Part 1 of 2

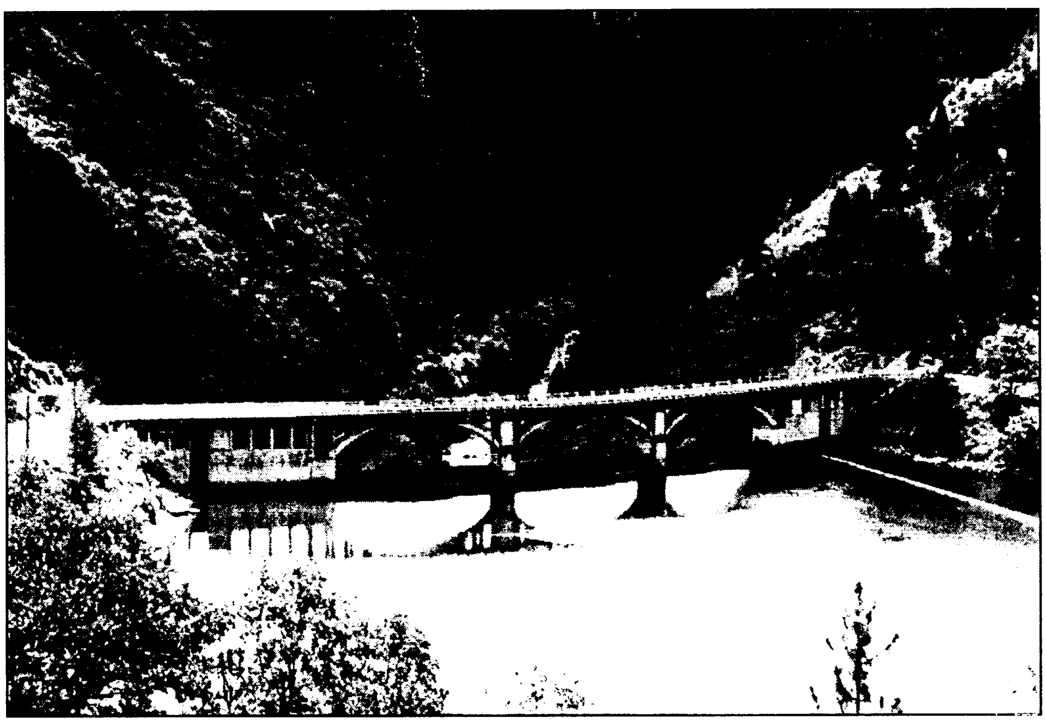
Federal Energy Regulatory Commission

Office of Energy Projects

June 2004

FERC/FEIS - 0158F

Final Environmental Impact Statement



Pit 3, 4, 5 Hydroelectric Project
(FERC No. 233-081)
California

888 First Street N.E., Washington, DC 20426

FEDERAL ENERGY REGULATORY COMMISSION
Washington, DC

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the Federal Energy Regulatory Commission's (FERC's or Commission's) final environmental impact statement (EIS) for Pacific Gas and Electric Company's application for a new license for its Pit 3, 4, 5 Hydroelectric Project (FERC No. 233-081) located in the Pit River Basin in Shasta County, California. This final EIS has been prepared pursuant to requirements of the National Environmental Policy Act (NEPA) and the Commission's regulations implementing NEPA (18 CFR Part 380). The draft EIS was sent to the U.S. Environmental Protection Agency and made available to the public on March 19, 2003.

The final EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Commission staff. It contains staff recommendations on licensing for the Pit 3, 4, 5 Hydroelectric Project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, NE, Washington, DC 20426. The final EIS may also be viewed on the Internet at http://www.ferc.gov under the eLibrary link. For further information, please contact John Mudre at (202) 502-8902.

Attachment: Final Environmental Impact Statement

FINAL
ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER LICENSE

Pit 3, 4, 5 Hydroelectric Project

FERC Project No. 233-081

California

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
888 First Street, N.E.
Washington, DC 20426

June 2004

COVER SHEET

a. Title: Relicensing the Pit 3, 4, 5 Hydroelectric Project in the Pit River Basin, Federal Energy Regulatory Commission (FERC or Commission) Project No. 233-081

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract: Pacific Gas and Electric Company (PG&E) filed an application for a new license for the existing Pit 3, 4, 5 Hydroelectric Project, which is located on the Pit River in Shasta County, California, and occupies private lands and 746 acres of federally owned lands administered by the Forest Supervisor of the Shasta-Trinity National Forest and the Forest Supervisor of the Lassen National Forest.

The final environmental impact statement (EIS) presents the staff's evaluation of the developmental and non-developmental consequences of PG&E's proposal, alternatives to the proposed action, and the No-action Alternative. Key issues associated with relicensing this project are establishing an appropriate flow regime in the bypassed reaches to maintain sustainable ecosystem functions and to protect and enhance fish and wildlife resources, including special status species (i.e., bald eagle and foothill yellow-legged frog), while balancing measures to enhance recreational use and minimize effects on sensitive cultural resources and energy production.

The staff's recommendation is to relicense the project as proposed, with additional measures to protect and enhance environmental resources, including various measures to protect and monitor water quality; measures to control flows to the bypassed reaches and manage Lake Britton water levels to enhance habitat for aquatic biota; monitoring aquatic, riparian, and terrestrial plants, fish, and wildlife; protective measures for fish and wildlife; various recreational enhancements; and development of several land use plans.

e. Contact: John Mudre
Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street, N.E.
Washington, DC 20426
(202) 502-8902

f. Transmittal: This final EIS prepared by the Commission's staff on the hydroelectric license application filed by PG&E for the existing Pit 3, 4, 5 Project (FERC No. 233-081) is being made available to the public on or about June 9, 2004, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR Part 380).

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1 National Environmental Policy Act of 1969, as amended (Pub. L. 91-190. 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[1] and the U.S. Department of Energy (DOE) Organization Act,[2] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric developments subject to its jurisdiction, on the necessary conditions:

> That the project adopted . . . shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of waterpower development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in Section 4(e) . . .[3]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[4] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[5]

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1 16 U.S.C. §§791(a)-825(r), as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986) and the Energy Policy Act of 1992, Public Law 102-486 (1992).

2 Public Law 95-91, 91 Stat. 556 (1977).

3 16 U.S.C. §803(a).

4 16 U.S.C. §803(g).

5 18 C.F.R. §385.206 (1987).

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ACS	aquatic conservation strategy
ADA	Americans with Disabilities Act
AIR	additional information request
APE	area of potential effect
AWA	American Whitewater Affiliation
BCMP	Biological Compliance Monitoring Program
BE	Biological Evaluation
BEFS	bald eagle and fish study
BLM	Bureau of Land Management
BMP	best management practice
BOD	biological oxygen demand
C	Celsius
CAISO	California Independent System Operator
CalEPPC	California Exotic Pest Plant Council
CalPX	California Power Exchange
CalTrans	California Department of Transportation
CA/MX	California-Mexico Power Area
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CDWR	California Department of Water Resources
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CRMP	Cultural Resources Management Plan (in this document, we consider this to be synonymous with HPMP)
CWTPS	California Wild Trout Preservation Society
DAU	Deer Assessment Unit
Denny	Denny Land and Cattle Company, LLC
DHS	California Department of Health Services
District	Lake Britton Archaeological District
DO	dissolved oxygen
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit

FERC	Federal Energy Regulatory Commission
Fly Fishers	Northern California Council of the Federation of Fly Fishers
FPA	Federal Power Act
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
GWh	gigawatt-hours
HPMP	Historic Properties Management Plan (in this document, we consider this to be synonymous with CRMP)
HSP	hazardous substances plan
IBEMP	Interagency Bald Eagle Management Plan
I&E	information and education
IFIM	Instream Flow Incremental Methodology
Interior	U.S. Department of the Interior
KVP	key viewing point
kWh	kilowatt-hours
LHMP	Land and Habitat Management Plan
LRMP	Land and Resource Management Plan
LSR	Late Successional Reserves
mg/l	milligrams per liter
MIS	Management Indicator Species
ml	milliliters
MPN	most probable number
MW	megawatts
MWh	megawatt-hours
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NERC	North American Electric Reliability Council
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NPS	National Park Service
NTU	nephelometric turbidity units
O&M	operations and maintenance
ORV	off-road vehicle
PA	Programmatic Agreement
PAC	protected activity center
PAOT	people at one time
PCT	Pacific Crest Trail
PG&E	Pacific Gas and Electric Company
PM&E	protection, mitigation, and enhancement measures
ppm	parts per million
PRCT	Pit River Collaborative Team

PSEA	Pacific Service Employee's Association
RD	recreational days
REA	Ready for Environmental Analysis
Reclamation	U.S. Bureau of Reclamation
RMO	Road Management Objective
ROS	Recreation Opportunity Spectrum
RV	recreational vehicle
SFID	South Fork Irrigation District
SHPO	State Historic Preservation Officer
SM	Survey and Manage
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TPZ	Timberland Production Zones
TRG	Technical Review Group
Tribe	Pit River Tribe
UC Davis	University of California-Davis
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle
VMP	visual management plan
vpd	vehicles per day
VQO	visual quality objective
WHR	Wildlife Habitat Relationship
WQC	water quality certification
WSCC	Western Systems Coordinating Council
WUA	Weighted Useable Area

EXECUTIVE SUMMARY

The Pit 3, 4, 5 Hydroelectric Project (Pit 3, 4, 5 Project) is an existing 325-megawatt (MW) hydroelectric facility located on the Pit River, in Shasta County, California. The project occupies 746 acres of lands of the United States administered by the Forest Supervisors of the Shasta-Trinity and Lassen National Forests. The Pit 3, 4, 5 Project consists of three hydraulically connected developments, with a total of four dams, four reservoirs, three powerhouses, associated tunnels, surge chambers, and penstocks. The project has a combined average annual generation of 1,913.7 gigawatt-hours. Pacific Gas and Electric Company (PG&E) proposes no increased capacity.

In this final environmental impact statement, we, the Federal Energy Regulatory Commission (Commission or FERC) staff, analyze the effects of continued project operations with added environmental measures. PG&E filed with the Commission by letter dated October 29, 2003, a collaborative agreement reached by the Pit River Collaborative Team (PRCT) on proposed protection, mitigation, and enhancement (PM&E) measures pertaining to reservoir operations, minimum streamflows, freshet flow releases, out-of-season spill flows, recreation streamflow releases, ramping rates, and streamflow information. We refer to this as the PRCT agreement. We also consider project decommissioning and a No-action Alternative.

PG&E proposes to continue operating the Pit 3, 4, 5 Project with the following PM&E measures: (1) operate the project in accordance with the provisions of the PRCT agreement, including reservoir operation, minimum flows, freshet flows, out-of-season spill control, recreation releases, ramping rates, and streamflow information; (2) develop a water temperature and dissolved oxygen monitoring plan; (3) develop a dredging plan, if needed; (4) develop a remediation plan for the Miners Creek spoil pile; (5) develop a spoil pile management and maintenance plan; (6) maintain and/or replace the Hat Creek fish barrier; (7) fund Hat Creek Wild Trout Management Plan initiatives (we do not include this measure in Staff's Alternative); (8) develop fish, invertebrate, riparian vegetation, peregrine, and bank swallow monitoring plans; (9) develop a noxious weed control plan; (10) revise the Interagency Bald Eagle Management Plan (IBEMP) and periodically update; (11) update the 1993 Biological Compliance Monitoring Plan; (12) develop a vegetation management plan; (13) exclude bats from the Pit 5 dam stairway, the Pit 5 gaging station, and the Pit 4 tunnel adit; (14) develop a valley elderberry longhorn beetle protection plan; (15) map habitat for northern spotted owl; (16) develop a recreation management plan; (17) develop a recreation monitoring plan; (18) develop an interpretive and education plan; (19) improve the car-top boat launch facility near the gasline crossing of Lake Britton; (20) close the parking area on the north side of Hat Creek; (21) evaluate management options for the North Ferry Crossing area; (22) install warning signs at the Clark Creek Road crossing of the Pit 3 dam; (23) improve Dusty Campground; (24) improve North Shore

Campground; (25) improve Jamo Point boat launch area; (26) move the "no boating" buoy line closer to the Pit 3 dam; (27) develop options for capacity issues at Lake Britton; (28) develop a day-use access area at the Pit 3 tailrace; (29) improve parking at Talus Siren and trails at Powder Spur, Delucci Ridge, Rock Creek, Malinda Gulch, and Oak Flat; (30) develop a scenic canyon overlook near the Pit 4 dam; (31) improve dispersed camping at Ruling Creek; (32) provide whitewater boater put in and take out sites; (33) evaluate developing a campground in the Pit River Canyon; (34) develop a road management and maintenance plan; (35) develop a fire management and response plan; (36) develop a visual resource management plan; and (37) prepare an historic properties management plan.

