyon, Wildcat, and Coleman Diversion Dams. No modifications would take place at Soap Creek Feeder and Lower Ripley Creek Feeder Diversion Dams under this alternative; however, minimum instream flows at Asbury Diversion Dam would be set at 10 cfs for Baldwin Creek. While the Three Dam Removal Alternative would offer greater benefits for fish than would the No Action Alternative, it would not offer greater benefits than the Proposed Action. The minimum flow requirements (i.e., AFRP minimum flow requirements) below the diversion dams would be higher than the instream flows for the No Action Alternative (i.e., FERC minimum flow requirements), but generally less than under the Proposed Action (i.e., MOU minimum flow requirements). The differences between the Three Dam Removal Alternative and the Proposed Action are discussed in greater detail below.

Fish

Under the Three Dam Removal Alternative there would be fewer passage benefits and greater diversion-related effects as a result of not removing South Diversion Dam as would occur under the Proposed Action. However, Eagle Canyon Diversion Dam would be removed under the Three Dam Removal Alternative, potentially providing more secure passage benefits because of the complete absence of diversion-related effects at that dam.

The minimum instream flow requirements under the Three Dam Removal Alternative (i.e., AFRP minimum flow requirements) below the diversion dams would be less than under the Proposed Action (i.e., MOU minimum flow requirements) (see Tables 3-2 and 3-5 and Figures 3-2 and 3-5 in Chapter 3 of this report). The Three Dam Removal Alternative would not incorporate the additional flexibility provided by the higher flow requirements for the Proposed Action and future adaptive management of flow targets for habitat, fish passage, and water temperature considerations that would occur under the Proposed

Action. In addition, the Three Dam Removal Alternative would maintain No Action conditions at Soap Creek Feeder and Lower Ripley Creek Feeder Diversion Dams, which means that this alternative would not provide Battle Creek with additional spawning and rearing habitat as a result of increased instream flows from Soap, Ripley, and Baldwin Creeks, which would occur under the Proposed Action.

Botanical, Wetland, and Wildlife Resources

Although the Three Dam Removal Alternative would result in the same type of significant construction-related impacts on biological resources as the Proposed Action, the Three Dam Removal Alternative would generally result in fewer construction-related impacts because this alternative would not involve removing South, Soap Creek Feeder, or Lower Ripley Creek Feeder Diversion Dams.

Compared to the Proposed Action, the Three Dam Removal Alternative would avoid the loss of blue oak woodland/savanna and live oak woodland habitat associated with ceasing flows in South Canal. However, the Three Dam Alternative would result in the potential loss of seasonal wetlands associated with closure of the Eagle Canyon Canal, which would not occur under the Proposed Action. The loss of riparian habitat associated with ceasing flows in Wildcat Canal would be similar to that under the Proposed Action. The Three Dam Removal Alternative would result in less impact on waters of the United States (approximately 12 acres) than the Proposed Action (approximately 18). The Three Dam Removal Alternative would also not provide the additional biological benefits associated with increasing bat habitat from dewatering the South Canal.

Hydrology

The Three Dam Removal Alternative would result in the potential benefits of minimized flow fluctuations during canal and powerhouse outages that would be provided by connectors at South and Inskip Powerhouses and in the stream channel below Wildcat, Eagle Canyon, and Coleman Diversion Dams. The absence of an absolute connector and bypass facility at Inskip Powerhouse, however, could result in less benefit than that realized by minimum instream flow requirements and water temperature fluctuations under the Proposed Action. The minimum flow requirements (i.e., AFRP minimum flow requirements) below the diversion dams would be higher than the instream flows for the No Action Alternative (i.e., FERC minimum flow requirements) but would be generally less than the instream flows recommended under the Proposed Action (i.e., MOU minimum flow requirements).

Water Quality

Both the Three Dam Removal Alternative and the Proposed Action would have short-term construction-related sedimentation and erosion impacts, which would be mitigated to less-than-significant levels. The Three Dam Removal Alternative, however, would generally have slightly less relative impact on water quality because of less construction and dam removal activity under this alternative.

Groundwater

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on groundwater, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Land Use

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on land use, although impacts would occur only at the facilities proposed to be improved under this alternative and localized differences in impacts could occur on a temporary basis.

Geology and Soils

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on geology and soils, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Aesthetics and Visual Resources

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on aesthetics and visual resources, except that the Three Dam Removal Alternative would result in an additional significant and unavoidable impact from installing armoring or revetment within the South Fork Battle Creek channel for the open tailrace connector between the South Powerhouse and the Inskip Canal.

Transportation

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on transportation, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Noise

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on noise, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Air Quality

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on air quality, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Public Health and Safety

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on public health and safety, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Public Services and Utilities

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on public services and utilities, although impacts would occur only at the facilities proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Recreation

The Three Dam Removal Alternative and the Proposed Action would result in similar impacts on recreation, although impacts would occur only at the facilities

proposed to be improved under the Three Dam Removal Alternative and localized differences in impacts could occur on a temporary basis.

Cultural Resource

The Three Dam Removal Alternative would have slightly greater impacts on historic dams on Battle Creek than the Proposed Action because Eagle Canyon Diversion Dam would be removed, in addition to Wildcat and Coleman Diversion Dams. Eagle Canyon, Wildcat, and Coleman Diversion Dams are each considered eligible for listing in the NRHP and CRHR.

Other NEPA Analyses

Power Generation and Economics

The Three Dam Removal Alternative would result in a reduction of hydropower produced by the Hydroelectric Project of approximately 31%, whereas the Proposed Action would result in a reduction of approximately 30%.

Like the Proposed Action, the Three Dam Removal Alternative would require the replacement of lost hydropower; however, the Proposed Action is the only action alternative where the annual cost of Hydroelectric Project power production is less than the annual power benefits because the Proposed Action includes a cost-sharing agreement as defined in the 1999 MOU (Appendix A). In other words, the power production benefits achieved under the Three Dam Removal Alternative would not be sufficient to cover the applicable operating costs and replacement power cost under this alternative.

The likely renewable resource to replace lost hydropower would be wind power. Environmental impacts typically associated with wind power production include impacts on biological resources (particularly raptors), aesthetics and visual resources, and noise. Compared to existing conditions, the Three Dam Removal Alternative would require replacing slightly less energy (approximately 71,000 MWh annually) than the Proposed Action (approximately 69,000 MWh annually). Therefore, although the indirect effects of securing replacement energy would be similar to the Proposed Action, it is likely that the magnitude of these effects would be less under the Three Dam Removal Alternative.

Socioeconomics

Although the mitigation measure proposed at the Jeffcoat aquaculture facility would not be needed because flows in Eagle Canyon Canal would cease, the Three Dam Removal Alternative would nevertheless result in a socioeconomic effect on MLTF because of the risk to their fish marketing program from the potential spread of catastrophic anadromous fish diseases to the Willow Springs

facility. Otherwise, the socioeconomic effects associated with the Three Dam Removal Alternative and the Proposed Action are similar.

Environmentally Preferred Alternative

According to Reclamation's NEPA Handbook, the alternative or alternatives considered to be environmentally preferred should be specified in an EIS. The environmentally preferred alternative under NEPA is defined as "the alternative that will promote the national environmental policy as expressed in NEPA's Section 101." Ordinarily, the environmentally preferred alternative refers to the alternative that causes the least damage to the physical environment; it also refers to the alternative that best protects, preserves, and enhances historic, cultural, and natural resources. It is implicit in NEPA that the environmentally preferred alternative is a reasonable and feasible alternative.

Section 15126.6(e) of the State CEQA Guidelines also requires the state lead agency (State Water Board) to identify the environmentally superior alternative. If the No Action Alternative is also the environmentally superior alternative, the EIR will also identify an environmentally superior alternative from among the other alternatives.

In this EIS/EIR for the Restoration Project, the environmentally superior alternative is referred to as the *environmentally preferred* alternative (NEPA terminology).

In addition to the No Action Alternative, four alternatives are considered for the Restoration Project: the Five Dam Removal Alternative (the Proposed Action), No Dam Removal Alternative, Six Dam Removal Alternative, and the Three Dam Removal Alternative. Table 7-2 presents those environmental impacts that are different among the alternatives. Impacts that are shared by all alternatives are not listed in this table.

Based on the comparison presented in Table 7-2, the Five Dam Removal (Proposed Action) and Six Dam Removal Alternatives would result in the greatest number of beneficial effects among all the alternatives. The Five Dam and Six Dam Removal Alternatives would have more benefits to fish, amphibians, and riparian species than the other alternatives. In addition, decommissioning South Canal under the Five Dam Removal and Six Dam Removal Alternatives would provide potential habitat in the canal tunnels for special-status bat species. Improvements under both alternatives would substantially improve the reliability and effectiveness of upstream and downstream fish passage. In addition, powerhouse tailrace connectors are proposed under the Five Dam Removal and Six Dam Removal Alternatives. These connectors would prevent North Fork Battle Creek water from mixing with South Fork Battle Creek water, which would prevent false attraction of anadromous fish to South Fork Battle Creek.