Our analysis shows that the best alternative for the Pit 3, 4, 5 Project is to issue a new license consistent with PG&E's proposed environmental measures (unless noted otherwise) with the following additional measures (Staff's Alternative): (1) include details that we specify in the following PG&E-proposed plans: (a) water temperature and DO monitoring; (b) spoil pile management; (c) dredging; (d) stream flow and water surface monitoring; (e) fish and invertebrate monitoring; (f) vegetation management; (g) riparian vegetation monitoring; (h) bank swallow monitoring; (i) peregrine falcon monitoring; (j) valley elderberry longhorn beetle protection; (k) northern spotted owl protection; (l) IBEMP; (m) recreation management; (n) information and education; (o) road management and maintenance; (p) fire management and response; and (q) visual resource management; (2) develop an erosion and sedimentation control plan for those sites not addressed by other plans; (3) develop a gravel augmentation plan; (4) develop a woody debris transport plan; (4) develop plans to monitor neotropical migrant songbirds and terrestrial molluscs; (5) conduct surveys for northern goshawks, if influenced by project-related activities; (6) develop a foothill yellow-legged frog monitoring plan; (7) develop a western pond turtle monitoring plan; (8) consult with the U.S. Department of Agricultural, Forest Service (FS) prior to undertaking any actions that would affect FS sensitive species to determine if a Biological Evaluation is needed; (9) develop a biological monitoring and adaptive management plan; (10) include in PG&E's proposed recreation streamflow release plan a specific decision point regarding whether or not scheduled releases should be implemented; (11) develop a plan for providing a full time project patrol; (12) develop a signage plan; (13) develop a land and habitat management plan; and (14) modify the project boundary to include the project-related features that we specify. Licensed with these measures, the Pit 3, 4, 5 Project would be best adapted to a comprehensive plan for developing the Pit River Basin.

We estimate that the net annual benefit of the project as currently operated (the No-Action Alternative) is $85,773,260. The net annual benefit of the project as proposed by PG&E is estimated to be $77,639,120. The net annual benefit of the proposed project with our additional recommended measures would be about $77,412,570. If the Pit 3, 4, 5 Project is decommissioned, we estimate that the net benefit would be about negative

$95,589,130, which includes the estimated capital cost of removing the project dams and sealing the intake structures, and the lost revenue from generation, which would need to be purchased from an alternative source.

FINAL ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
Washington, DC

Pit 3, 4, 5 Hydroelectric Project
FERC No. 233-081 California

On October 19, 2001, Pacific Gas and Electric Company (PG&E) filed an application with the Federal Energy Regulatory Commission (FERC or Commission) for a new license for the existing Pit 3, 4, 5 Hydroelectric Project (Pit 3, 4, 5 Project). The installed capacity of the project is 317.25 megawatts (MW), and PG&E estimates the dependable capacity to be 325 MW.[1] The project has a combined average annual generation of 1,913.7 gigawatt-hours (GWh). The Pit 3, 4, 5 Project is located on the Pit River in Shasta County, California, near the unincorporated residential communities of Burney, Cassel, Fall River Mills, Hat Creek, McArthur, Big Bend, and Montgomery Creek (figure 1). The project occupies 746 acres of lands of the United States administered by the Forest Supervisors of the Shasta-Trinity and Lassen National Forests.

1.0 PURPOSE OF ACTION AND NEED FOR POWER

1.1 Purpose of Action

The Commission must decide whether to issue a new license to PG&E for the Pit 3, 4, 5 Project and what conditions, if any, should be placed on that license. Issuing a license would allow PG&E to continue generating electricity for the term of that license, making electric power from a renewable source available to its customers.

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[1] The project's total authorized installed capacity of 317.25 MW is based on the turbine capacity ratings of the units, which is the limiting equipment for all units except Units 3 and 4 in the Pit 5 powerhouse. The total generator capacity rating of the units is 330.33 MW. PG&E provides a combined normal operating capacity for the Pit 3, 4, 5 Project of about 325 MW, which reflects the fact that the Pit 3 units are typically operated slightly below their turbine rating, while the Pit 4 and 5 units are typically operated above their turbine rating. PG&E bases its dependable capacity on the project's load carrying ability during the critical hydrologic period coincident with its peak system load. Currently, the critical hydrologic period was in 1977, and the typical peak system is in July and August.

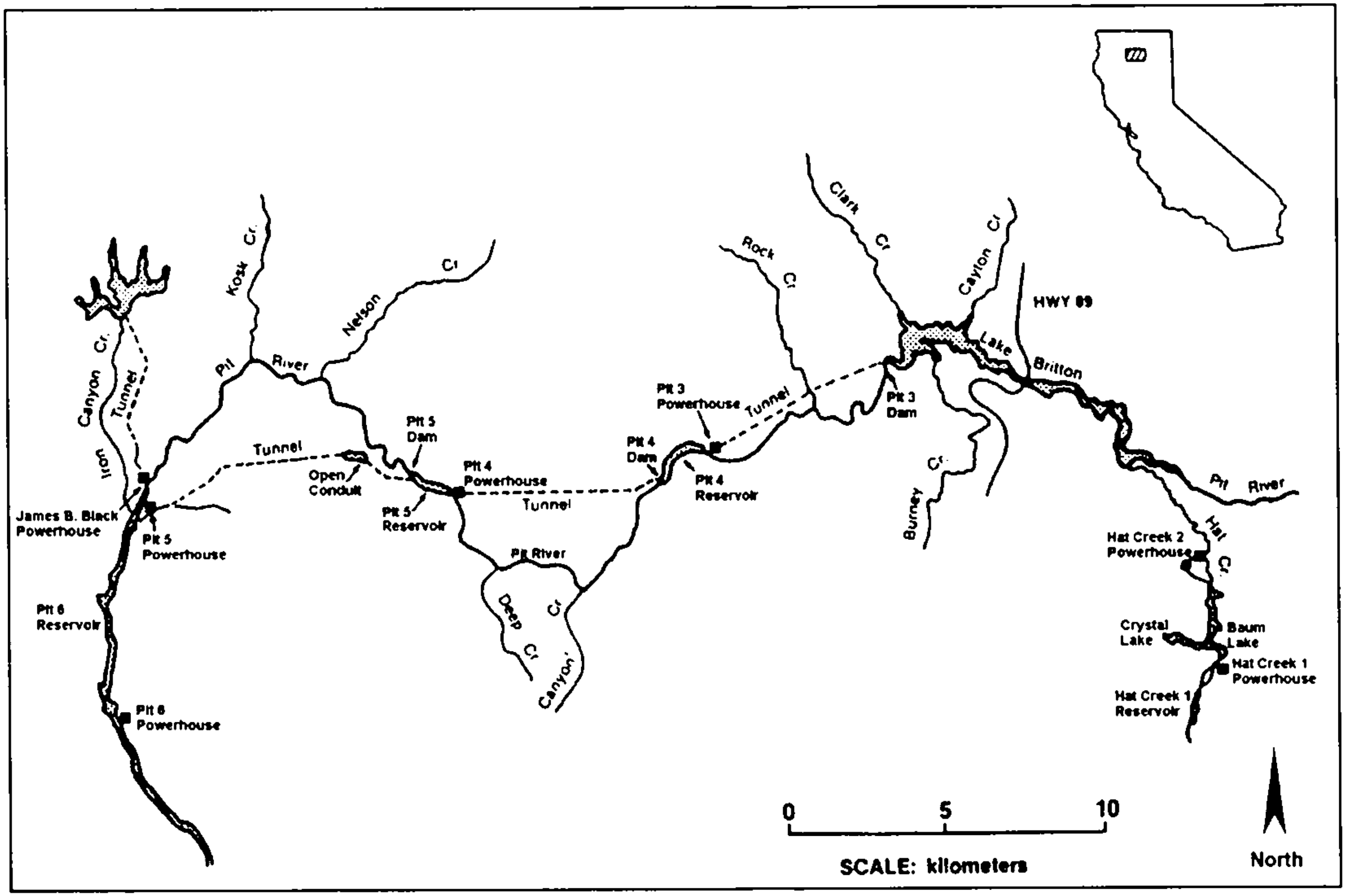

Figure 1. General site location of the Pit 3, 4, 5 Hydroelectric Project. (Source: PG&E, 2001, as modified by staff)

In this final environmental impact statement (EIS), we assess the effects associated with operation of the project and alternatives to the proposed project; make recommendations to the Commission on whether to issue a new license; and, if so, recommend terms and conditions to become a part of any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

In this final EIS, we assess the environmental and economic effects of licensing the project (1) as proposed by PG&E, and (2) with our recommended measures (Staff's Alternative). We also consider the effects of project decommissioning and the No-action Alternative. Important issues that we address include providing appropriate minimum flows in the bypassed reaches, whether enhancement of the supply of gravel and other native materials in the bypassed reaches is needed, management of Lake Britton water surface elevations and its effect on nearshore and riparian habitat, controlling noxious weeds, protecting threatened and endangered species, providing recreational enhancements, and protecting cultural resources.

1.2 Need for Power

The Pit 3, 4, 5 Project has been providing hydroelectric generation for more than 77 years. It can continue to provide a portion of PG&E's power requirements, and contribute to PG&E's resource diversity, as well as to the state of California's capacity needs.

The North American Electric Reliability Council (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Pit 3, 4, 5 Project is in the California-Mexico Power Area (CA/MX) of the Western Systems Coordinating Council (WSCC). According to the NERC's most recent forecast, peak demands and annual energy requirements for the CA/MX are projected to grow at annual compound rates of 2.6 percent and 2.8 percent, respectively, from 2000 through 2010. Projected resource capacity margins (generating capacity in excess of demand) range between 10.2 percent and 34.5 percent of firm peak demand during the 10-year forecast period (NERC, 2001).

Table 1 summarizes electric supply and demand (actual and forecasted) for the CA/MX in particular and for the WSCC as a whole. Table 2 summarizes the mix of generation resources (actual and forecasted) for the CA/MX and for the WSCC. Table 2 shows that approximately 37,000 MW of additional capacity is expected to be brought on line over the next 10 years in the CA/MX region.

With the start of the California competitive generation market in 1998, the California Power Exchange (CalPX) and the California Independent System Operator (CAISO) were responsible for conducting a competitive bidding process for procuring electricity resources and operating the transmission system throughout the state to provide reliable electricity service at minimum cost. Soon after the CalPX ceased to function in 2001, the California Department of Water Resources (CDWR) began to purchase power for the state's electricity customers. PG&E schedules its power with the CAISO, and the CAISO and the CDWR purchase energy and ancillary services on the spot market and through long-term contracts. The project is operated in conjunction with PG&E's other generating resources to help meet electricity demands and ancillary service needs of PG&E's customers and the state.