The Five Dam Removal (Proposed Action) and Six Dam Removal Alternatives would also result in similar environmental impacts. However, one difference between the two alternatives is that the Five Dam Removal Alternative would include environmental impacts associated with the mitigation that is proposed for the MLTF Jeffcoat mitigation site. Implementing mitigation at the Jeffcoat mitigation site would result in additional significant impacts associated with the potential disturbance to or the loss of habitat for special-status species, including valley elderberry longhorn beetle, foothill yellow-legged frog, northwestern pond turtle, and California black rail. Additionally, mitigation at Jeffcoat would affect waters of the United States and sensitive plant communities and associated wildlife habitats (e.g., riparian forest and scrub plant community). However, under the Six Dam Removal Alternative, there would be a greater loss of seasonal wetlands from the closure of the Eagle Canyon Canal that would not occur under the Proposed Action, although the loss of these wetlands is considered somewhat speculative.

Impacts associated with erosion, noise, air quality, and general public health and safely may also occur as a result of implementing the mitigation proposed for the Jeffcoat site. As described in this document, measures will be implemented to mitigate these significant impacts.

With respect to cultural resources, Eagle Canyon Diversion Dam, which was determined to be eligible for inclusion in the NRHP, would be removed under the Six Dam Removal Alternative; however, the dam would not be removed under the Five Dam Removal Alternative. Conversely, mitigation activities proposed at the Jeffcoat site under the Five Dam Removal Alternative could potentially disturb historic-era cultural resources and archeological sites, if these sites are found to be eligible and cannot be avoided.

Both the Five Dam Removal Alternative and the Six Dam Removal Alternative would also require replacing lost hydropower with a renewable resource. The likely renewable resource to replace lost hydropower would be wind power. Environmental impacts typically associated with wind power production include impacts on biological resources (particularly raptors), aesthetics and visual resources, and noise (see Power Generation and Economics in Section 4.16, Other NEPA Analyses). Because more hydropower is lost under the Six Dam Removal Alternative than under the Five Dam Removal Alternative (Table 4.16-9), environmental impacts associated with replacement power under the Six Dam Removal Alternative would also be of greater magnitude than under the Five Dam Removal Alternative. However, these impacts are difficult to quantify because not enough information is known about where the windfarm would be located, how the wind turbines would be designed, and how long the wind turbines would be in operation.

In relation to power generation, the annual power benefits associated with the Five Dam Removal Alternative would be greater than the increased annual total and going-forward cost of Hydroelectric Project power (Section 4.16, Other NEPA Analyses). The No Dam Removal, Six Dam Removal, and Three Dam

Removal Alternatives would have greater project costs and fewer power generation benefits.

In summary, the Six Dam Removal Alternative and the Five Dam Removal Alternative are nearly equal because they both have the most environmental benefits and a similar number of impacts compared to the other Action Alternatives. The main difference between the Five Dam Removal and Six Dam Removal Alternatives is that the Five Dam Removal Alternative would result in additional significant impacts to the physical environment associated with the Jeffcoat mitigation site. Although the Six Dam Removal Alternative would result in indirect environmental impacts associated with replacement power at a magnitude greater than the Five Dam Removal Alternative, difference between the two alternatives is difficult to quantify. For these reasons, the Six Dam Removal Alternative is identified as the environmentally preferred alternative.

Under NEPA, the federal lead agency is not obligated to select the environmentally preferred alternative as the Proposed Action but must identify it in the Record of Decision and should, if possible, identify it in the final EIS. Similarly, CEQA does not require the state lead agency to select the environmentally superior alternative as the Proposed Action in its EIR, as long as the significant impacts of the proposed project are otherwise avoided or mitigated without implementation of the environmentally superior alternative. No significant impacts associated with the Five Dam Removal Alternative (i.e., the Proposed Action) would in fact be avoided by implementation of the Six Dam Removal Alternative.

Table 7-1. Summary of Impacts, Levels of Significance, and Proposed Mitigation Measures for the No Action Alternative, Five Dam Removal Alternative (Proposed Action), No Dam Removal Alternative, Six Dam Removal Alternative, and Three Dam Removal Alternative