Table 1. Actual and forecasted electric supply and demand, CA/MX and WSCC. (Source: Staff, based on WSCC, 2001)

	2000 actual	2010 forecast	Annual change (%)
California-Mexico Power Area			
Existing/planned generation (MW)	51,103	88,199	5.6
Summer peak demand (MW)	51,213	66,186	2.6
Winter peak demand (MW)	37,993	48,056	2.4
Annual energy load (GWh)	275,588	362,568	2.8
Western Systems Coordinating Council			
Existing/planned generation (MW)	159,154	225,993	3.6
Summer peak demand (MW)	130,892	163,176	2.2
Winter peak demand (MW)	116,104	145,721	2.3
Annual energy load (GWh)	786,087	996,989	2.4

Table 2. Actual and forecasted electric generation resources, CA/MX and WSCC. (Source: Staff, based on WSCC, 2001)

	2000 actual		2010 forecast	
	MW	**percent**	**MW**	**percent**
California-Mexico Power Area				
Conventional hydro	9,896	19.4	9,896	11.2
Pumped storage hydro	3,477	6.8	3,477	3.9
Coal steam	3,220	6.3	3,220	3.7
Oil steam	286	0.6	136	0.2
Gas steam	18,653	36.5	17,234	19.5
Nuclear	4,359	8.5	4,359	4.9
Combustion turbine	5,211	10.2	6,870	7.8
Combined cycle	3,711	7.3	38,895	44.1
Geothermal	1,971	3.9	1,971	2.2
Internal combustion	48	0.1	48	0.1
Other	271	0.5	2,093	2.4
Total	**51,103**	**100.0**	**88,199**	**100.0**
Western Systems Coordinating Council				
Conventional hydro	61,918	38.9	62,321	27.6
Pumped storage hydro	4,050	2.5	4,050	1.8
Coal steam	36,579	23.0	37,371	16.5
Oil steam	446	0.3	296	0.1
Gas steam	23,392	14.7	22,219	9.8
Nuclear	9,262	5.8	9,317	4.1
Combustion turbine	10,569	6.6	17,035	7.5
Combined cycle	8,430	5.3	66,390	29.4
Geothermal	2,469	1.6	2,514	1.1
Internal combustion	300	0.2	300	0.1
Other	1,729	1.1	4,180	1.8
Total	**159,144**	**100.0**	**225,993**	**100.0**

We conclude that power from the Pit 3, 4, 5 Project would help meet a need for power and ancillary services in the CA/MX in both the short and long term. The project provides low-cost power that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil-fueled facilities avoids some power plant emissions and creates an environmental benefit. If the electric output of the project was replaced with fossil-fueled generation, greenhouse gas emissions could potentially increase by 292,000 metric tons of carbon per year.

1.3 Interventions

On April 9, 2002, the Commission issued a notice accepting PG&E's application to relicense the Pit 3, 4, 5 Project. This notice set June 8, 2002, as the deadline for filing protests and motions to intervene. The following entities filed motions to intervene:

Intervenors	Date of Letter
California State Water Resource Control Board	December 12, 2001
Pit River Tribe	March 18, 2002
Northern California Council of the Federation of Fly Fishers	May 28, 2002
U.S. Department of Agriculture, Forest Service	June 4, 2002
California Trout and Trout Unlimited	June 6, 2002
California Department of Fish and Game	June 6, 2002
U.S. Department of the Interior	June 6, 2002
South Fork Irrigation District and the County of Modoc	June 7, 2002
American Whitewater Affiliation and Shasta Paddlers	June 7, 2002
Anglers Committee Against Artificial Whitewater Flows	September 10, 2002
Chico Paddleheads	October 10, 2002
Northeastern California Water Association	November 27, 2002
Association for Safe Access to the Pit River	March 12, 2004

1.4 Scoping

Before preparing the draft EIS, we conducted scoping to identify issues and alternatives. Scoping Document 1 was distributed to interested agencies and other parties on April 23, 2002. We held one scoping meeting on May 22, 2002, in Burney, California, and two scoping meetings on May 23, 2002, in Redding and Big Bend, California, to receive oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these comments are part of the

Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entities	Date of Letter
Pit River Tribe	June 19, 2002
U.S. Department of Agriculture, Forest Service	June 20, 2002
California Department of Fish and Game	June 21, 2002
U.S. Department of the Interior, Fish and Wildlife Service	June 21, 2002
U.S. Department of the Interior, Bureau of Indian Affairs	June 21, 2002
South Fork Irrigation District and Modoc County	June 24, 2002
California State Water Resources Control Board	June 24, 2002
U.S. Department of the Interior, National Park Service	June 26, 2002

We issued the revised Scoping Document 2 on July 31, 2002, to address these comments.

1.5 Agency Consultation

The Commission's regulations require applicants to consult with appropriate state and federal environmental resource agencies, Indian tribes, and the public before filing a license application. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be completed and documented in accordance with the Commission's regulations. The Commission issued a public notice on August 12, 2002, that the application for the Pit 3, 4, 5 Project was Ready for Environmental Analysis (REA) and comments should be filed by October 11, 2002. The following entities commented:

Commenting Entities	Date of Letter
California State Water Resources Control Board	September 24, 2002
California Department of Fish and Game	October 3, 2002
Anglers Committee Against Artificial Whitewater Flows	October 7, 2002
Northern California Council of the Federation of Fly Fishers	October 8, 2002
U.S. Department of the Interior	October 9, 2002
California Department of Parks and Recreation	October 9, 2002

American Whitewater Affiliation, Shasta Paddlers, and Chico Paddleheads	October 9, 2002
U.S. Forest Service	October 9, 2002
National Marine Fisheries Service	October 10, 2002
Pit River Tribe	October 10, 2002
Pacific Gas and Electric Company	October 11, 2002
Trout Unlimited and California Trout	October 11, 2002
California Wild Trout Preservation Society	October 23, 2002
Denny Land & Cattle Company, LLC	December 19, 2002

PG&E filed reply comments to the recommended terms, conditions, and prescriptions by letter dated November 25, 2002.

1.6 Comments on the Draft EIS

The Commission sent the draft EIS to the U.S. Environmental Protection Agency and made the draft EIS available to the public on or about March 19, 2003. The Commission requested that any comments on the draft EIS be filed by May 21, 2003, and later extended this deadline to June 20, 2003. Letters commenting on the draft EIS were filed with the Commission and we modified the text of the EIS in response to these comments, as appropriate. Appendix A lists the commentors, summarizes the comments, and presents our responses to those comments.

2.0 PROPOSED ACTIONS AND ALTERNATIVES

2.1 Applicant's Proposal

2.1.1 Project Description

The existing Pit 3, 4, 5 Project consists of three hydraulically connected developments, with a total of four dams, four reservoirs, three powerhouses, associated tunnels, surge chambers, and penstocks. The powerhouses contain nine generating units with a combined normal operating capacity of about 325 MW. The storage capability of the project reservoirs is too small to provide any effective flood control. There are no direct irrigation diversions within the project area. However, after passing through the project powerhouses, the Pit River waters flow into Shasta Lake for subsequent release for additional beneficial uses, including downstream irrigation.

The Pit 3 development consists of: (1) the 1,293-acre Pit 3 reservoir, known as Lake Britton, with a gross storage capacity of 41,877 acre-feet at elevation 2,737.5 feet National Geodetic Vertical Datum (NGVD) and a useable capacity of 14,443 acre-feet; (2) the Pit 3 dam, a concrete gravity structure with a crest length of 494 feet and a maximum height of 130 feet, which includes a 254-foot-wide ogee spillway with three bays that contain 6-foot-high inflatable rubber gates and three low-level outlets each with a 7-foot by 7-foot gate; (3) a reinforced concrete intake structure located upstream of the dam with steel trashracks and two 8-foot-wide by 18-foot-high slide gates; (4) a 19-foot-diameter concrete tunnel in two sections, with a total length of 21,203 feet; (5) a surge chamber that ranges from 64 to 94 feet in diameter and has a 10-foot-diameter riveted steel overflow pipe that extends to the river; (6) three penstocks, 9 to 11 feet in diameter and 600 feet in length; (7) an 84-foot by 194-foot reinforced concrete, multi-level powerhouse; (8) three generating units, driven by three vertical Francis turbines, each with a normal operating capacity of 23.3 MW for a total normal operating capacity of 69.9 MW; and (9) appurtenant facilities. One of the low level outlets has been modified in order to provide a minimum flow release.

The Pit 4 development consists of: (1) the 105-acre Pit 4 reservoir, with a gross storage capacity of 1,970 acre-feet at elevation 2,422.5 feet NGVD and a useable storage of 1,382 acre-feet; (2) the Pit 4 dam, consisting of a gravity-type overflow section, including a spillway with two drum gates, three 7-foot-wide by 7-foot-high low-level sluice gates, a 42-inch-diameter minimum flow outlet that is 213 feet long with a maximum height of 115 feet, and a slab-and-buttress-type section that is 202 feet long with a maximum height of 65 feet, and a wing wall that is approximately 115 feet long and 3 to 5 feet high; (3) a reinforced concrete intake structure located upstream of the dam with steel trashracks and one 15-foot-wide by 19-foot-high roller gate; (4) a 19-foot-diameter pressure tunnel with a total length of 21,408 feet; (5) two 12-foot-diameter, riveted pipe penstocks that are 780 feet long and taper to 9 feet in diameter; (6) a 63-foot-diameter reinforced concrete surge chamber with a 16-foot-diameter central riser; (7) a four-level, 84.5-foot by 155-foot steel-framed, reinforced concrete powerhouse; (8) two generating units, driven by two vertical Francis turbines, each with a combined normal operating capacity of 47.5 MW for a total operating capacity of 95 MW; and (9) appurtenant facilities.

The Pit 5 development consists of: (1) the 32-acre Pit 5 reservoir, with a gross storage capacity of 314 acre-feet at elevation 2,040.5 feet NGVD and a useable storage capacity of 202 acre-feet; (2) the Pit 5 dam, with a concrete gravity overflow structure 340 feet long and 67 feet high, including four spill bays with 50-foot-wide by 26.3-foot-high steel wheel gates and a 30-inch-diameter outlet for minimum flow releases; (3) a reinforced concrete intake structure located upstream of the dam with steel trashracks and a 15-foot-wide by 19-foot-high gate; (4) the 19-foot-diameter and 5,109-foot-long tunnel

No. 1; (5) the 48-acre Pit 5 Tunnel Reservoir (also known as the open conduit), with a gross storage capacity of 1,044 acre-feet at elevation 2,040.5 feet NGVD and a useable storage capacity of 645 acre-feet; (6) the Pit 5 Tunnel Reservoir dam, a compacted earth fill embankment structure that is approximately 3,100 feet long and 66 feet high, and includes a reinforced concrete, siphon spillway with six 8-foot-wide by 3.5-foot-high barrels and a separate 30-inch-diameter outlet pipe to drain the reservoir; (7) the 19-foot-diameter Pit 5 tunnel No. 2 consisting of circular and horseshoe-shaped sections with a total length of 23,149 feet; (8) a reinforced concrete surge chamber that varies from 40 to 88 feet in diameter and has a 16-foot-diameter central riser; (9) four penstocks that range from 7.5 to 9 feet in diameter and are 1,380 feet long; (10) a 90-foot by 266.5-foot steel-framed, reinforced concrete, multi-level powerhouse; (11) four generating units, driven by four vertical Francis turbines, each with a normal operating capacity of 40 MW for a total capacity of 160 MW; and (12) appurtenant facilities. The outlet of tunnel No. 1 and the inlet for tunnel No. 2 are located in the bed of the Tunnel Reservoir.

2.1.2 Project Operation

The Pit 3 and 4 units are monitored and controlled from the Pit 3 powerhouse control room, which is staffed 24 hours per day. The Pit 5 units are monitored and controlled from the Pit 5 powerhouse control room, also staffed 24 hours per day. The maximum hydraulic capacity is 3,315 cubic feet per second (cfs) for the Pit 3 development; 3,700 cfs for the Pit 4 development; and 3,580 cfs for the Pit 5 development. The minimum hydraulic capacity and corresponding output per PG&E's December 3, 2002, additional information request (AIR) response for each facility is as follows:

- Pit 3 - 0 MW at 290 cfs,
- Pit 4 - 0 MW at 502 cfs, and
- Pit 5 - 5 MW at 110 cfs.

Although we accept the minimum capacity values provided for the Pit 5 station as reasonable, we believe that PG&E would not release the stated flows through the Pit 3 and Pit 4 powerhouses without getting any generation in return, unless there is substantial leakage through the units. Therefore, for our energy estimates, we calculated an approximate minimum generation output for the Pit 3 and Pit 4 powerhouses of 5.6 MW and 11.7 MW, respectively.

The units are typically operated as peaking facilities. When operating in a peaking mode, the project output varies on an hourly basis from minimum or no load during the off-peak periods, up to the project's maximum outputs during peak demand periods. During mid-peak demand periods, the units are operated near their most efficient loads, depending on inflows. During periods of high flow, when inflow to each development equals or exceeds the hydraulic capacity of the turbines, the units operate at maximum capacity to minimize spill at the dams. For the period 1975 through 1999, the Pit 3, 4 and 5 developments produced an average of 434.9, 563.3, and 950.4 GWh, respectively, for a total annual average output of 1,948.7 GWh.