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
FISH			
No Action Alternative			
Hydroelectric Project facilities (including fish ladders) and operations would be maintained and operated in accordance with Federal Energy Regulatory Commission (FERC) regulations, and the existing minimum flows would continue to be provided; fish populations would continue to be maintained at levels lower than those targeted by restoration goals.	No change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.1-1. Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials	Significant	Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program	Less than Significant
Impact 4.1-2. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities	Significant	Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan	Less than Significant
Impact 4.1-3. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Wildcat Diversion Dams, which would release currently stored fine sediment to the stream channel	Significant	Reclamation will remove diversion dams during low-flow season (July–October) and will construct pilot channels	Less than Significant
Impact 4.1-4. Disturbed steelhead and Chinook salmon habitat in the stream channel as a result of construction activities	Less than Significant	None	Not Applicable
Impact 4.1-5. Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-6. Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities	Less than Significant	None	Not Applicable
Impact 4.1-7. Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities	Less than Significant	None	Not Applicable
Impact 4.1-8. Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish	Significant	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam.	Less than Significant
Impact 4.1-9. Reduced habitat and range of some resident warmwater species because of cooler water temperatures	Less than Significant	None	Not Applicable
Impact 4.1-10. Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams	Less than Significant	None	Not Applicable
Impact 4.1-11. Increased exposure of rainbow trout to pathogens because of the increase of Chinook salmon and steelhead in Battle Creek	Less than Significant	None	Not Applicable
Impact 4.1-12. Substantially increased capacity indices for spawning and rearing of steelhead and Chinook salmon resulting from increased minimum instream flows	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-13. Substantially increased production indices for fry and juvenile life stages for steelhead and Chinook salmon as a result of cooler water temperatures	Beneficial	None	Not Applicable
Impact 4.1-14. Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of Chinook salmon and steelhead over natural barriers	Beneficial	None	Not Applicable
Impact 4.1-15. Increased survival of adults and increased spawning success because removal of five dams and the construction of more reliable effective fish ladders would facilitate passage of Chinook salmon and steelhead	Beneficial	None	Not Applicable
Impact 4.1-16. Potentially increased spawning success and fry production because separating the powerhouse water discharge from the normal stream channel would facilitate the return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek	Beneficial	None	Not Applicable
Impact 4.1-17. Restoration of natural streamflows and processes by ceasing the discharge of North Fork Battle Creek water to South Fork Battle Creek	Beneficial	None	Not Applicable
Impact 4.1-18. Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of eliminating some diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek	Beneficial	None	Not Applicable
Impact 4.1-19. Reduction of predation-related mortality as a result of removing dams and improving fish ladders	Beneficial	None	Not Applicable
Impact 4.1-20. Substantially increased production of food for fish resulting from increased minimum instream flows	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
No Dam Removal Alternative			
Impact 4.1-21. Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1)	Significant	Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that identified for Proposed Action, Impact 4.1-1)	Less than Significant
Impact 4.1-22. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (similar to Impact 4.1-2)	Significant	Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that identified for Proposed Action, Impact 4.1-2)	Less than Significant
Impact 4.1-23. Disturbed steelhead and Chinook salmon habitat in the stream channel as a result of construction activities	Less than Significant	None	Not Applicable
Impact 4.1-24. Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5)	Less than Significant	None	Not Applicable
Impact 4.1-25. Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6)	Less than Significant	None	Not Applicable
Impact 4.1-26. Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-27. Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish (similar to Impact 4.1-8)	Significant	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.1-28. Reduced habitat and range of some resident warmwater species because of cooler water temperatures	Less than Significant	None	Not Applicable
Impact 4.1-29. Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams	Less than Significant	None	Not Applicable
Impact 4.1-30. Increased exposure of rainbow trout to pathogens because of the increase of Chinook salmon and steelhead in Battle Creek (similar to Impact 4.1-11)	Less than Significant	None	Not Applicable
Impact 4.1-31. Substantially increased capacity indices for spawning and rearing of steelhead and Chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-12)	Beneficial	None	Not Applicable
Impact 4.1-32. Substantially increased production indices for fry and juvenile life stages for steelhead and Chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-13)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-33. Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of Chinook salmon and steelhead over natural barriers (similar to Impact 4.1-14)	Beneficial	None	Not Applicable
Impact 4.1-34. Increased survival of adults and increased spawning success because of the construction of more effective fish ladders on North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams would facilitate passage of Chinook salmon and steelhead	Beneficial	None	Not Applicable
Impact 4.1-35. Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek	Beneficial	None	Not Applicable
Impact 4.1-36. Reduction of predation-related mortality as a result of improving fish ladders	Beneficial	None	Not Applicable
Impact 4.1-37. Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-20)	Beneficial	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.1-38. Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1)	Significant	Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that identified for Proposed Action, Impact 4.1-1)	Less than Significant
Impact 4.1-39. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (Similar to Impact 4.1-2)	Significant	Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that identified for Proposed Action, Impact 4.1-2)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-40. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel (similar to Impact 4.1-3)	Significant	Reclamation will remove diversion dams during low-flow season (July–October) and construct pilot channels (same mitigation as that identified for Proposed Action, Impact 4.1-3)	Less than Significant
Impact 4.1-41. Disturbed steelhead and Chinook salmon habitat in the stream channel as a result of construction activities (similar to 4.1-4)	Less than Significant	None	Not Applicable
Impact 4.1-42. Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5)	Less than Significant	None	Not Applicable
Impact 4.1-43. Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6)	Less than Significant	None	Not Applicable
Impact 4.1-44. Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-45. Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish (similar to Impact 4.1-8)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.1-46. Reduced habitat and range of some resident warmwater species because of cooler water temperatures (similar to Impact 4.1-9)	Less than Significant	None	Not Applicable
Impact 4.1-47. Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams (similar to Impact 4.1-10)	Less than Significant	None	Not Applicable
Impact 4.1-48. Increased exposure of rainbow trout to pathogens because of the increase of Chinook salmon and steelhead in Battle Creek	Less than Significant	None	Not Applicable
Impact 4.1-49. Substantially increased capacity indices for spawning and rearing habitat of steelhead and Chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-12)	Beneficial	None	Not Applicable
Impact 4.1-50. Substantially increased production indices for fry and juvenile life stages for steelhead and Chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-13)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-51. Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of Chinook salmon and steelhead over natural barriers (similar to Impact 4.1-14)	Beneficial	None	Not Applicable
Impact 4.1-52. Increased survival of adults and increased spawning success because removal of dams and the construction of more effective fish ladders would facilitate passage of Chinook salmon and steelhead (similar to Impact 4.1-15)	Beneficial	None	Not Applicable
Impact 4.1-53. Potentially increased spawning success and fry production because separating the powerhouse water discharge from the normal stream channel would facilitate the return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek (similar to Impact 4.1-16)	Beneficial	None	Not Applicable
Impact 4.1-54. Restoration of natural streamflows and processes by ceasing the discharge of North Fork Battle Creek water to South Fork Battle Creek (similar to Impact 4.1-17)	Beneficial	None	Not Applicable
Impact 4.1-55. Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of ceasing diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (similar to Impact 4.1-18)	Beneficial	None	Not Applicable
Impact 4.1-56. Reduction of predation-related mortality as a result of removing dams and improving fish ladders (similar to Impact 4.1-19)	Beneficial	None	Not Applicable
Impact 4.1-57. Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-20)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Three Dam Removal Alternative			
Impact 4.1-58. Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1)	Significant	Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that identified for Proposed Action, Impact 4.1-1)	Less than Significant
Impact 4.1-59. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (similar to Impact 4.1-2)	Significant	Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that identified for Proposed Action, Impact 4.1-2)	Less than Significant
Impact 4.1-60. Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel (similar to Impact 4.1-3)	Significant	Reclamation will remove diversion dams during low-flow season (July–October) and construct pilot channels (same mitigation as that identified for Proposed Action, Impact 4.1-3)	Less than Significant
Impact 4.1-61. Disturbed steelhead and Chinook salmon habitat in the stream channel as a result of construction activities (similar to Impact 4.1-4)	Less than Significant	None	Not Applicable
Impact 4.1-62. Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5)	Less than Significant	None	Not Applicable
Impact 4.1-63. Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6)	Less than Significant	None	Not Applicable
Impact 4.1-64. Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-65. Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish (similar to Impact 4.1-8)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.1-66. Reduced habitat and range of some resident warmwater species because of cooler water temperatures (similar to Impact 4.1-9)	Less than Significant	None	Not Applicable
Impact 4.1-67. Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams (similar to Impact 4.1-10)	Less than Significant	None	Not Applicable
Impact 4.1-68. Increased exposure of rainbow trout to pathogens because of the increase of Chinook salmon and steelhead in Battle Creek (similar to Impact 4.1-11)	Less than Significant	None	Not Applicable
Impact 4.1-69. Substantially increased capacity indices for spawning and rearing of steelhead and Chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-12)	Beneficial	None	Not Applicable
Impact 4.1-70. Substantially increased production indices for fry and juvenile life stages for steelhead and Chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-13)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.1-71. Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of Chinook salmon and steelhead over natural barriers (similar to Impact 4.1-14)	Beneficial	None	Not Applicable
Impact 4.1-72. Increased survival of adults and increased spawning success because removal of dams and the construction of more effective fish ladders would facilitate passage of Chinook salmon and steelhead (similar to Impact 4.1-15)	Beneficial	None	Not Applicable
Impact 4.1-73. Potentially increased spawning success and fry production because separating the powerhouse water discharge from the normal stream channel would facilitate the return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek (similar to Impact 4.1-16)	Beneficial	None	Not Applicable
Impact 4.1-74. Restoration of natural stream flows and processes by ceasing the discharge of North Fork Battle Creek water to South Fork Battle Creek (similar to Impact 4.1-17)	Beneficial	None	Not Applicable
Impact 4.1-75. Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of eliminating some diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (similar to Impact 4.1-18)	Beneficial	None	Not Applicable
Impact 4.1-76. Reduction of predation-related mortality as a result of removing dams and improving fish ladders (similar to Impact 4.1-19)	Beneficial	None	Not Applicable
Impact 4.1-77. Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-20)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
BOTANICAL, WETLAND, AND WILDLIFE RESOURCES			
No Action Alternative			
Botanical, wildlife, and wetland resources would not be affected under the No Action Alternative; the Hydroelectric Project would continue to operate consistent with the current FERC license.	No Change	None	
Five Dam Removal Alternative (Proposed Action)			
Impact 4.2-1. Potential disturbance or loss of 4.18 acres of woody riparian vegetation and associated wildlife habitat	Significant	Reclamation will avoid and minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat	Less than Significant
Impact 4.2-2. Potential introduction of noxious weeds or spread of existing noxious weeds	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites	Less than Significant
Impact 4.2-3. Potential loss or disturbance of 18.86 acres of waters of the United States (including wetlands)	Significant	In addition to mitigation identified for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, compensate for loss of waters of the United States, and revegetate lost habitat	Less than Significant
Impact 4.2-4. Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat	Significant	A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth; Reclamation will compensate for the loss of oak and woodland habitat	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-5. Potential disturbance to valley elderberry longhorn beetle habitat	Significant	A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction	Less than Significant
Impact 4.2-6. Potential disturbance of foothill yellow-legged frogs and their habitat	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction	Less than Significant
Impact 4.2-7. Potential disturbance of northwestern pond turtles and their habitat	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction	Less than Significant
Impact 4.2-8. Potential disturbance of breeding habitat for yellow-breasted chat and little willow flycatcher	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats and little willow flycatchers before construction begins; if breeding chats or little willow flycatchers are found, the construction contractor will limit removal of riparian vegetation and establish a 500-foot no disturbance buffer around all active sites until after construction	Less than Significant
Impact 4.2-9. Potential disturbance to nesting raptors	Significant	A qualified biologist will perform preconstruction surveys of the project sites to locate active osprey, Cooper's hawk, peregrine falcon, golden eagle, and bald eagle nests; if active nests are found, Reclamation will limit construction activities near the nests to the nonbreeding season (mid-July to late March), establish a 500-foot-radius direct line-of-sight buffer for active nonlisted special-status raptor nests and a 0.5-mile-radius direct line-of-sight buffer for active bald eagle nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-10. Potential disturbance to nesting California black rails in emergent marsh	Significant	A qualified biologist will conduct a tape-playback survey to determine presence of California black rails in the emergent marsh, and construction activities will be seasonally restricted to avoid disturbance during the rails' nesting season	Less than Significant
Impact 4.2-11. Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls	Significant	A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game	Less than Significant
Impact 4.2-12. Possible loss of woody riparian vegetation along PG&E canals	Less than Significant	None	Not Applicable
Impact 4.2-13. Potential disturbance of mixed chaparral habitat	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Chapter 3, including compensation for habitat loss, to avoid or minimize temporary effects on mixed chaparral	Less than Significant
Impact 4.2-14. Potential disturbance of annual grassland habitat	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Chapter 3, including compensation for habitat loss, to avoid or minimize temporary effects on annual grassland	Less than Significant
Impact 4.2-15. Potential disturbance of foraging bald eagles along Battle Creek	Less than Significant	None	Not Applicable
Impact 4.2-16. Reduction of artificial flow fluctuations and increased survival of amphibians	Beneficial	None	Not Applicable
Impact 4.2-17. Increase in quantity of amphibian habitat resulting from increased minimum instream flows	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-18. Substantial increase in quantity of bat roosting habitat in the South Canal tunnels as a result of termination of water flow through the tunnels	Beneficial	None	Not Applicable
No Dam Removal Alternative			
Impact 4.2-19. Potential disturbance or loss of 1.87 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1)	Significant	Reclamation will avoid and minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as identified for the Proposed Action, Impact 4.2-1)	Less than Significant
Impact 4.2-20. Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as identified for the Proposed Action, Impact 4.2-2)	Less than Significant
Impact 4.2-21. Potential loss or disturbance of 14.57 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3)	Significant	In addition to mitigation identified for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, compensate for loss of waters of the United States, and revegetate lost habitat (same mitigation as identified for the Proposed Action, Impact 4.2-3)	Less than Significant
Impact 4.2-22. Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4)	Significant	A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth; Reclamation will compensate for the loss of oak and woodland habitat (same mitigation as identified for the Proposed Action, Impact 4.2-4)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-23. Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5)	Significant	A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as identified for the Proposed Action, Impact 4.2-5)	Less than Significant
Impact 4.2-24. Potential disturbance of foothill yellow-legged frogs and their habitat (similar to Impact 4.2-6)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-6)	Less than Significant
Impact 4.2-25. Potential disturbance of northwestern pond turtles and their habitat (similar to Impact 4.2-7)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-7)	Less than Significant
Impact 4.2-26. Potential disturbance of breeding habitat for yellow-breasted chat and little willow flycatcher (similar to Impact 4.2-8)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats and little willow flycatchers before construction begins; if breeding chats or little willow flycatchers are found, the construction contractor will limit removal of riparian vegetation and establish a 500-foot no disturbance buffer around all active sites until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-8)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-27. Potential disturbance to nesting raptors (similar to Impact 4.2-9)	Significant	A qualified biologist will perform preconstruction surveys of the project sites to locate active osprey, Cooper's hawk, peregrine falcon, golden eagle, and bald eagle nests; if active nests are found, Reclamation will limit construction activities near the nests to the nonbreeding season (mid-July to late March), establish a 500-foot-radius direct line-of-sight buffer for active nonlisted special-status raptor nests and a 0.5-mile-radius direct line-of-sight buffer for active bald eagle nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests (same mitigation as identified for the Proposed Action, Impact 4.2-9)	Less than Significant
Impact 4.2-28. Potential disturbance to nesting California black rails in emergent marsh (similar to Impact 4.2-10)	Significant	A qualified biologist will conduct a tape-playback survey to determine presence of California black rails in the emergent marsh and construction activities will be seasonally restricted to avoid disturbance during the rails' nesting season (same mitigation as identified for the Proposed Action, Impact 4.2-10)	Less than Significant
Impact 4.2-29. Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-11)	Significant	A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as identified for the Proposed Action, Impact 4.2-11)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-30. Possible loss of woody riparian vegetation along PG&E Canals (similar to Impact 4.2-12)	Less than Significant	None	Not Applicable
Impact 4.2-31. Potential disturbance of mixed chaparral habitat (similar to Impact 4.2-13)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Chapter 3, including compensation for habitat loss, to avoid or minimize temporary effects on mixed chaparral (same mitigation as identified for the Proposed Action, Impact 4.2-13)	Less than Significant