Water from Lake Britton either passes into the Pit 3 powerhouse intake or the Pit 3 bypassed reach (see figure 1). A minimum flow release of 150 cfs is provided to the bypassed reach though a fixed orifice in one of the low-level sluice gate openings in the Pit 3 dam. When the hydraulic capacity of the Pit 3 powerhouse is reached (3,315 cfs when all three turbines are at full operation), water spills over the crest of the dam into the Pit 3 bypassed reach. The inflatable rubber gates on the dam crest provide some degree of control over the water level of Lake Britton and the amount of water that is spilled as inflow to Lake Britton or flow through the Pit 3 powerhouse changes. Water that passes through the Pit 3 powerhouse and the Pit 3 bypassed reach converges at the upper end of the Pit 4 reservoir. Water in the Pit 4 reservoir either enters the Pit 4 powerhouse intake or the Pit 4 bypassed reach. Minimum flow is provided to the Pit 4 bypassed reach via an automatic valve set to release 15 cfs. When the hydraulic capacity of the Pit 4 powerhouse is reached (3,700 cfs when both turbines are at full operation), water spills over the crest of the Pit 4 dam into the Pit 4 bypassed reach. Water that passes through the Pit 4 powerhouse and the Pit 4 bypassed reach converges at the upper end of the Pit 5 reservoir. Water in the Pit 5 reservoir either enters the Pit 5 powerhouse intake or the Pit 5 bypassed reach. A 30-inch diameter pipe releases a minimum flow of about 100 cfs to the Pit 5 bypassed reach from the Pit 5 dam, which equates to a minimum flow of 120 cfs or greater as measured at the gaging station at Big Bend (which is near the mid-point of the bypassed reach). Water that passes through the powerhouse intake passes through tunnel No. 1 into Tunnel Reservoir, and out of Tunnel Reservoir into tunnel No. 2 before reaching the Pit 5 powerhouse. When the maximum hydraulic capacity of the Pit 5 development is reached (3,580 cfs when all four turbines are at full operation), water spills over the crest of the Pit 5 dam into the Pit 5 bypassed reach. Water from the Pit 5 bypassed reach enters the Pit 6 reservoir (which is not a part of this project) as does flow from the Pit 5 powerhouse and the James B. Black powerhouse (not part of this project).

There are no specific operating criteria for the project. In general, the operational goal of the Pit 3 development is to prevent spills at the end of the spring runoff from stopping and restarting. This goal is achieved by regulating Lake Britton water elevations at the end of the spill period using the three inflatable rubber crest gates on the spillway. As spill declines to a manageable rate via the crest gates, water is also drafted through the Pit 3 powerhouse such that, between spill and draft, the water surface elevation in Lake Britton is lowered. At the lower elevation, the spill is stopped and the amount of inflow in excess of what can be taken by the powerhouse may raise Lake Britton elevation, but not to a point where a new spill is required unless inflow should change due to warm weather during the spring snowmelt or a storm. There are no set guidelines as to what flow would trigger a decision to attempt to end spill. The flow is generally less than 500 cfs in the river before spill control is attempted. Generally, the decision to attempt to control spill is based on operator experience, calculated inflow amounts at the powerhouse, and weather forecasts. Storm spills tend to increase and decrease more rapidly than spring runoff spills.

During non-spill periods, the project is operated daily for peak loads with a cycling of Lake Britton on a weekly basis. The lake is typically drawn down 3 to 6 feet by project generation over the course of the week from a full reservoir level of 2,737.5 feet NGVD, and the lake is refilled during the weekends by reducing project generation. Operation of Lake Britton below elevation 2,724.5 feet NGVD (the minimum allowable level under current license) seldom occurs unless necessary due to public and facility safety or extreme load demands. Lake Britton is kept above this level to minimize the effect on recreational use of the reservoir, to maintain head on the Pit 3 powerhouse, and to enable refill of the reservoir during the off-peak period on the weekend.

The water surface elevations of the Pit 4 and Pit 5 reservoirs fluctuate because they are the forebays for the Pit 4 and Pit 5 powerhouses, respectively. The normal maximum elevation of Pit 4 reservoir is 2,422.5 feet NGVD. The Pit 4 reservoir is not normally drawn down below elevation 2,404.5 feet NGVD. The normal maximum elevation of the Pit 5 reservoir and the Pit 5 Tunnel Reservoir is 2,040.5 feet NGVD. The Pit 5 reservoirs are not normally drawn down below elevation 2,030.5 feet NGVD. There is generally no set pattern to water level fluctuations in the Pit 4, Pit 5, and Tunnel reservoirs, which have limited storage capacity, but fluctuations occur as inflow to the reservoirs, which is governed by flows through the Pit 3 powerhouse and Pit 3 bypassed reach, is balanced with generation capacity and needs at the Pit 4 and 5 powerhouses.

2.1.3 Proposed Environmental Measures

PG&E did not propose extensive environmental measures in its license application because at the time it was filed (October 19, 2001), it was engaged in negotiations with other stakeholders to reach mutually acceptable protection, mitigation, and enhancement measures (PM&Es) for a new license that would be issued for this project. This group of stakeholders, known as the Pit River Collaborative Team (PRCT), was formed in November 1998 and met on a regular basis. PG&E filed with the Commission by letter dated October 29, 2003, a collaborative agreement on proposed PM&E measures pertaining to reservoir operations, minimum streamflows, freshet flow releases, out-of-season spill flows, recreation streamflow releases, ramping rates, and streamflow information (Appendix B). We refer to this as the PRCT agreement in this final EIS and consider it to represent the proposed measures of PG&E and the other signatory parties to the agreement,[2] superceding previous recommendations made by those respective entities.

In addition to measures proposed in the PRCT agreement, PG&E expanded the measures that it proposed to implement by concurring with some recommendations that we made in the draft EIS (by letter to the Commission dated June 19, 2003) and, in the case of operation and maintenance of the Hat Creek fish barrier, by filing its proposed measure with the Commission on December 29, 2003. We consider such updated proposed measures to supercede previously proposed corresponding measures. PG&E currently proposes the following measures to protect and enhance the environmental resources that the project could affect (of these PG&E measures, items 1, 2, 3, 4, 5, 6, and 29 are addressed in the PRCT agreement):

1. Operate the Pit 3, Pit 4, and Pit 5 developments in accordance with the protocols established in the PRCT agreement.

2. Provide minimum flows to each of the three bypassed reaches in accordance with the provisions of the PRCT agreement (see table 27).

3. Measure streamflow as specified in the PRCT agreement.

4. Provide freshet flow releases in accordance with the provisions of the PRCT agreement.

5. Operate the project in a manner that minimizes discretionary, out-of-season spill flows in excess of twice the required minimum flows at the project dams, as specified in the PRCT agreement.

6. Implement ramping rates in accordance with the provisions of the PRCT agreement.

7. Develop and implement a water temperature monitoring plan, including monitoring during months when temperatures could be limiting to aquatic biota and taking spot

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[2] Signatory parties to the PRCT agreement include the following: PG&E; U.S. Department of Agriculture - Forest Service; California Department of Parks & Recreation; Modoc County; Trout Unlimited; American Whitewater; U.S. Fish and Wildlife Service; National Park Service; California Department of Fish & Game; South Fork Irrigation District; California Trout; and Iverson Reservoir. Other parties, such as the State Water Resources Control Board and the Tribe, participated in PRCT negotiations, but for various reasons did not sign the PRCT agreement.

dissolved oxygen (DO) measurement and periodic temperature and DO profiles in Lake Britton near the Pit 3 dam.

8. Develop a dredging plan, should dredging in project waters be needed during the term of a new license (no dredging is currently envisioned).

9. Develop a remediation plan for the Miners Creek spoil pile with measures for slope stabilization, water quality protection, and revegetation.

10. Develop and implement a spoil pile management and maintenance plan for other spoil piles created during project construction.

11. Cooperate with California Department of Fish and Game (CDFG) in maintaining an effective fish barrier located on Hat Creek by providing the following: cost of materials; and archeological investigation, monitoring, and mitigation required for needed maintenance. (CDFG has agreed to be responsible for planning, permitting, and construction.)

12. In the event that it is necessary to replace the Hat Creek barrier dam, PG&E would, at a minimum, provide materials, archaeological review and coordination, and some equipment (up to $1 million). (CDFG has agreed to provide design, planning, environmental review, permitting, and personnel to complete the replacement.)

13. Make available a total of $150,000 during years 1 through 10, $100,000 during years 11 through 20, and $50,000 during years 21 through 30 for implementation of a Hat Creek Wild Trout Management Plan and be an active member of the Hat Creek Technical Advisory Committee (TAC) that would develop and implement this management plan.

14. Develop and implement a fish and invertebrate monitoring plan that is based on the methods used in surveys conducted during the relicensing effort and the current Biological Compliance Monitoring Program (BCMP).

15. Develop a plan for controlling noxious weeds for all project lands.

16. Prepare a revised Interagency Bald Eagle Management Plan (IBEMP) and update every 5 years.

17. Update the 1993 BCMP, implement the monitoring specified in the updated IBEMP, and prepare a comprehensive report at 5-year intervals.

18. Develop and implement a riparian vegetation monitoring plan for the three bypassed reaches to document changes over time and in response to any new instream flow requirements.

19. Prepare a vegetation management plan for all project lands.

20. Include in the vegetation management plan and the final Historic Properties Management Plan (HPMP),[3] as appropriate, provisions identified in the ongoing supplemental ethnographic studies that pertain to identification of ethnobotanical resources

21. Conduct annual surveys of known peregrine falcon nesting territories, and note any project-related activities in the vicinity (within 0.25 miles) of the nest territories and any behavioral responses observed.

22. Consult with a bat expert regarding methods to prevent bats from entering the stairway chamber at the Pit 5 dam and the control room at the Pit 5 gaging station to minimize human/bat interactions.

23. Construct a bat-friendly gate at the Pit 4 tunnel adit that would prevent public access while allowing bats to enter and exit.

24. Consult with the U.S. Forest Service (FS), U.S. Fish and Wildlife Service (FWS), and CDFG.

25. Develop a plan for the protection of valley elderberry longhorn beetle (VELB).

26. Map suitable habitat for northern spotted owl that could be affected by project operations.

27. Develop a comprehensive recreation plan, including site drawings and implementation schedule.

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[3] Throughout much of this proceeding, we, and numerous other parties, have referred to this as a Cultural Resource Management Plan (CRMP). To be consistent with current Commission practice, we now refer to this as an Historic Properties Management Plan (HPMP) throughout the remainder of this final EIS, regardless of what we or other parties may have called it in the past. We consider both naming conventions to be synonymous.

28. Develop a recreation monitoring plan to assess levels of recreation use, need for additional resource protection measures, and need for facility expansion.

29. Develop a plan within 6 months of license issuance for providing annual recreation streamflow releases in the Pit 5 reach suitable for whitewater boating, in accordance with the provisions of the PRCT agreement.

30. Develop an interpretive and education (I&E) plan for Lake Britton and the Pit River Canyon area.

31. Provide streamflow information to the public beginning no later than 1 year from license issuance, in accordance with the provisions of the PRCT agreement.

32. Improve and maintain the car-top boat launch facility near the gasline crossing of Lake Britton, and keep it open from the last Saturday in April through December 31.

33. Close the parking area on the north side of Hat Creek.

34. Evaluate management options for the North Ferry Crossing area, to control environmental problems (i.e., sanitation-related and disturbance of sensitive cultural sites) that are occurring due to the current level of informal use.

35. Seek cooperation with Shasta County regarding the installation of pedestrian warning signs at the Clark Creek Road crossing of the Pit 3 dam.

36. Implement improvements at the Dusty Campground (as recommended in the draft EIS).

37. Implement improvements at the North Shore Campground.

38. Provide measures to enhance the existing Jamo Point boat launch area.

39. Move the "no boating" buoy line at Lake Britton closer to the dam.

40. Explore options to address capacity issues at Lake Britton and assess recreational boating management options to help control potential recreational use conflicts.

41. Develop a day-use access area at the Pit 3 tailrace.

42. Improve and provide adequate parking at Talus Siren and implement trail improvements to enhance access to the bypassed reaches at Powder Spur, Delucci Ridge, Rock Creek, Malinda Gulch, and Oak Flat.

43. Develop spoil pile 4D, near the Pit 4 dam, into a scenic canyon overlook vista.

44. Provide recreation-related improvements at Ruling Creek.

45. Provide whitewater boater put in and take out sites at each of the three bypassed reaches.

46. Consider developing a campground within or adjacent to the project boundary, providing a site can be found that would have no or minimal impact on sensitive resources, does not conflict with neighboring land owners, is compatible with desired recreation experiences, and is project related.

47. Develop a road management and maintenance plan.

48. Develop a fire management and response plan for project lands within 6 months of license issuance.

49. Develop a visual management plan (VMP).

50. Prepare a final HPMP, including site-specific protection measures and provisions for monitoring and patrol.

2.2 Modifications to Applicant's Proposal

2.2.1 Mandatory Conditions

2.2.1.1 Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act (FPA), 16 USC §811, states that the Commission shall require the construction, maintenance, and operation by a licensee of such fishways as the Secretaries of Commerce and the U.S. Department of the Interior (Interior) may prescribe. By letter dated October 9, 2002, Interior reserved its authority to prescribe the construction, operation, and maintenance of such fishways as deemed necessary, including measures to determine, ensure, or improve the effectiveness of such fishways. According to Interior's letter, this reservation includes, but is not limited to, authority to prescribe fishways for any fish species to be managed, enhanced, protected, or restored to the Pit River during the term of the license.

2.2.1.2 Section 4(e) Conditions

Because the project occupies lands of the Shasta National Forest, the FS has authority to impose conditions under Section 4(e) of the FPA. The FS provided preliminary license conditions by letter dated October 9, 2002 (letter from J. Gipsman, Attorney, U.S. Department of Agriculture, Office of General Counsel, Pacific Region, San Francisco, CA, to the Commission, October 9, 2002). The FS provided 27 final Section 4(e) conditions by letter dated November 14, 2003.

Conditions 1 through 14 are standard conditions that would involve obtaining FS approval on final project design and changes, yearly consultation with the FS to ensure the protection and development of natural resources, restrictions and protective measures that should be in place, and project operation and maintenance procedures that would enable continued project operations to be consistent with applicable provisions of the Lassen and Shasta-Trinity National Forests' Land and Resource Management Plans. Conditions 19, 20, 21, 23 (in part), 24, 26 (in part), and 27 pertain to development of plans for use of FS-managed lands (including future dredging, spoil pile, habitat, recreation, fire, road, aesthetic, and cultural resource management). Conditions 17, 18, and 26 (in part) pertain to establishing and publicizing reservoir water levels and flow regimes in project reaches. Conditions 15 and 16 pertain to project specific consultation with the FS regarding FS special status species and the need for emergency erosion and sedimentation control. Conditions 22, 23 (in part), 25, and 26 (in part) pertain to monitoring water quality, plants, fish, wildlife, recreational use, and project lands and facilities to enable appropriate corrective actions to be taken and serve as a basis for adaptive management decisions. We include the complete FS final 4(e) conditions in Appendix C of this EIS.

2.2.2 Staff's Alternative

We recommend additional measures beyond those proposed by PG&E. In most cases, we provide additional details regarding elements not specified by PG&E that we recommend be included in a new license (measures 1, 3, 4, 5, 6, 9,10, 11, 12, 15, 19, 20, 21, 23, 24, 25, 26, 28, and 29). In some cases, we recommend additional measures not proposed by PG&E (measures 2, 7, 8, 13, 14, 16, 17, 18, 22, 27, 30, 31, and 32). We also do not include one PG&E proposed measure, measure 13 (which pertains to funding future management actions at the Hat Creek Wild Trout Management Area), in staff's alternative because we have been unable to establish a nexus to project purposes. Except as noted above, staff's alternative includes PG&E's proposed measures, with the following additional measures:

1. Develop a water temperature and DO monitoring and maintenance plan that includes the following that are not specified in PG&E's proposed measure:

   - the location of stations at which water temperature would be monitored;
   - the time frame during which water temperature would be monitored at each station;
   - the type of instrumentation, frequency of data collection, and calibration procedures that would be used to monitor temperature;
   - temperature conditions that would trigger spot DO measurements at specific stations;
   - potential project operational procedures that could be implemented to maintain project waters at or below 20 degrees Celsius (C) (68 degrees Fahrenheit [F]) and what circumstances would trigger implementation of those procedures;
   - the schedule for installation of temperature monitoring equipment; and
   - procedures that would be followed to report the results of monitoring to the resource agencies and the Commission.

2. Develop and implement an erosion and sedimentation control plan that would cover those sites not addressed in other plans.

3. Develop a single spoil pile management plan that addresses whether or not stabilization measures are warranted at the erosion site across the Pit River from spoil pile 4D and addresses the measures specified by the FS in its final 4(e) condition No. 20.a.

4. Prior to conducting any dredging operation in project waters, develop a plan that includes the following: a description of the need for the proposed dredging; the selected method of dredging, and alternative methods considered; a figure showing the areal extent of the dredging; the estimated volume to be dredged; a description of the substrate to be dredged; a figure showing the proposed dredge spoil disposal site, with a description of measures to prevent erosion and sedimentation; and a schedule for dredging, dredge disposal, and dredge spoil pile stabilization.

5. Develop a stream flow and water level monitoring plan that includes the following that are not specified in PG&E's proposed measure:

- a description of the existing flow and any existing water surface elevation monitoring devices, including location and type of instrumentation;

- installation and/or calibration of a water release system from the Pit 3 dam, which can accurately provide the flow regime specified in the license order;

- the proposed frequency of data downloads, how the data would be accessed during the term of the new license, and the proposed technique and frequency of calibration;

- a detailed description of any structural modifications that would be necessary to accommodate the flow regime (and its measurement) specified in the new license;

- proposed interim measures to comply with required flow releases until structural modifications have been completed;

- identification of the entities responsible for installing, maintaining, and ensuring the continued accuracy of the flow and water surface elevation monitoring devices; and

- reporting frequencies to appropriate agencies and the Commission.

6. Develop a gravel augmentation plan to increase trout spawning habitat in the upper portions of the Pit 3, Pit 4, and Pit 5 bypassed reaches with a total combined annual cost cap of $45,000.

7. Coordinate the proposed fish and invertebrate monitoring plan with the BCMP, gravel augmentation, and the collection of baseline data for potential recreation streamflow releases to the Pit 5 reach, to avoid redundancy.

8. Develop a woody debris transport plan for placement of woody debris from Lake Britton to the Pit 3 bypassed reach and, if feasible, from the Pit 5 reservoir to the Pit 5 bypassed reach, using operational modifications.

9. Develop and implement a vegetation and noxious weed management plan for all project lands that provides for the following that are not specified in PG&E's proposed measure:

- provisions for noxious weed surveys and management on all PG&E project lands, including transmission line and access road rights-of-way and recreational facilities;

- identification of management responsibilities, goals, and objectives;

- definitions of realistic control intensities for each noxious weed that meet management objectives;

- comparisons and evaluations of resource trade-offs of various control methods;

- prioritization of treatment sites;

- presentation of an integrated noxious weed treatment scenario, including plans for long-term monitoring; and details of a plan for action, showing a schedule for implementation, funding requirements, and a mechanism for annual review and revision of the plan to incorporate information collected during monitoring efforts;

- proposed measures for revegetation following noxious weed treatments;

- emphasis on education and other pro-active measures to prevent establishment and spread of weeds;

- emphasis on the use of non-herbicide techniques, and allow for herbicide use, if needed, only at specific sites; and

- incorporation of noxious weed monitoring into other programs PG&E would be implementing, where possible, to maximize the potential for detection and early treatment.

10. PG&E's proposed riparian vegetation monitoring plan should identify measurable riparian habitat parameters, survey protocols and timing, and provisions for reporting, prior to submission to the Commission for approval.

11. Implement measures to exclude bats from the stairwell chamber at the Pit 5 dam and the control room at the Pit 5 gaging station, and provide for annual inspections of structures designed and installed to protect bats.

12. Include in PG&E's bank swallow monitoring plan measures to coordinate bank swallow monitoring with the results of other Lake Britton erosion monitoring that

would occur under our recommended erosion and sedimentation control plan and the final HPMP.

13. Develop and implement plans to monitor neotropical migrant songbirds and terrestrial molluscs that could be affected by changes in riparian habitat as a result of increased flows in the bypassed reaches and other changes to the project.

14. Conduct northern goshawk surveys, if it is determined that project-related construction measures and vegetation management activities would affect potential nesting habitat.

15. Modify the timing of PG&E's proposed peregrine falcon surveys and the survey protocol, as appropriate, to match the guidelines of the federal peregrine monitoring plan (FWS, 2003).

16. Develop a foothill yellow-legged frog monitoring plan that includes provisions for conducting a 4-year study (at a minimum) of breeding site characteristics that includes the following:

   - surveys of foothill yellow-legged frog distribution in the Pit 4 reach throughout the spring and summer to determine presence and life stage development as well as distribution and presence in the Pit 3 and Pit 5 reach;
   - a more thorough search during the spring breeding season to identify population centers and breeding sites and count numbers of clutches found;
   - descriptions of the physical features of all identified frog breeding sites;
   - determination of whether changes in flows result in breeding in newly inundated margins, or use of old sites that are now deeper;
   - assessments of whether the new breeding sites connect with the summer lower flow channel, remain as disconnected off channel water bodies, or dry up entirely;
   - return visits to breeding sites and adjacent low flow areas that may be tadpole rearing habitat to assess survival of tadpoles to metamorphosis;
   - estimates of the number of adults at the onset of breeding at each breeding site;
   - monitoring of the time from egg deposition to hatching;

- monitoring of tadpole numbers and life stage development;

- monitoring of water temperatures annually in March through May;

- an assessment of whether the high tadpole mortality observed in 2002 was due to a water quality factor or predation;

- taking advantage of unplanned spring or summer high flow events, to the extent possible, to determine any correlation between these spill events and changes in tadpole or metamorph numbers from years when these events did not occur;

- taking advantage of the receding spring hydrograph to determine flow vectors at known breeding sites and their changes with flows; and

- reporting procedures for survey and monitoring results.

17. Develop a monitoring plan for western pond turtle.

18. Consult with the FS prior to undertaking any actions that would affect FS sensitive species or their habitat, to determine whether preparation of a Biological Evaluation is necessary.

19. Include in PG&E's proposed protection plan for VELB and its habitat, provisions for ensuring that measures identified in the plan (e.g., flagging and protecting elderberry shrubs with stems over 1 inch in diameter) are consistent with the current FWS guidelines (if the guidelines issued in 1999 are updated).

20. In addition to PG&E's proposal to map suitable habitat for northern spotted owl, identify the process that would be used to determine if field surveys or protection measures might be required; file a plan with the Commission that identifies the area to be mapped and subject to potential survey, the process that would be used to determine when field surveys and assessment of potential protective measures would be needed, and a schedule for submitting maps of suitable northern spotted owl habitat within the defined study area to the Commission.

21. Include local communities, commercial operators, recreational groups, and the Tribe in the consultation process planned for PG&E's proposed IBEMP update; include a mechanism for regular meetings with plan cooperators to identify any changes to the plan that may be needed.

22. Develop a biological monitoring and adaptive management plan that establishes the framework for evaluating the effects of environmental measures on fish and wildlife, as defined by monitoring, including defining the process that would be used to determine whether or not there is a need to adjust measures that may be specified in a new license or implement new measures.

23. Include in PG&E's proposed recreation management plan the following, in addition to those proposed by PG&E:

    - Identification of recreational use management objectives for the project area, specifically for the upper and lower Lake Britton area and the Pit River Canyon reaches, and consider FS Recreation Opportunity Spectrum (ROS) objectives associated with these areas, as appropriate, in developing these objectives.

    - Provision of a summary of the existing project-related facilities, including type, location, owner, and entity responsible for the management of the facilities.

    - Development of recreational-use capacity triggers to help assess the need for future development of additional facilities, such as a new campground or day-use facility at Lake Britton, or a new primitive campground in the Pit River Canyon area.

    - The results of PG&E's proposed assessment of whether a primitive campground can be developed along the Pit 5 bypassed reach.

    - Identification of boating management options, such as charging fees to reduce usage, implementing one-on/one-off policy at boat ramps, or restricting development of additional boat launches.

    - Identification of specific measures to provide new and upgraded existing project-related recreational facilities and trails within the project area.