Impact 4.2-32. Potential disturbance of annual grassland habitat (similar to Impact 4.2-14)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Ch. 3, including compensation for habitat loss, to avoid or minimize temporary effects on annual grassland (same mitigation as identified for the Proposed Action, Impact 4.2-14)	Less than Significant
Impact 4.2-33. Potential disturbance of foraging bald eagles along Battle Creek	Less than Significant	None	Not Applicable
Impact 4.2-34. Increase in quantity of amphibian habitat resulting from increased minimum instream flows	Beneficial	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.2-35. Potential disturbance or loss of 4.18 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1)	Significant	Reclamation will avoid and minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as identified for the Proposed Action, Impact 4.2-1)	Less than Significant
Impact 4.2-36. Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as identified for the Proposed Action, Impact 4.2-2)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-37. Potential loss or disturbance of 16.4 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3)	Significant	In addition to mitigation identified for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, compensate for loss of waters of the United States, and revegetate lost habitat (same mitigation as identified for the Proposed Action, Impact 4.2-3)	Less than Significant
Impact 4.2-38. Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4)	Significant	A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth; Reclamation will compensate for loss of oak and woodland habitat (same mitigation as identified for the Proposed Action, Impact 4.2-4)	Less than Significant
Impact 4.2-39. Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5)	Significant	A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as identified for the Proposed Action, Impact 4.2-5)	Less than Significant
Impact 4.2-40. Potential disturbance of foothill yellow-legged frogs and their habitat (similar to Impact 4.2-6)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-6)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-41. Potential disturbance of northwestern pond turtles and their habitat (similar to Impact 4.2-7)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-7)	Less than Significant
Impact 4.2-42. Potential disturbance of breeding habitat for yellow-breasted chat and little willow flycatcher (similar to Impact 4.2-8)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats and little willow flycatchers before construction begins; if breeding chats or little willow flycatchers are found, the construction contractor will limit removal of riparian vegetation and establish a 500-foot no disturbance buffer around all active sites until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-8)	Less than Significant
Impact 4.2-43. Potential disturbance to nesting raptors (similar to Impact 4.2-9)	Significant	A qualified biologist will perform preconstruction surveys of the project sites to locate active osprey, Cooper's hawk, peregrine falcon, golden eagle, and bald eagle nests; if active nests are found, Reclamation will limit construction activities near the nests to the nonbreeding season (mid-July to late March), establish a 500-foot-radius direct line-of-sight buffer for active nonlisted special-status raptor nests and a 0.5-mile-radius direct line-of-sight buffer for active bald eagle nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests (same mitigation as identified for the Proposed Action, Impact 4.2-9)	Less than Significant
Impact 4.2-44. Potential disturbance to nesting California black rails in emergent marsh (similar to Impact 4.2-10)	Significant	A qualified biologist will conduct a tape-playback survey to determine presence of California black rails in the emergent marsh, and construction activities will be seasonally restricted to avoid disturbance during the rails' nesting season (same mitigation as identified for the Proposed Action, Impact 4.2-10)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-45. Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-11)	Significant	A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as identified for the Proposed Action, Impact 4.2-11)	Less than Significant
Impact 4.2-46. Possible loss of woody riparian vegetation along PG&E canals (similar to Impact 4.2-12)	Less than Significant	None	Not Applicable
Impact 4.2-47. Potential disturbance of mixed chaparral habitat (similar to Impact 4.2-13)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Ch. 3, including compensation for habitat loss, to avoid or minimize temporary effects on mixed chaparral (same mitigation as identified for the Proposed Action, Impact 4.2-13)	Less than Significant
Impact 4.2-48. Potential disturbance of annual grassland habitat (similar to Impact 4.2-14)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Chapter 3, including compensation for habitat loss, to avoid or minimize temporary effects on annual grassland (same mitigation as identified for the Proposed Action, Impact 4.2-14)	Less than Significant
Impact 4.2-49. Potential disturbance of foraging bald eagles along Battle Creek	Less than Significant	None	Not Applicable
Impact 4.2-50. Reduction in artificial flow fluctuations and increased survival of amphibians	Beneficial	None	Not Applicable
Impact 4.2-51. Increase in the quantity of amphibian habitat resulting from increased minimum instream flows	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-52. Substantial increase in the quantity of bat roosting habitat in the South Canal tunnels as a result of termination of water flow through the tunnels	Beneficial	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.2-53. Potential loss or disturbance of 3.81 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1)	Significant	Reclamation will avoid and minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as identified for the Proposed Action, Impact 4.2-1)	Less than Significant
Impact 4.2-54. Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as identified for the Proposed Action, Impact 4.2-2)	Less than Significant
Impact 4.2-55. Potential loss or disturbance of 12.07 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3)	Significant	In addition to mitigation identified for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, compensate for loss of waters of the United States, and revegetate lost habitat (same mitigation as identified for the Proposed Action, Impact 4.2-3)	Less than Significant
Impact 4.2-56. Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4)	Significant	A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth; Reclamation will compensate for loss of oak and woodland habitat (same mitigation as identified for the Proposed Action, Impact 4.2-4)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-57. Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5)	Significant	A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as identified for the Proposed Action, Impact 4.2-5)	Less than Significant
Impact 4.2-58. Potential disturbance of foothill yellow-legged frogs and their habitat (similar to Impact 4.2-6)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-6)	Less than Significant
Impact 4.2-59. Potential disturbance of northwestern pond turtles and their habitat (similar to Impact 4.2-7)	Significant	In addition to mitigation identified for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-7)	Less than Significant
Impact 4.2-60. Potential disturbance of breeding habitat for yellow-breasted chat (similar to Impact 4.2-8)	Significant	A qualified biologist will survey for breeding yellow-breasted chats before construction begins; if breeding chats are found, the construction contractor will limit removal of riparian vegetation and establish a 500-foot no disturbance buffer around all active sites until after construction (same mitigation as identified for the Proposed Action, Impact 4.2-8)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-61. Potential disturbance to nesting raptors (similar to Impact 4.2-9)	Significant	A qualified biologist will perform preconstruction surveys of the project sites to locate active osprey, Cooper's hawk, peregrine falcon, golden eagle, and bald eagle nests; if active nests are found, Reclamation will limit construction activities near the nests to the nonbreeding season (mid-July to late March), establish a 500-foot-radius direct line-of-sight buffer for active nonlisted special-status raptor nests and a 0.5-mile-radius direct line-of-sight buffer for active bald eagle nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests (same mitigation as identified for the Proposed Action, Impact 4.2-9)	Less than Significant
Impact 4.2-62. Potential disturbance to nesting California black rails in emergent marsh (similar to Impact 4.2-10)	Significant	A qualified biologist will conduct a tape-playback survey to determine presence of California black rails in the emergent marsh, and construction activities will be seasonally restricted to avoid disturbance during the rails' nesting season (same mitigation as identified for the Proposed Action, Impact 4.2-10)	Less than Significant
Impact 4.2-63. Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-11)	Significant	A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as identified for the Proposed Action, Impact 4.2-11)	Less than Significant
Impact 4.2-64. Possible loss of woody riparian vegetation along PG&E canals (similar to Impact 4.2-12)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.2-65. Potential disturbance of mixed chaparral habitat (similar to Impact 4.2-13)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Ch. 3, including compensation for habitat loss, to avoid or minimize temporary effects on mixed chaparral (same mitigation as identified for the Proposed Action, Impact 4.2-13)	Less than Significant
Impact 4.2-66. Potential disturbance of annual grassland habitat (similar to Impact 4.2-14)	Less than Significant	Reclamation will implement BMPs and environmental commitments described in Ch. 3, including compensation for habitat loss, to avoid or minimize temporary effects on annual grassland (same mitigation as identified for the Proposed Action, Impact 4.2-14)	Less than Significant
Impact 4.2-67. Potential disturbance of foraging bald eagles along Battle Creek	Less than Significant	None	Not Applicable
Impact 4.2-68. Reduction of artificial flow fluctuations and increased survival of amphibians	Beneficial	None	Not Applicable
Impact 4.2-69. Substantial increase in the quantity of amphibian habitat resulting from increased minimum instream flows	Beneficial	None	Not Applicable
HYDROLOGY			
No Action Alternative			
Current hydrology would not change; Hydroelectric Project facilities and operations would be maintained and operated in accordance with FERC regulations, and the existing minimum flows would continue to be provided.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.3-1. In-water construction could result in short-term disruption of streambed and flows	Less than Significant	None	Not Applicable
Impact 4.3-2. Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
No Dam Removal Alternative			
Impact 4.3-3. In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.3-4. Removal of Eagle Canyon Diversion Dam could result in minor, slight increases to downstream bed elevations	Less than Significant	None	Not Applicable
Impact 4.3-5. In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1)	Less than Significant	None	Not Applicable
Impact 4.3-6. Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse (similar to Impact 4.3-2)	Beneficial	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.3-7. Removal of Eagle Canyon Diversion Dam could result in minor, slight increases to downstream bed elevations	Less than Significant	None	Not Applicable
Impact 4.3-8. In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1)	Less than Significant	None	Not Applicable
Impact 4.3-9. Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse (similar to Impact 4.3-2)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
WATER QUALITY			
No Action Alternative			
The No Action Alternative would not affect water quality. Under the No Action Alternative, the Hydroelectric Project would continue to operate consistent with the current FERC license.	No change		
Five Dam Removal Alternative (Proposed Action)			
Impact 4.4-1. Increased erosion and subsequent discharge of settleable material and runoff into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders	Significant	Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board	Less than Significant
Impact 4.4-2. Potential spills of hazardous materials could occur	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills	Less than Significant
Impact 4.4-3. Potential reduction in beneficial uses of waters used at Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery	Significant	A pipeline to bypass the Jeffcoat site would be constructed to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.4-4. Potential reduction in beneficial uses of California waters from the distribution of infected Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish	Significant	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.4-5. Removal of South and Coleman Diversion Dams could cause erosion of minor amounts of sediment from behind the dam	Less than Significant	None	Not Applicable
Impact 4.4-6. Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge	Less than Significant	None	Not Applicable
Impact 4.4-7. Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.4-8. Increased erosion and subsequent discharge of settleable material and runoff into Battle Creek as a result of constructing fish screens and fish ladders (similar to Impact 4.4-1)	Significant	Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as identified for the Proposed Action, Impact 4.4-1)	Less than Significant
Impact 4.4-9. Potential spills of hazardous materials could occur (similar to Impact 4.4-2)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.4-2)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.4-10. Potential reduction in beneficial uses of waters used at Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery (similar to Impact 4.4-3)	Significant	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.4-11. Potential reduction in beneficial uses of California waters from the distribution of infected Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish (similar to Impact 4.4-4)	Significant	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Six Dam Removal Alternative			
Impact 4.4-12. Increased erosion and subsequent discharge of settleable material and runoff into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders (similar to Impact 4.4-1)	Significant	Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as identified for the Proposed Action, Impact 4.4-1)	Less than Significant
Impact 4.4-13. Potential spills of hazardous materials could occur (similar to Impact 4.4-2)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.4-2)	Less than Significant
Impact 4.4-14. Potential reduction in beneficial uses of waters used at Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery (similar to Impact 4.4-4)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.4-15. Potential reduction in beneficial uses of California waters from the distribution of infected Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish (similar to Impact 4.4-4)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.4-16. Removal of South and Coleman Diversion Dams could cause erosion of minor amounts of sediment from behind the dam (similar to Impact 4.4-5)	Less than Significant	None	Not Applicable
Impact 4.4-17. Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge (similar to Impact 4.4-6)	Less than Significant	None	Not Applicable
Impact 4.4-18. Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam (similar to Impact 4.4-7)	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.4-19. Increased erosion and subsequent discharge of settleable material and runoff into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders (similar to Impact 4.4-1)	Significant	Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as identified for the Proposed Action, Impact 4.4-1)	Less than Significant
Impact 4.4-20. Potential spills of hazardous materials could occur (similar to Impact 4.4-2)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.4-2)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.4-21. Potential reduction in beneficial uses of waters used at Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery (similar to Impact 4.4-4)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.4-22. Potential reduction in beneficial uses of California waters from the distribution of infected Mount Lassen Trout Farm and Darrah Springs State Fish Hatchery fish (similar to Impact 4.4-3)	Significant	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. The Asbury Diversion Dam would be modified to prevent fish passage above the dam. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Less than Significant
Impact 4.4-23. Removal of Coleman Diversion Dam could cause erosion of minor amounts of sediment from behind the dam (similar to Impact 4.4-5)	Less than Significant	None	Not Applicable
Impact 4.4-24. Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge (similar to Impact 4.4-6)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.4-25. Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam (similar to Impact 4.4-7)	Less than Significant	None	Not Applicable
GROUNDWATER			
No Action Alternative			
Groundwater would not change under the No Action Alternative.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.5-1. Potential spills of hazardous materials could occur and contaminate the shallow groundwater system	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills	Less than Significant
No Dam Removal Alternative			
Impact 4.5-2. Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.5-1)	Less than Significant
Six Dam Removal Alternative			
Impact 4.5-3. Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.5-1)	Less than Significant
Three Dam Removal Alternative			
Impact 4.5-4. Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1)	Significant	Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as identified for the Proposed Action, Impact 4.5-1)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
LAND USE			
No Action Alternative			
The No Action Alternative would not impact land use; the No Action Alternative is not expected to conflict with general plans and established land uses, alter existing land uses, displace a large number of people, or convert agricultural land to nonagricultural land.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.6-1. Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.6-2. Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.6-3. Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.6-4. Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses	Less than Significant	None	Not Applicable
GEOLOGY AND SOILS			
No Action Alternative			
Geological and soil resources would not change.	No change	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Five Dam Removal Alternative (Proposed Action)			
Impact 4.7-1. Potential accelerated water and wind erosion from construction activities	Significant	The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites	Less than Significant
Impact 4.7-2. Construction workers could be exposed to falling rocks	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.7-3. Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1)	Significant	The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as identified for the Proposed Action, Impact 4.7-1)	Less than Significant
Impact 4.7-4. Construction workers could be exposed to falling rocks (similar to Impact 4.7-2)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.7-5. Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1)	Significant	The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as identified for the Proposed Action, Impact 4.7-1)	Less than Significant
Impact 4.7-6. Construction workers could be exposed to falling rocks (similar to Impact 4.7-2)	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.7-7. Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1)	Significant	The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as identified for the Proposed Action, Impact 4.7-1)	Less than Significant
Impact 4.7-8. Construction workers could be exposed to falling rocks (similar to Impact 4.7-2)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
AESTHETICS AND VISUAL RESOURCES			
No Action Alternative			
Aesthetics and visual resources would not change under the No Action Alternative; the No Action Alternative would not alter existing views of Hydroelectric Project facilities or affect any scenic vistas.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.8-1. Construction of tailrace connectors, new fish screens and fish ladders, and associated facilities would reduce scenic quality at the Oasis Springs Lodge	Significant and Unavoidable	Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside	Significant
Impact 4.8-2. Proposed construction of tailrace connector, bypass chute, and fish screen and fish ladders would alter views from adjacent area	Less than Significant	None	Not Applicable
Impact 4.8-3. Removal of diversion dams and associated construction would substantially reduce scenic quality from public viewing areas	Less than Significant	None	Not Applicable
Impact 4.8-4. Potential reduction in scenic resources caused by closure of PG&E canals.	Less than Significant	None	Not Applicable
Impact 4.8-5. Temporarily reduced scenic resources along the Eagle Canyon Canal as a result of construction of Eagle Canyon Pipeline	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.8-6. Construction of new fish screens and fish ladders and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1)	Significant and Unavoidable	Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside (same mitigation as identified for the Proposed Action, Impact 4.8-1)	Not Applicable
Impact 4.8-7. Proposed construction of fish screen and fish ladders would alter views from adjacent area	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.8-8. Construction of fish screens and fish ladders and associated project activities would substantially reduce scenic quality from public viewing areas	Less than Significant	None	Not Applicable
Impact 4.8-9. Potential reduction in scenic resources caused by closure of PG&E canals	Less than Significant	None	Not Applicable