    - Assessment of the potential effects of the proposed facilities on the project area's sensitive resources, and identification of appropriate site-specific mitigation measures, if needed.

    - Coordination of the development of the plan and facility upgrades and development with the road and facilities management plan, particularly the off-road vehicle (ORV) management component of that plan, the vegetation management plan, the IBEMP, and the HPMP for the project.

- Identification of measures to maintain and manage the existing and new project-related recreational facilities and trails within the project area, including identifying the entity responsible for managing the facility, and recreational site vegetation management measures for the existing and proposed recreational access areas within the project boundary.

- Inclusion in PG&E's proposed recreation management plan the following measures that pertain to Lake Britton beyond those proposed by PG&E (in some instances, the measures are proposed by PG&E, but we provide additional details):

  (a) maintain recreational access and provide improvements at the Hat Creek fish barrier area or at an alternate location downstream of the fish barrier, including exploring measures to provide parking, a car-top boat launch area, and an accessible trail for fishing access to the river; select the location for the provision of these facilities considering potential effects on the areas sensitive resources; continue to provide signage restricting access to sensitive areas to help protect sensitive resource areas; and address in the plan whether public access to this area should be restricted to foot traffic by gating the access road at Highway 299 for the protection of sensitive resources;

  (b) at the North Shore Campground: provisions for the host to provide firewood (either for sale or free of charge) to campground users; install flush toilets and showers; and explore measures to create and maintain beach areas;

  (c) provide additional beach day-use capacity around Lake Britton that would increase the existing capacity by 100 people at one time (PAOT); concentrate on enhancing existing sites or disturbed areas before any new locations are considered; day use areas would include the following: regularly maintained beach sand, if needed; access to the shore designed to minimize erosion; restrooms on site or nearby; access by road or boat; designated parking, if access is by road; trash collection; and regular monitoring by a host or PG&E employee;

  (d) provide 25 percent more public overnight developed camping units over the life of the license (an increase of 39 sites); at least half of the capacity would be added during the first 10 years from license issuance and the balance within 15 years of license issuance; additions to capacity should be within the project boundary or situated to enhance public access to project lands and waters; new capacity would emphasize expansion of existing sites and use areas over the development of new sites and use areas;

(e) establish a reservoir water surface zoning plan that documents existing speed zones and displays recommended changes;

(f) provide personnel at the Jamo Point boat launch area and the Pines picnic area to provide trash removal and maintenance of restrooms during weekends from Labor day through the end of September; assess whether the proposed potable water source at this location should be available on a year-round basis; and

(g) incorporate measures that would ensure that the Pacific Crest Trail (PCT) portion of the trail over Pit 3 dam would remain publicly accessible over the term of the license to the extent that they are consistent with the project license requirements.

- Include in PG&E's proposed recreation management plan the following measures that pertain to the Pit River Canyon beyond those proposed by PG&E (in some instances, the measures are proposed by PG&E, but we provide additional details):

  (a) if the Shasta County ordinance prohibiting boating on the Pit 4 reservoir is modified to allow public use by non-gasoline powered boats, address the most appropriate location for this access;

  (b) provide a day-use access area at the Pit 5 or Tunnel reservoirs;

  (c) proposed upgrades to the Powder Spur, Delucci Ridge, Rock Creek, Malinda Gulch, and Oak Flat trails should be designed to provide signage to designate trails, improve and provide adequate parking at each trailhead, provide trailhead trash receptacles as appropriate, provide sanitation facilities as appropriate, and stabilize soil erosion areas;

  (d) in the design of the proposed spoil pile 4D canyon scenic overlook, include parking areas, pathways, signage, and safety barriers at the edge of the steep slope, as needed; coordinate the design with the spoil pile management plan;

  (e) address the following issues that pertain to dispersed use along the project bypassed reaches: fire prevention, sanitation, parking, unintended expansion of the area influenced by recreational use (site creep), crowding, and length of stay limits; although we expect PG&E to address these issues, we do not necessarily conclude that PG&E should be responsible for solving them, unless there is a clear connection to project purposes;

(f) include in PG&E's proposed improvements at the Ruling Creek dispersed camping area the following: either remove or incorporate into the site design the piles of road debris; realign the access road away from the river; address riverbank erosion associated with the old roadbed; create camping and parking locations; install metal fire rings; and improve pedestrian access to the river; and

(g) development of appropriate whitewater access locations, as proposed by PG&E, including on the Pit 3 reach, improve egress from the river in the vicinity of the powerhouse; on the Pit 4 reach, improve egress from the river in the vicinity of the existing informal take-out at the Pit 4 powerhouse, grade the parking lot, and provide a vault toilet; and on the Pit 5 reach, improve ingress to the river by improving access and providing additional parking in the vicinity of the existing informal put-in near Trailer Road, and at the take-out in the vicinity of the existing informal access just upstream of the Pit 5 powerhouse, grade and gravel the parking area and provide a vault toilet.

- include in PG&E's proposed recreation monitoring plan the following components that are not specified in PG&E's proposed measure:

  (a) identification of measures to provide recreational use data for the year prior to the submittal of the summary report (i.e., every 6 years) by activity and by facility location and information related to boating use with a description of the methodology used to collect the data;

  (b) the process for identification of unforeseen management factors or issues, based on the results of the monitoring, that were not addressed in the original recreation management plan, and measures to address these issues; and

  (c) submittal of a summary report to the Commission every 6 years (coinciding with the FERC Form 80 submittal) to include the recreation monitoring results, documentation of consultation, and a summary of any planned recreational facility improvement measures or resources protection mitigation measures associated with the recreational facilities, including schedule, party responsible for funding and implementing the measures, estimated costs for implementation, and entity responsible for the long-term maintenance and management of the planned recreational facilities or mitigation measures.

24. Include in PG&E's proposed I&E plan, in addition to those proposed by PG&E, the specific measures to provide interpretive materials (e.g., brochures and signage, as appropriate), to educate the public about the topics proposed by PG&E (specified

under item 27 of PG&E's proposed measures), in addition to public safety information, such as safe boating and angling practices on project waters.

25. Include in PG&E's proposed plan for providing recreation streamflow releases to the Pit 5 reach suitable for whitewater boating a decision point, where the results of baseline monitoring would be assessed by the consulted parties and a final recommendation, with the basis for the recommendation, made to the Commission regarding whether or not scheduled recreation streamflow releases should be implemented.

26. Include in PG&E's proposed road management and maintenance plan the following that are not specified in PG&E's proposed measure:

- An inventory and map of existing road segments and parking areas within the project boundary, both FS classified and unclassified, including: the purpose of each road and parking areas, relative to project purposes; season of operation; designated FS Road Management Objectives (RMO) (if applicable); drainage crossings or bridges and culverts and verification of ability to pass water and debris during a 100-year storm event; location of road watering sources; and disposal sites for surplus material such as rocks, brush, and spoil piles; this inventory would serve to identify those roads that serve project purposes and thus should be the responsibility of PG&E to ensure that they are maintained in a manner consistent with current criteria and consistent with the FS RMOs.

- A road rehabilitation schedule to bring existing project-related roads and associated facilities (i.e., culverts, gates, bridges, crossings, cribwalls) into compliance with applicable standards that achieve the FS's designated RMOs (for roads on National Forest System Lands).

- Specification of applicable limited operating periods for road rehabilitation and maintenance that would protect sensitive species of wildlife.

- Measures to address existing road and parking area rehabilitation needs to bring existing project roads up to current public safety levels. General road rehabilitation needs would include items such as gates and signage for road closures; measures to prevent introduction of noxious weeds at constructions sites, implementation of the FS's *Best Management Practices*; bridge inspections; installation of vehicle control measures to protect against erosion; and regular maintenance of roadways including replacing faded signs, clearing vegetation to provide adequate sight distances, and repairing or replacing damaged culverts.

- Measures to discourage user-created roads including grading and adding red cinder to limit rutting and muddiness; revegetating and bouldering ORV-created roads; consultation to determine which roads should be closed; and developing an ORV management plan to protect sensitive cultural and terrestrial resources. The ORV management plan would include identifying resource damaged areas, rehabilitation needs for damaged areas, time frames for seasonal road closures, and restrictions to protect bald eagles, cultural resources, and sensitive habitats. The ORV management plan would also include measures to address access roads near the Hat Creek fish barrier dam to assess the need for vehicular access roads and ways to balance access with protection of sensitive areas. Development of the ORV management plan would be coordinated with the implementation of the project's HPMP.

- Where dust from project roads has been identified as a problem (e.g., Hagan Flat Road from Tunnel Reservoir to the Pit 5 dam), address dust control measures that are proposed for implementation.

- An implementation plan and schedule, and estimated costs for road rehabilitation and ORV management measures.

- Measures to monitor future use and condition of the project area road segments and parking areas, and conduct future road and parking area rehabilitation measures, as necessary.

- Measures to monitor and address landslide and soil erosion activity related to project roads and parking areas within the project area.

- A description of the types of materials allowed to be disposed of in spoil piles and how organic materials would be treated.

- A water quality monitoring plan that includes runoff management.

- A traffic safety plan.

- An adaptive management component to allow changes to the plan should use or applicable standards necessitate.

- Provisions to submit a summary report to the Commission every 6 years to include the road survey results, documentation of consultation, and a summary of planned road segment and parking area rehabilitation measures.

27. Develop a plan for providing a full time patrol of the project for purposes of resource protection that provides for routine and regular physical inspections of affected lands, project facilities, and structures including implemented protection, mitigation, and enhancement measures and the provisions of the HPMP. The plan would also include a description of reporting responsibilities, including observed violations of laws, and communications with law enforcement agencies as well as required documentation of inspections.

28. Include in PG&E's proposed fire management and response plan the following which are not specified in PG&E's proposed measure: (1) how fire danger and public safety associated with project induced recreation would be addressed; (2) an analysis of fire prevention needs including equipment and personnel availability and fire patrols; (3) a list of the location of available fire prevention equipment and the location and availability of fire prevention personnel; (4) provisions for reporting any project related fires to the FS as soon as practicable; (5) how fire control and extinguishing would be addressed; and (6) how PG&E would ensure that fire prevention measures would meet water quality best management practices (BMPs).

29. Address in PG&E's proposed VMP practical methods that could be implemented for removal of project-related debris from project waters.

30. Develop a signage plan that specifies the location, design, size, color, and message for the following types of signs: information and education; fire prevention; regulatory and warning; project license; road; recreation; directional; and safety; address maintenance standards, so that all signs are maintained in a neat and presentable condition, and sign format is consistent throughout the project.

31. Develop a land and habitat management plan (LHMP) for project lands, that includes previously described plans to facilitate cross-referencing the many inter-related component plans and help ensure that management of project resources is coordinated throughout the term of the license. The LHMP would include the following:

- overview and discussion of general land management measures within the project area (this section would include a discussion of key land management objectives, and a description of how coordination of the various components of the LHMP would be accomplished);

- erosion and sedimentation control plan;

- spoil pile management plan;
- biological monitoring and adaptive management plan that includes the following components: the fish and invertebrate monitoring plan; foothill yellow-legged frog monitoring plan; western pond turtle monitoring plan; IBEMP; BCMP; wildlife management plan (which specifies monitoring and mitigation to protect sensitive wildlife species proposed and recommended elsewhere); and vegetation and noxious weed management plan;
- HPMP (portions that do not include sensitive materials);
- recreation management plan;
- project patrol plan;
- road and facilities management plan;
- sign plan;
- fire management and response plan; and
- VMP.

32. Modify the project boundary to include the following project-related features that are currently partially not within the existing project boundary:

- The access road from State Highway 299 to the gasline parking area and car-top boat launch at Lake Britton;
- A single access road from State Highway 299 to the south side of the Hat Creek barrier dam, and any recommended facility at this location that may not be in the existing project boundary.
- Any portion of Dusty Campground not within the existing project boundary.
- Any portion of the access road to Jamo Point boat launch area and the Pines picnic area, and the facilities themselves, that are not within the existing project boundary.
- Any portion of the access road to the North Shore Campground that is not within the existing project boundary.

- That portion of the Powder Spur, Delucci Ridge, Rock Creek, Malinda Gulch, and Oak Creek trails, and associated parking areas, from the road to the waters edge.
- The portion of the Pit 3 surge tank road not within the existing project boundary.
- Any portion of River Road not in the existing project boundary.
- The spoil pile 4D road and the area proposed for development as a canyon scenic overlook.
- The Ruling Creek dispersed camping area (with sufficient land to accommodate proposed new enhancements).
- The access road to the Pit 4 gaging station and the station itself.
- The land on which all functional portions of the Pit 5 gaging station lies.
- The proposed whitewater boater put-in site for the Pit 5 reach at the Trailer dispersed use area, including the access road and parking facilities.
- Any portion of the Miners Creek spoil pile not in the existing project boundary.
- Extend the project boundary at the Bush Bar site to the waters edge, to include the proposed whitewater boater take-out site.
- Any recommended recreational facility that has not yet been designed should be within the existing project boundary, or the boundary modified to include the functional elements of the facility.

2.3 Project Decommissioning

The only party that requested that we assess decommissioning during scoping for this project was the Pit River Tribe (Tribe) (letter from S.J. Dolan, Staff Attorney, California Indian Legal Services (representing the Tribe), Eureka, California, to the Commission, dated June 19, 2002). The context of this request was that decommissioning the project would better enable restoration of anadromous fish runs to project waters. We conclude that the most likely decommissioning approach that would facilitate reintroduction of anadromous fish would be if all project dams are removed. Consequently, we assess project decommissioning with all project structures left in place except the dams, to the extent that information is available to address each of the resource issues identified for analysis.

2.4 No-action Alternative

Under the No-action Alternative, the project would continue to operate under the terms and conditions of the existing license, and no environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative as the baseline environmental condition for comparison with other alternatives.

2.5 Alternatives Considered but Eliminated from Detailed Study

We also considered other alternatives to PG&E's proposal, but eliminated them from detailed study because they are not reasonable in the circumstances of this case.

2.5.1 Federal Government Takeover

We do not consider federal takeover to be a reasonable alternative. Federal takeover of the Pit 3, 4, 5 Project would require Congressional approval. Although that fact alone would not preclude further consideration of this alternative, there is currently no evidence showing that a federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed an interest in operating the Pit 3, 4, 5 Project.

2.5.2 Nonpower License

A nonpower license is a temporary license the Commission would terminate whenever it determines that another governmental agency is authorized and willing to assume regulatory authority and supervision over the lands and facilities covered by the nonpower license. At this time, no government agency has suggested a willingness or ability to takeover the project. No party has sought a nonpower license, and we have no basis for concluding that the Pit 3, 4, 5 Project should no longer produce power. Thus, we do not consider a nonpower license to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the Pit 3, 4, 5 Project. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions—and then the environmental effects of the proposed project, including proposed enhancement measures. Unless otherwise stated, the source of our information is the license application (PG&E, 2001). Our recommendations pertaining to each affected environmental resource may be found in section 5.2, *Comprehensive Development and Recommended Alternative*.

3.1 General Description of the Pit River Basin

The Pit River Basin, in northeastern California, covers an area of 4,900 square miles. The basin is part of the much larger Sacramento River Basin. The 384-mile-long Sacramento River drains the north central part of California. The watershed includes the eastern slopes of the Coast Ranges, Mount Shasta, and the western slopes of the southernmost region of the Cascades and the northern section of the Sierra Nevada. The Sacramento River is California's largest river and carries approximately 31 percent of the state's total runoff.

Variations in terrain and elevation in the project vicinity result in variable precipitation. In general, precipitation is higher in the mountainous project vicinity compared with upstream areas of the watershed, not within the project area, such as the Modoc Plateau, near Alturas, in Modoc County. The yearly precipitation averages under 18 inches in most of the plateau area, and about 34 inches in higher terrain such as the Warner Mountains, which form the eastern drainage divide of the watershed. Yearly precipitation is highest in the western areas of the watershed but is highly variable due to varying topography and exposure. In the immediate project area, the Pit 5 powerhouse averages 75 inches per year, which is one of the highest totals in this area of California other than monitoring stations in the Coastal Range. The majority of the area in the western section of the watershed averages between 30 and 50 inches per year. The most precipitation falls between October and May as storms move eastward from the Pacific Ocean. A substantial amount of this precipitation, especially during the winter and at higher elevations, falls as snow. Consumptive use of surface and groundwater is much higher in the eastern, more arid region of the watershed than in the immediate project vicinity.

The Pit 3, 4, 5 Project is located on the Pit River, which flows into Shasta Lake, a major water storage reservoir for the U.S. Bureau of Reclamation's (Reclamation's) Central

Valley Project. In addition to the Pit 3, 4, 5 Project, PG&E owns and operates other projects within the Pit River and Hat Creek basins: Pit 1 Project (FERC No. 2687); Hat Creek Project (FERC No. 2661); and James B. Black, Pit 6, and Pit 7 developments (FERC No. 2106). Pit 1 is located upstream of the Pit 3, 4, 5 Project and upstream of Hat Creek. Pit 6 and 7 are located downstream of Pit 5 and upstream of Shasta Lake. The James B. Black powerhouse, whose source is the Iron Canyon reservoir, is located along the Pit River, just upstream, but is not a factor in the operation, of the Pit 5 powerhouse.

3.2 Scope of Cumulative Impact Analysis

According to the Council on Environmental Quality's Regulations for implementing the National Environmental Policy Act (40 CFR §1508.7), an action may cause cumulative effects on the environment if its effects overlap in space and/or time with effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities. At this time, we have identified water quantity, rainbow trout, and bald eagles as resources that could be cumulatively affected by relicensing the Pit 3, 4, 5 Project.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary.

For water quantity, our geographic scope includes the Pit River from the project upstream through Modoc County. Upstream consumptive water users with water rights junior to those of PG&E could be adversely affected by alternative flow regimes that are included in any new license issued for this project. We address this cumulative effect in our discussion of water use in section 3.3.1, *Water Resources*.

For rainbow trout, our geographical scope includes the Pit River from Pit Falls, on the Pit 1 Project bypassed reach, to and including the Pit 6 reservoir and the Hat Creek Wild Trout Management area, which extends from the vicinity of the Hat Creek 2 powerhouse to the fish exclusion dam adjacent to Lake Britton. Rainbow trout residing in Lake Britton may move upstream into the Pit River as far as Pit Falls to spawn. Therefore, proposed actions that affect rainbow trout in Lake Britton could cumulatively influence rainbow trout. Similarly, rainbow trout that reside in the Pit 6 reservoir may move upstream of this reservoir into the Pit 5 bypassed reach. Changes in the Pit 5 bypassed reach flow regime could therefore cumulatively influence rainbow trout in the Pit 6 reservoir. The CDFG's management strategies for the Hat Creek Wild Trout Management Area would cumulatively influence the disposition of the fish exclusion barrier and whether measures should be taken to either prevent rainbow trout from moving downstream of the fish exclusion dam or allow rainbow trout to move upstream of the fish exclusion dam after they have entered Lake Britton.

For bald eagles, we chose the Pit River from Pit Falls to and including the Pit 6 reservoir because bald eagles that either nest or winter near the project are known to forage in these areas. Therefore, factors that influence the availability of prey (which is mostly the Sacramento pikeminnow, Sacramento sucker, hardhead, and other fish) throughout this geographical area may also influence bald eagles. Changes in the populations of preferred prey and in the amount of foraging habitat, as well as potential changes in the amount of human disturbance associated with recreational use of project lands and waters, could affect prey availability.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the EIS includes past, present, and future actions and their possible cumulative effects on each resource. Based on the license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource.

3.3 Proposed Action and Action Alternatives

This section outlines the proposed action and action alternatives with regard to: (1) water resources, (2) aquatic resources, (3) terrestrial resources, (4) threatened and endangered species, (5) recreational resources, (6) land use and aesthetic resources, and (7) cultural resources.

3.3.1 Water Resources

3.3.1.1 Affected environment:

Water Quantity

The Pit River is formed by the confluence of the North and South Forks near the town of Alturas in Modoc Count, approximately 140 miles upstream of the Pit 5 powerhouse. The Warner Mountains, with elevations between 5,000 and 10,000 feet in extreme northeastern California, are the headwaters for both the North and South Forks. Major tributaries of the Pit River include Fall River, Ash Creek, Hat Creek, Burney Creek, and Horse Creek. Shasta Lake on the Sacramento River extends upstream to approximately 15 miles downstream of the Pit 5 powerhouse.

Several reservoirs exist in the watershed upstream of the Pit 3, 4, 5 Project area. The storage capabilities of the project's reservoirs are too small to provide any effective flood control. There are no direct irrigation diversions within the project area. However, the Pit River waters, after passing through the project powerhouses, flow into Shasta Lake for subsequent release for additional beneficial uses, including downstream irrigation. Upstream, during periods of high runoff, outflow from Goose Lake reaches the North Fork; however, during many times of the year, this flow is lost due to irrigation withdrawals and other uses. Other upstream reservoirs, such as the Big Sage, West Valley, and Antelope Flat, were constructed mostly for irrigation supply in the Alturas area.

The average Pit River flow in the project area is about 3,000 cfs (table 3). Peak flows occur in the winter and spring and can exceed 10,000 cfs. Flow duration data for locations throughout the project area are shown in table 4. Summer flows, which average about 2,000 cfs per year, are relatively consistent because of a high percentage of flow originating from groundwater sources. We estimate that the mean annual flow at Lake Britton is 2,944 cfs (2,129,000 acre-feet per year).

Table 3. Summary of average flows in the project area for the period of record from 1975 through 2001. (Source: USGS, 2002a, as modified by staff)

Location	Drainage area (square miles)	Mean annual flow (acre-feet x 1,000)	Mean annual flow (cfs)
Lake Britton[a]	4,606	2,129	2,944
Pit 3 powerhouse[b]	4,606	1,644	2,273
Pit 4 powerhouse[c]	4,648	1,799	2,487
Pit 5 powerhouse[d]	4,673	1,964	2,716
Below Pit 4 dam[e]	4,648	350	484
Pit River at Big Bend[f]	4,710	409	566

[a] Combination of U.S. Geological Survey (USGS) gage nos. 11362600 and 11362500 and adjusted for drainage area differences.
[b] USGS gage no. 11362300 Pit 3 powerhouse near Burney, CA.
[c] USGS gage no. 11362600 Pit 4 powerhouse near Burney, CA.
[d] USGS gage no. 11362700 Pit 5 powerhouse near Big Bend, CA.
[e] USGS gage no. 11362500 below Pit 4 dam.
[f] USGS gage no. 11363000 at Big Bend, CA.

Table 4. Flow duration statistics for gaging stations within the project area, water years 1975 through 2001. (Source: USGS, 2002a)

	Flow (cfs)					
Exceedance (%)	Lake Britton[a]	Pit 3 power-house[b]	Pit 4 power-house[c]	Pit 5 power-house[d]	Below Pit 4 dam[e]	Pit River at Big Bend[f]
5	5,956	3,360	4,060	4,060	2,150	2,630
10	4,705	3,320	3,830	4,000	999	1,330
15	3,865	3,250	3,600	3,910	265	546
20	3,598	2,970	3,470	3,820	188	243
25	3,455	2,880	3,290	3,610	177	195
30	3,162	2,830	2,980	3,260	172	178
35	2,931	2,670	2,760	3,020	169	167
40	2,778	2,530	2,620	2,870	167	157
45	2,668	2,430	2,520	2,780	164	151
50	2,572	2,350	2,420	2,670	162	147
55	2,489	2,250	2,340	2,570	161	143
60	2,403	2,144	2,250	2,480	160	139
65	2,303	2,050	2,140	2,390	158	135
70	2,199	1,940	2,040	2,270	153	130
75	2,091	1,820	1,940	2,150	149	123
80	1,953	1,700	1,810	2,020	114	115
85	1,715	1,480	1,560	1,790	93	109
90	1,335	1,130	1,180	1,420	65	94
95	835	633	679	1,000	54	66

[a] Combination of USGS gage nos. 11362600 and 11362500 adjusted for drainage area.
[b] USGS gage no. 11362300 Pit 3 powerhouse near Burney, CA.
[c] USGS gage no. 11362600 Pit 4 powerhouse near Burney, CA.
[d] USGS gage no. 11362700 Pit 5 powerhouse near Big Bend, CA.
[e] USGS gage no. 11362500 below Pit 4 dam.
[f] USGS gage no. 11363000 at Big Bend, CA.