Impact 4.8-10. Temporarily reduced scenic resources along the Eagle Canyon Canal as a result of construction of Eagle Canyon Pipeline (similar to Impact 4.8-5)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.8-11. Construction of tailrace connectors, new fish screen and fish ladder and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1)	Significant and Unavoidable	Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside (same mitigation as identified for the Proposed Action, Impact 4.8-1)	Significant
Impact 4.8-12. Proposed construction of tailrace connector, bypass chute, and fish screen and fish ladders would alter views from adjacent area (similar to Impact 4.8-2)	Less than Significant	None	Not Applicable
Impact 4.8-13. Removal of diversion dams and associated construction would substantially reduce scenic quality from public viewing areas (similar to Impact 4.8-3)	Less than Significant	None	Not Applicable
Impact 4.8-14. Potential reduction in scenic resources caused by closure of PG&E canals (similar to Impact 4.8-4)	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.8-15. Construction of new fish screen and fish ladder and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1)	Significant and Unavoidable	Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside (same mitigation as identified for the Proposed Action, Impact 4.8-1)	Significant
Impact 4.8-16. Construction of the channel with armoring or revetment would alter views of the South Fork creek bank	Significant and Unavoidable	None	Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.8-17. Proposed construction of fish screens and fish ladders would alter views from adjacent area (similar to Impact 4.8-2)	Less than Significant	None	Not Applicable
Impact 4.8-18. Removal of diversion dams and associated construction would substantially reduce scenic quality from public viewing areas	Less than Significant	None	Not Applicable
Impact 4.8-19. Potential reduction in scenic resources caused by closure of PG&E canals (similar to Impact 4.8-4)	Less than Significant	None	Not Applicable
TRANSPORTATION			
No Action Alternative			
The No Action Alternative would not result in the construction of new access roads or improvements to existing roads, other than those already planned as a part of the operation and maintenance plan for the Hydroelectric Project.	No change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.9-1. Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-2. Construction traffic could damage county and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-3. Construction traffic or activities could delay emergency vehicle response times	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.9-4. Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-5. Construction traffic could damage county and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-6. Construction traffic or activities could delay emergency vehicle response times	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Six Dam Removal Alternative			
Impact 4.9-7. Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-8. Construction traffic could damage county and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-9. Construction traffic or activities could delay emergency vehicle response times	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.9-10. Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-11. Construction traffic could damage county and private roadways	Less than Significant	None	Not Applicable
Impact 4.9-12. Construction traffic or activities could delay emergency vehicle response times	Less than Significant	None	Not Applicable
NOISE			
No Action Alternative			
The No Action Alternative would not increase noise levels above existing levels in the vicinity of the Restoration Project or at the locations of nearby sensitive receptors.	No change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.10-1. Exposure of noise-sensitive uses to noise and vibration from blasting	Significant	The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices	Less than Significant
Impact 4.10-2. Exposure of noise-sensitive land uses to noise from on-site construction activities	Significant	Reclamation will implement noise reducing construction practices	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.10-3. Exposure of noise-sensitive land uses along site access roads to construction-related truck noise	Significant	Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00 a.m. to 9:00 p.m.	Less than Significant
Impact 4.10-4. Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.10-5. Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1)	Significant	The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as identified for the Proposed Action, Impact 4.10-1)	Less than Significant
Impact 4.10-6. Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2)	Significant	Reclamation will implement noise reducing construction practices (same mitigation as identified for the Proposed Action, Impact 4.10-2)	Less than Significant
Impact 4.10-7. Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3)	Significant	Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00 a.m. to 9:00 p.m. (same mitigation as identified for the Proposed Action, Impact 4.10-3)	Less than Significant
Impact 4.10-8. Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.10-9. Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1)	Significant	The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as identified for the Proposed Action, Impact 4.10-1)	Less than Significant
Impact 4.10-10. Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2)	Significant	Reclamation will implement noise reducing construction practices (same mitigation as identified for the Proposed Action, Impact 4.10-2)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.10-11. Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3)	Significant	Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00 a.m. to 9:00 p.m. (same mitigation as identified for the Proposed Action, Impact 4.10-3)	Less than Significant
Impact 4.10-12. Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.10-13. Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1)	Significant	The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as identified for the Proposed Action, Impact 4.10-1)	Less than Significant
Impact 4.10-14. Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2)	Significant	Reclamation will implement noise reducing construction practices (same mitigation as identified for the Proposed Action, Impact 4.10-2)	Less than Significant
Impact 4.10-15. Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3)	Significant	Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00 a.m. to 9:00 p.m. (same mitigation as identified for the Proposed Action, Impact 4.10-3)	Less than Significant
Impact 4.10-16. Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities	Less than Significant	None	Not Applicable
AIR QUALITY			
No Action Alternative			
Air quality would not change under the No Action Alternative.	No change	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Five Dam Removal Alternative (Proposed Action)			
Impact 4.11-1. Construction-related emissions in excess of allowable thresholds	Significant	The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District	Less than Significant
Impact 4.11-2. Increased emissions from operational and maintenance activities would contribute to violation of air quality standards	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.11-3. Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1)	Significant	The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation identified for the Proposed Action, Impact 4.11-1)	Less than Significant
Impact 4.11-4. Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.11-2)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.11-5. Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1)	Significant	The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation identified for the Proposed Action, Impact 4.11-1)	Less than Significant
Impact 4.11-6. Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.3-2)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Three Dam Removal Alternative			
Impact 4.11-7. Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1)	Significant	The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation identified for the Proposed Action, Impact 4.11-1)	Less than Significant
Impact 4.11-8. Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.11-2)	Less than Significant	None	Not Applicable
PUBLIC HEALTH AND SAFETY			
No Action Alternative			
The No Action Alternative is expected to have no impacts on public health and safety in addition to those already anticipated as part of the current operations at the existing facilities.	No change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.12-1. Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites	Significant	Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site and develop a plan to minimize risk to the public	Less than Significant
Impact 4.12-2. The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials	Significant	Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.12-3. Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals	Significant	Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues	Less than Significant
Impact 4.12-4. Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes	Significant	Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health	Less than Significant
Impact 4.12-5. Helicopter operations at some of the Restoration Project sites could result in worker injury or fire	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.12-6. Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites (similar to Impact 4.12-1)	Significant	Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site and develop a plan to minimize risk to the public (same mitigation as identified for the Proposed Action, Impact 4.12-1)	Less than Significant
Impact 4.12-7. The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2)	Significant	Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as identified for the Proposed Action, Impact 4.12-2)	Less than Significant
Impact 4.12-8. Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3)	Significant	Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as identified for the Proposed Action, Impact 4.12-3)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.12-9. Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4)	Significant	Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as identified for the Proposed Action, Impact 4.12-4)	Less than Significant
Impact 4.12-10. Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.12-11. Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites (similar to Impact 4.12-1)	Significant	Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site and develop a plan to minimize risk to the public (same mitigation as identified for the Proposed Action, Impact 4.12-1)	Less than Significant
Impact 4.12-12. The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2)	Significant	Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as identified for the Proposed Action, Impact 4.12-2)	Less than Significant
Impact 4.12-13. Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3)	Significant	Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as identified for the Proposed Action, Impact 4.12-3)	Less than Significant
Impact 4.12-14. Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4)	Significant	Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as identified for the Proposed Action, Impact 4.12-4)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.12-15. Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5)	Less than Significant	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.12-16. Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites (similar to Impact 4.12-1)	Significant	Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site and develop a plan to minimize risk to the public (same mitigation as identified for the Proposed Action, Impact 4.12-1)	Less than Significant
Impact 4.12-17. The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2)	Significant	Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as identified for the Proposed Action, Impact 4.12-2)	Less than Significant
Impact 4.12-18. Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3)	Significant	Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as identified for the Proposed Action, Impact 4.12-3)	Less than Significant
Impact 4.12-19. Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4)	Significant	Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as identified for the Proposed Action, Impact 4.12-4)	Less than Significant
Impact 4.12-20. Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
PUBLIC SERVICES AND UTILITIES			
No Action Alternative			
The No Action Alternative would not affect public services and utilities and is not expected to contribute to the increased usage of those public services and utilities described in the document.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.13-1. Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services	Significant	The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments	Less than Significant
Impact 4.13-2. Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities	Less than Significant	None	Not Applicable
Impact 4.13-3. Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities	Less than Significant	None	Not Applicable
No Dam Removal Alternative			
Impact 4.13-4. Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1)	Significant	The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as identified for the Proposed Action, Impact 4.13-1)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.13-5. Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2)	Less than Significant	None	Not Applicable
Impact 4.13-6. Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3)	Less than Significant	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.13-7. Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1)	Significant	The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as identified for the Proposed Action, Impact 4.13-1)	Less than Significant
Impact 4.13-8. Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2)	Less than Significant	None	Not Applicable
Impact 4.13-9. Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3)	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Three Dam Removal Alternative			
Impact 4.13-10. Significant Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1)	Significant	The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as identified for the Proposed Action, Impact 4.13-1)	Less than Significant
Impact 4.13-11. Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2)	Less than Significant	None	Not Applicable
Impact 4.13-12. Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3)	Less than Significant	None	Not Applicable
RECREATION			
No Action Alternative			
The No Action Alternative would not result in any changes to the existing recreational resources in and around the Restoration Project.	No change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.14-1. Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge	Significant and Unavoidable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary.	Significant
Impact 4.14-2. Construction activities could temporarily reduce recreational resources and activities	Significant	Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.14-3. Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights	Significant	Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity	Less than Significant
Impact 4.14-4. Removing canals and installing fish screens to stop movement of fish into the remaining canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals	Less than Significant	None	Not Applicable
Impact 4.14-5. Loss of a recreational fishery at Oasis Springs Lodge	Less than Significant	None	Not Applicable
Impact 4.14-6. Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities	Beneficial	None	Not Applicable
No Dam Removal Alternative			
Impact 4.14-7. Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1)	Significant and Unavoidable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as identified for the Proposed Action, Impact 4.14-1)	Significant
Impact 4.14-8. Construction activities could temporarily reduce recreational resources and activities (similar to Impact 4.14-2)	Significant	Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-2)	Less than Significant
Impact 4.14-9. Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3)	Significant	Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-3)	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.14-10. Installing fish screens to stop movement of fish into the canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals (similar to Impact 4.14-4)	Less than Significant	None	Not Applicable
Impact 4.14-11. Loss of a recreational fishery at Oasis Springs Lodge (similar to Impact 4.14-5)	Less than Significant	None	Not Applicable
Impact 4.14-12. Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-6)	Beneficial	None	Not Applicable
Six Dam Removal Alternative			
Impact 4.14-13. Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1)	Significant and Unavoidable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as identified for the Proposed Action, Impact 4.14-1)	Significant
Impact 4.14-14. Construction activities could temporarily reduce recreational resources and activities (similar to Impact 4.14-2)	Significant	Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-2)	Less than Significant
Impact 4.14-15. Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3)	Significant	Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-3)	Less than Significant
Impact 4.14-16. Removing canals and installing fish screens to stop movement of fish into the remaining canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals	Less than Significant	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.14-17. Loss of a recreational fishery at Oasis Springs Lodge (similar to Impact 4.14-5)	Less than Significant	None	Not Applicable
Impact 4.14-18. Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-6)	Beneficial	None	Not Applicable
Three Dam Removal Alternative			
Impact 4.14-19. Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1)	Significant and Unavoidable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as identified for the Proposed Action, Impact 4.14-1)	Significant
Impact 4.14-20. Construction activities could temporarily reduce recreational resources and activities (similar to Impact 4.14-2)	Significant	Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-2)	Less than Significant
Impact 4.14-21. Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3)	Significant	Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as identified for the Proposed Action, Impact 4.14-3)	Less than Significant
Impact 4.14-22. Installing fish screens to stop movement of fish into the canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals	Less than Significant	None	Not Applicable
Impact 4.14-23. Loss of a recreational fishery at Oasis Springs Lodge	Less than Significant	None	Not Applicable
Impact 4.14-24. Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-6)	Beneficial	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
CULTURAL			
No Action Alternative			
No impacts would occur on cultural resources; the diversion dams and canals would continue to be affected by existing use and upgrades.	No Change	None	Not Applicable
Five Dam Removal Alternative (Proposed Action)			
Impact 4.15-1. Removal of historic properties	Significant and Unavoidable	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties	Significant
Impact 4.15-2. Historic properties would be adversely affected	Significant	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-1)	Less than Significant
Impact 4.15-3. Potential damage to archaeological deposits as a result of vehicular traffic	Significant	Access roads will be flagged during construction, and traffic will be limited to these areas	Less than Significant
Impact 4.15-4. Potential impact on cultural resources at the Jeffcoat aquaculture facility	Significant	Reclamation will complete a full assessment of the significance of the resources. To comply with Section 106, Reclamation will consult with the SHPO, the Advisory Council on Historic Preservation, and any other consulting parties in the Section 106 review process regarding eligibility of the significant resources. An MOA will be developed among Reclamation, the SHPO, and any identified consulting parties if eligible cultural resources would be adversely affected by the proposed undertaking. The MOA will describe methods for Reclamation to mitigate the adverse effects. Mitigation measures may include data recovery excavations and avoidance through project design. The Section 106 review process described here will be completed before beginning construction of the Restoration Project.	Less than Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
No Dam Removal Alternative			
Impact 4.15-5. Historic properties would be adversely affected (similar to Impact 4.15-2)	Significant	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-2)	Less than Significant
Impact 4.15-6. Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3)	Significant	Access roads will be flagged during construction, and traffic will be limited to these (same as mitigation identified for the Proposed Action, Impact 4.15-3)	Less than Significant
Impact 4.15-7. Potential impact on cultural resources at the Jeffcoat aquaculture facility (Similar to Impact 4.15-4)	Significant	Reclamation will complete a full assessment of the significance of the resources. To comply with Section 106, Reclamation will consult with the SHPO, the Advisory Council on Historic Preservation, and any other consulting parties in the Section 106 review process regarding eligibility of the significant resources. An MOA will be developed among Reclamation, the SHPO, and any identified consulting parties if eligible cultural resources would be adversely affected by the proposed undertaking. The MOA will describe methods for Reclamation to mitigate the adverse effects. Mitigation measures may include data recovery excavations and avoidance through project design. The Section 106 review process described here will be completed before beginning construction of the Restoration Project.	Less than Significant
Six Dam Removal Alternative			
Impact 4.15-8. Removal of historical properties (similar to Impact 4.15-1)	Significant and Unavoidable	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-1)	Significant

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Impact 4.15-9. Historic properties would be adversely affected (similar to Impact 4.15-2)	Significant	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-2)	Less than Significant
Impact 4.15-10. Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3)	Significant	Access roads will be flagged during construction, and traffic will be limited to these areas (same as mitigation identified for the Proposed Action, Impact 4.15-3)	Less than Significant
Three Dam Removal Alternative			
Impact 4.15-11. Removal of historic properties (similar to Impact 4.15-1)	Significant and Unavoidable	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-1)	Significant
Impact 4.15-12. Eligible historic properties would be adversely affected (similar to Impact 4.15-2)	Significant	HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation identified for the Proposed Action, Impact 4.15-2)	Less than Significant
Impact 4.15-13. Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3)	Significant	Access roads will be flagged during construction, and traffic will be limited to these areas (same as mitigation identified for the Proposed Action, Impact 4.15-3)	Less than Significant
OTHER NEPA ANALYSES			
POWER GENERATION AND ECONOMICS			
No Action Alternative			
Ongoing operation, maintenance, and capital expenditures would not change. This alternative would not result in any effects on the cost of power.	No change	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Five Dam Removal Alternative (Proposed Action)			
Effect 4.16-1. Increased cost of project power	Not Applicable	None	Not Applicable
No Dam Removal Alternative			
Effect 4.16-2. Increased cost of project power	Not Applicable	None	Not Applicable
Six Dam Removal Alternative			
Effect 4.16-3. Increased cost of project power	Not Applicable	None	Not Applicable
Three Dam Removal Alternative			
Effect 4.16-4. Increased cost of project power	Not Applicable	None	Not Applicable
SOCIOECONOMICS			
No Action Alternative			
No substantial change in regional or local employment or income levels is expected.	Not Applicable	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Five Dam Removal Alternative (Proposed Action)			
Effect 4.16-5. Potential socioeconomic risk to Mount Lasses Trout Farm fish-marketing program	Not Applicable	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Not Applicable
Effect 4.16-6. Potential construction-related loss of revenues at Oasis Springs Lodge.	Not applicable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as that identified for the Proposed Action, Impact 4.14-1)	Not applicable
Effect 4.16-7. Potential long-term loss in revenue at Oasis Springs Lodge	Not applicable		Not applicable
Effect 4.16-8. Slight increase of regional sales/receipts during construction	Not Applicable	None	Not Applicable
Effect 4.16-9. Slight increase of construction-related jobs during Restoration Project construction	Not Applicable	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
No Dam Removal Alternative			
Effect 4.16-10. Potential socioeconomic risk to Mount Lasses Trout Farm fish-marketing program (Similar to Effect 4.16-5)	Not Applicable	A pipeline would be constructed to bypass the Jeffcoat site to prevent the potential contamination of spring water with the IHN virus. In addition, one of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Not Applicable
Effect 4.16-11. Potential construction-related loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-6)	Not applicable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as that identified for the Proposed Action, Impact 4.14-1)	Not applicable
Effect 4.16-12. Potential long-term loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-7)	Not applicable		Not applicable
Effect 4.16-13. Slight increase of regional sales/receipts during construction	Not Applicable	None	Not Applicable
Effect 4.16-14. Slight increase of construction-related jobs during Restoration Project construction	Not Applicable	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Six Dam Removal Alternative			
Effect 4.16-15. Potential socioeconomic risk to Mount Lassen Trout Farm fish-marketing program (Similar to Effect 4.16-5)	Not Applicable	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Not Applicable
Effect 4.16-16. Potential construction-related loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-6)	Not applicable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as that identified for the Proposed Action, Impact 4.14-1)	Not applicable
Effect 4.16-17. Potential long-term loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-7)	Not applicable		Not applicable
Effect 4.16-18. Slight increase of regional sales/receipts during construction (similar to Effect 4.16-6)	Not Applicable	None	Not Applicable
Effect 4.16-19. Slight increase of construction-related jobs during Restoration Project construction (similar to Effect 4.16-7)	Not Applicable	None	Not Applicable

Table 7-1. Continued

Impact	Level of Significance	Proposed Mitigation Measure(s)	Level of Significance after Mitigation
Three Dam Removal Alternative			
Effect 4.16-20. Potential socioeconomic risk to Mount Lassen Trout Farm fish-marketing program (Similar to Effect 4.16-5)	Not Applicable	One of the following options at the Willow Springs facility would be implemented: ■ Option A—install a disinfection facility, ■ Option B—relocate Willow Springs to raise trout at an equivalent off-site facility, ■ Option C—modify MLTF's operations at the Willow Springs facility, and ■ Option D—acquire Willow Springs. (same mitigation as that identified for the Proposed Action, Impact 4.1-8)	Not Applicable
Effect 4.16-21. Potential construction-related loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-6)	Not applicable	Reclamation will notify Oasis Springs Lodge of the construction activity schedule and will consult with lodge operators to identify any additional impacts on recreational opportunities and determine whether any further appropriate mitigation measures are necessary (same mitigation as that identified for the Proposed Action, Impact 4.14-1)	Not applicable
Effect 4.16-22. Potential long-term loss in revenues at Oasis Springs Lodge (Similar to Effect 4.16-7)	Not applicable		Not applicable
Effect 4.16-23. Slight increase of regional sales/receipts during construction (similar to Effect 4.16-6)	Not Applicable	None	Not Applicable
Effect 4.16-24. Slight increase of construction-related jobs during Restoration Project construction (similar to Effect 4.16-7)	Not Applicable	None	Not Applicable

Table 7-2. Comparison of Benefits and Impacts Associated with Each Action Alternative[1]

Impact/Effect	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative
Section 4.1, Fish				
Increased survival of adults and increased spawning success because removal of five dams and the construction of more reliable, effective fish ladders would facilitate passage of Chinook salmon and steelhead (migration habitat).	Impact 4.1-15 Beneficial		Impact 4.1-52 Beneficial	Impact 4.1-72 Beneficial
Increased survival of adults and increased spawning success because the construction of more effective fish ladders on North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams would facilitate passage of Chinook salmon and steelhead.		Impact 4.1-34 Beneficial		
Potentially increased spawning success and fry production because separating the powerhouse water discharge from the normal stream channel would facilitate the return of adult Chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek (migration and habitat stability).	Impact 4.1-16 Beneficial		Impact 4.1-53 Beneficial	Impact 4.1-73 Beneficial
Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of eliminating some diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (entrainment).	Impact 4.1-18 Beneficial		Impact 4.1-55 Beneficial	Impact 4.1-75 Beneficial
Substantially increased survival of juvenile steelhead and Chinook salmon during downstream movement and migration as a result of constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (entrainment).		Impact 4.1-35 Beneficial		
Reduction of predation-related mortality as a result of removing dams and improving fish ladders (predation, pathogens, and food).	Impact 4.1-19 Beneficial		Impact 4.1-56 Beneficial	Impact 4.1-76 Beneficial
Reduction of predation-related mortality as a result of improving fish ladders (predation, pathogens, and food).		Impact 4.1-36 Beneficial		

[1] This table lists only those impacts that are different among the alternatives. Impacts that are shared by all alternatives are not listed in this table.

Table 7-2. Continued

Impact/Effect	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative
Substantially increased production of food for fish resulting from increased minimum instream flows (predation, pathogens, and food).	Impact 4.1-20 Beneficial	Impact 4.1-37 Beneficial	Impact 4.1-57 Beneficial	Impact 4.1-77 Beneficial
Section 4.2, Botanical, Wetland, and Wildlife Resources				
Substantial increase in quantity of bat roosting habitat in the South Canal tunnels as a result of termination of water flow through the tunnels.	Impact 4.2-18 Beneficial		Impact 4.2-52 Beneficial	
Section 4.3, Hydrology				
Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse.	Impact 4.3-2 Beneficial		Impact 4.3-6 Beneficial	Impact 4.3-9 Beneficial
Total number of beneficial impacts from each alternative	**7**	**4**	**7**	**6**
Section 4.1, Fish				
Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel (contaminants).	Impact 4.1-3 Significant *(Coleman and South Diversion Dams)*		Impact 4.1-40 Significant *(Eagle Canyon, Coleman, and South Diversion Dams)*	Impact 4.1-60 Significant *(Eagle Canyon and Coleman Diversion Dams)*
Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish. *Note: Mitigation at the Jeffcoat mitigation site is not required for the Six Dam Removal and Three Dam Removal Alternatives.*	Impact 4.1-8 Significant *(Jeffcoat, Willow Springs, and Asbury Diversion Dam)*	Impact 4.1-27 Significant *(Jeffcoat, Willow Springs, and Asbury Diversion Dam)*	Impact 4.1-45 Significant *(Willow Springs and Asbury Diversion Dam)*	Impact 4.1-65 Significant *(Willow Springs and Asbury Diversion Dam)*

Table 7-2. Continued

Impact/Effect	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative
Section 4.2, Botanical, Wetland, and Wildlife Resources				
Potential disturbance or loss of woody riparian vegetation and associated wildlife habitat.	Impact 4.2-1 Significant *(4.18 acres)*	Impact 4.2-19 Significant *(1.87 acres)*	Impact 4.2-35 Significant *(4.18 acres)*	Impact 4.2-53 Significant *(3.81 acres)*
Potential loss or disturbance of waters of the United States (including wetlands).	Impact 4.2-3 Significant *(18.86 acres)*	Impact 4.2-21 Significant *(14.57 acres)*	Impact 4.2-37 Significant *(16.43 acres)*	Impact 4.2-55 Significant *(12.07 acres)*
Potential disturbance of breeding habitat for yellow-breasted chat and little willow flycatcher. *Note: Breeding habitat for little willow flycatcher would not be affected under the Three Dam Removal Alternative.*	Impact 4.2-8 Significant	Impact 4.2-26 Significant	Impact 4.2-42 Significant	Impact 4.2-60 Significant *(only yellow-breasted chat)*
Possible loss of woody riparian vegetation along PG&E canals.	Impact 4.2-12 Less than significant *(includes Wildcat, South, and a portion of Eagle Canyon Canals)*	Impact 4.2-30 Less than significant *(includes a portion of Eagle Canyon Canal)*	Impact 4.2-46 Less than significant *(includes Wildcat, South, and Eagle Canyon Canals)*	Impact 4.2-64 Less than significant *(includes Wildcat and Eagle Canyon Canals)*
Section 4.3, Hydrology				
Removal of Eagle Canyon Diversion Dam could result in minor increases to downstream bed elevations.			Impact 4.3-4 Less than significant	Impact 4.3-7 Less than significant
Section 4.4, Water Quality				
Removal of South and Coleman Diversion Dams could cause erosion of minor amounts of sediment from behind the dam.	Impact 4.4-5 Less than significant		Impact 4.4-16 Less than significant	Impact 4.4-23 Less than significant *(only Coleman Diversion Dam)*
Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge.	Impact 4.4-6 Less than significant		Impact 4.4-17 Less than significant	Impact 4.4-24 Less than significant

Table 7-2. Continued

Impact/Effect	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative
Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam.	Impact 4.4-7 Less than significant		Impact 4.4-18 Less than significant	Impact 4.4-25 Less than significant
Section 4.8, Visual Resources				
Construction of the channel with armoring or revetment would alter views of the South Fork creek bank.				Impact 4.8-16 Significant and unavoidable
Potential reduction in scenic resources visible from canals caused by closure of PG&E canals.	Impact 4.8-4 Less than significant *(Includes Wildcat, South, and a portion of Eagle Canyon Canals)*	Impact 4.8-9 Less than significant *(Includes a portion of Eagle Canyon Canal)*	Impact 4.8-14 Less than significant *(Includes Wildcat, South, and Eagle Canyon Canals)*	Impact 4.8-19 Less than significant *(Includes Wildcat, South, and Eagle Canyon Canals)*
Temporarily reduced scenic resources along the Eagle Canyon Canal as a result of construction of Eagle Canyon pipeline.	Impact 4.8-5 Less than significant	Impact 4.8-10 Less than significant		
Section 4.15, Cultural Resources				
Removal of historic properties.	Impact 4.15-1 Significant and unavoidable		Impact 4.15-8 Significant and unavoidable	Impact 4.15-11 Significant and unavoidable
Potential impact on cultural resources at the Jeffcoat aquaculture facility.	Impact 4.15-4 Significant	Impact 4.15-7 Significant		

Table 7-2. Continued

Impact/Effect	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative
Section 4.16, Other NEPA Analyses				
Power Generation and Economics: Increased cost of project power.	Effect 4.16-1 *($5.0 million)*	Effect 4.16-2 *($12.6 million)*	Effect 4.16-3 *($16.8 million)*	Effect 4.16-4 *(13.7 million)*
Power Generation and Economics: Indirect environmental effects associated with the loss of hydropower and renewable replacement power.	Effect	Effect *(some degree of magnitude less than the Five Dam Removal Alternative)*	Effect *(some degree of magnitude greater than the Five Dam Removal Alternative)*	Effect *(some degree of magnitude less than the Five Dam Removal Alternative)*
Socioeconomics: Potential socioeconomic risk to MLTF fish marketing program.	Effect 4.16-5	Effect 4.16-10	Effect 4.16-15 *(some degree of magnitude less than the Five Dam Removal Alternative)*	Effect 4.16-20 *(some degree of magnitude less than the Five Dam Removal Alternative)*
Total number of impacts under each alternative	**16**	**11**	**15**	**16**

Chapter 8
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Personal Communications

Battle Creek Environmental Team. December 8, 2004—Conference call among the following Battle Creek Environmental Team members to discuss instream construction schedule for each Battle Creek project site: Bureau of Reclamation—Jim Goodwin, Civil Engineer; Tom Hepler, Civil Engineer; Mary Marshall, Project Manager; Rosemary Stefani, Environmental Specialist; California Department of Fish and Game—Mike Berry, Fishery Biologist; Federal Energy Regulatory Commission—TJ LoVullo, License Coordinator; National Marine Fisheries Service—Mike Tucker, Fishery Biologist; Pacific Gas & Electric Company—Angela Risdon, License Coordinator; Chip Stalica, Generation Supervisor; and U.S. Fish and Wildlife Service—Bart Prose, Fish and Wildlife Biologist.

Berry, Mike. Senior fishery biologist. California Department of Fish and Game, Redding, CA. August 19, 2004—email to Kim Marcotte of Jones & Stokes regarding the stocking agreement for Oasis Springs Lodge.

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