In addition to the Pit River, Lake Britton receives inflow from Hat Creek, a major tributary with an average inflow rate of 480 to 500 cfs (FERC, 2001) and Burney Creek with an average inflow of 150 to 200 cfs, according to PG&E flow studies. Other minor tributaries collectively contribute an average inflow of 54 cfs from June through September. Table 5 shows monthly inflow to Lake Britton and at other locations within the project area. Typical Lake Britton drawdown due to peaking operations is 3 to 6 feet per week. The typical retention time for Lake Britton is approximately 10 days during average July and August flows and approximately 4.5 days during March.

Table 5. Monthly discharge (cfs) statistics in the project area, water years 1975 through 2001. (Source: USGS, 2002a)

	October	November	December	January	February	March	April	May	June	July	August	September
Lake Britton[a]												
Mean	2,276	2,540	2,757	3,382	4,080	4,633	3,702	3,328	2,543	2,067	2,001	2,098
Median	2,354	2,565	2,764	3,175	3,681	4,521	3,725	3,374	2,734	2,298	2,249	2,208
Max.	3,217	3,641	4,526	6,151	7,285	7,036	5,116	4,757	3547	3,062	2,981	3,018
Min.	902	1,163	1,156	1,407	1,938	2,831	2,195	1,740	975	507	608	648
10% exceed.	2,874	3,241	3,694	5,295	6,200	6,207	4,564	4,341	3,225	2,740	2,642	2,750
90% exceed.	1,565	1,768	1,713	1,916	2,459	3,346	2,811	2,315	1,511	1,000	987	1,290
Pit 3 powerhouse[b]												
Mean	2,053	2,183	2,280	2,465	2,668	2,885	2,622	2,475	2,165	1,842	1,788	1,882
Median	2,136	2,265	2,402	2,646	2,777	2,956	2,750	2,580	2,355	2,071	2,026	2,001
Max.	2,898	2,904	3,005	3,111	3,212	3,222	3,133	3,106	2,956	2,742	2,789	2,732
Min.	745	964	951	1,180	1,544	2,161	1,476	1,346	691	322	442	487
10% exceed.	2,610	2,673	2,811	2,957	3,060	3,146	2,971	2,922	2,733	2,484	2,379	2,487
90% exceed.	1,395	1,521	1,479	1,667	2,085	2,532	2,071	1,867	1,253	817	825	1,135

	October	November	December	January	February	March	April	May	June	July	August	September
Pit 4 powerhouse[c]												
Mean	2,147	2,331	2,463	2,744	3,009	3,348	3,040	2,792	2,290	1,920	1,845	1,952
Median	2,216	2,387	2,585	2,908	3,114	3,429	3,125	2,892	2,508	2,159	2,089	2,065
Max.	3,109	3,228	3,436	3,585	3,863	3,951	3,741	3,620	3,193	2,899	2,851	2,884
Min.	771	1,023	1,023	1,245	1,761	2,275	1,841	1,540	752	346	450	488
10% exceed.	2,762	2,910	3,116	3,354	3,554	3,755	3,483	3,353	2,935	2,602	2,499	2,613
90% exceed.	1,439	1,610	1,569	1,807	2,160	2,829	2,425	2,096	1,285	843	838	1,136
Pit 5 powerhouse[d]												
Mean	2,339	2,566	2,728	2,979	3,217	3,553	3,270	3,018	2,569	2,154	2,066	2,161
Median	2,413	2,659	2,852	3,201	3,379	3,591	3,378	3,123	2,751	2,378	2,298	2,266
Max.	3,367	3,439	3,565	3,761	3,932	3,959	3,818	3,754	3,467	3,137	3,120	3,127
Min.	914	1,253	1,215	1,457	1,886	2,786	2,159	1,789	1,024	567	616	651
10% exceed.	2,902	3,092	3,326	3,570	3,735	3,877	3,633	3,527	3,193	2,826	2,729	2,840
90% exceed.	1,645	1,861	1,901	2,054	2,429	3,181	2,712	2,367	1,645	1,103	1,090	1,309

	October	November	December	January	February	March	April	May	June	July	August	September
Pit River below Pit 4 dam[e]												
Mean	150	232	319	669	1,108	1,328	695	565	275	165	175	164
Median	138	146	190	269	577	1,133	601	495	256	165	164	164
Max.	218	659	1345	2719	3,733	3,518	1,648	1,296	480	220	240	178
Min.	133	122	109	108	133	303	233	181	158	147	151	154
10% exceed.	171	442	744	2,040	2,812	2,638	1,266	1,055	400	169	231	169
90% exceed.	135	124	110	110	152	400	320	215	166	151	158	159
Pit River at Big Bend[f]												
Mean	148	224	369	826	1,341	1,640	867	705	286	140	147	139
Median	132	150	208	345	749	1,423	765	612	290	140	134	132
Max.	325	624	1546	3266	4,333	4,045	1,849	1,584	469	156	225	268
Min.	123	110	107	124	197	422	376	221	144	126	122	123
10% exceed.	176	435	830	2,496	3,147	3,187	1,456	1,338	382	149	208	147
90% exceed.	126	114	134	132	252	586	484	272	179	131	126	126

[a] Combination of USGS gage nos. 11362600 and 11362500 adjusted for drainage area differences.
[b] USGS gage no. 11362300 Pit 3 powerhouse near Bumey, CA.
[c] USGS gage no. 11362600 Pit 4 powerhouse near Bumey, CA.
[d] USGS gage no. 11362700 Pit 5 powerhouse near Big Bend, CA.
[e] USGS gage no. 11362500 below Pit 4 dam.
[f] USGS gage no. 11363000 at Big Bend, CA.

The majority of inflow to the Pit 4 reservoir, which has a retention time of 0.2 to 0.3 day, is from either the Pit 3 powerhouse or spillage and flow released from the Pit 3 dam. The Pit 3 bypassed reach currently has a minimum flow requirement of 150 cfs. Rock Creek is a major tributary to the Pit 3 bypassed reach. Its estimated average flow from June through September is approximately 9 cfs. Most of the Pit 3 reach is relatively straight and narrow with complex and irregular channel configuration and boulders. Accretion in the upper reach between the Pit 3 dam and Rock Creek was estimated to be 20 cfs during June through September 1999 and 37 cfs during June through September 2000. Accretion in the lower reach between Rock Creek and the Pit 3 powerhouse tailrace was estimated to be 45 cfs during June through September 1999 and 21 cfs during June through September 2000. The average flow in the downstream section of the Pit 3 reach averaged 231 cfs from June through September 1999 and 224 cfs from June through September 2000.

The majority of the flow reaching the Pit 5 reservoir comes from flow released from the Pit 4 powerhouse. The Pit 4 bypassed reach currently receives a minimum flow of 150 cfs from the Pit 4 dam. This reach is characterized by meanders and a well-defined channel with relatively long narrow pools and runs separated by riffles. According to USGS gage no. 11362500, average flow in the Pit 4 bypassed reach is 487 cfs, with an average flow of 168 cfs from July through the end of September (see table 5). Two tributaries enter the Pit 4 reach–Canyon Creek is approximately 3.2 miles downstream of Pit 4 dam, and Deep Creek is approximately 2.1 miles farther downstream. Based on a temporary flow monitoring station installed from August through September 1999 and from June through September 2000, flow in Canyon Creek averaged 6.7 cfs during 1999 and 6.8 cfs during 2000. Accretion flows in the upper section of this reach averaged 15 cfs in during June through September 1999 and 13 cfs during June through September 2000. Flows in Deep Creek averaged 12.2 cfs during June through September 1999 and 13.7 cfs during June through September 2000. Accretion in the lower section of this reach averaged 14 cfs during June through September 1999. PG&E did not report accretion estimates for June through September 2000 because measurements were judged to be unreliable. The average flow within the downstream section of Pit 4 reach was 234 cfs in during June through September 1999 and 233 cfs during June through September 2000.

The Pit 5 bypassed reach receives most of its water from releases from the Pit 5 dam. Although the minimum inflow is 100 cfs, this minimum is adjusted when necessary to maintain at least 120 cfs as measured at Big Bend, downstream of Nelson Creek. The Pit 5 bypassed reach is characterized by large amplitude meanders upstream of Big Bend with longer meanders and relatively straight sections downstream. Two main tributaries enter the Pit 5 bypassed reach: Nelson Creek about 3.7 miles downstream of Pit 5 dam and Kosk Creek about 1.8 miles downstream of the confluence of Nelson Creek. Based on a temporary flow monitoring station installed from August through September 1999 and June through September 2000, flow in Nelson Creek averaged 28.9 cfs for 1999 and 26.6 cfs for

2000. Flows in Kosk Creek averaged 56.6 cfs during June through September 1999 and 59.4 cfs during June through September 2000. The accretion flows in the lower portion of Pit 5 reach (between Kosk Creek and the James B. Black powerhouse tailrace) averaged 9 cfs during the July through September 1999 period and 29 cfs during the June through September 2000 period. The average flow within the upstream (Pit 5 dam to Nelson Creek) section of the Pit 5 reach was 129 cfs during June through September 1999 and 136 cfs during June through September 2000. The USGS gage, which is located 0.2 mile downstream of Nelson Creek, measured an average flow of 155 cfs during PG&E's 1999 monitoring period and 176 cfs during PG&E's 2000 monitoring period, suggesting that PG&E's temporary gage data for the Pit 5 bypassed reach are reasonable. Flow in the lower section of the Pit 5 reach averaged 232 cfs during June through September 1999 and 269 cfs during June through September 2000. According to USGS gage no. 11363000 at Big Bend just downstream of the confluence with Nelson Creek, the Pit River has an average yearly flow of 569 cfs and an average flow of 142 cfs for the July to the end of September period (see table 5).

Precipitation for 5 stations within the watershed amounted to 100 percent of normal in the 1999 water year and 105 percent of normal in the 2000 water year. Therefore, flows measured during PG&E's 1999 and 2000 monitoring program are likely to be representative of average conditions at the Pit 3, 4, 5 Project, although temporal variations in measured flow compared to average conditions may exist.

Water Use

Currently, over 1,400 separate water rights are on file with the State Water Resources Control Board (SWRCB) for the Pit River and its tributaries upstream of Lake Britton, with an estimated total storage capability of over 140,000 acre-feet. The majority of this water is used to support agricultural production. PG&E claims a direct diversion right of 3,000 cfs with a priority date of July 2, 1920, and a riparian right by virtue of its FERC license for flows up to the capacity of the Pit 3 powerhouse (i.e., 3,315 cfs). PG&E has contended that the diversion rights of certain upstream users, junior to PG&E's own water rights, are exercised in such a way as to adversely affect its hydropower operations.[4]

[4] PG&E had filed a complaint (subsequently withdrawn) with the SWRCB against SFID concerning this matter. For its part, SFID contends that the associated benefits to the Modoc County agricultural community in terms of irrigation water outweigh the associated costs to PG&E in terms of lost generation and that any reduction in its ability to divert and store water would have a substantial socioeconomic influence (letter from D.H. Clarke and P.C. Kissel, SFID Attorneys and Modoc County, Law Offices of GKRSE, Washington, DC, and A.B. Lilly, Attorney for SFID and Modoc County, Bartkiewicz, Kronick & Shanahan, Sacramento, CA, to the Commission dated June 7, 2002).

With respect to upstream diversions, it is important to distinguish here between (1) direct diversions to irrigation, which occur during the summer growing and irrigation season; and (2) diversions to storage (for later irrigation use), which generally occur instead during the non-irrigation seasons of fall, winter, and spring. During the summer period of direct diversions, the waters of the upper Pit River and its tributaries are so heavily used by irrigation interests that, in most years, flow is reduced to an insignificant level, and PG&E has no expectation of utilizing water from the upper Pit River for generation. Most flow reaching Lake Britton during the summer months comes from a combination of groundwater and tributary sources entering the Pit River downstream of the heavily diverted upper Pit River.

Diversions to storage, on the other hand, generally occur when the agricultural interests do not have any need for direct diversions. Thus, at this time (i.e., late fall, winter, and spring), direct diversions from the Pit River and its tributaries are minimal. Consequently, any diversions to storage during this period (when flow from the upper Pit River represents a substantial portion of inflow to the project) translate directly to a decrease in flows throughout the Pit system. PG&E has stated that these storage diversions deprive it of water it could use at Lake Britton (Pit 3 powerhouse), unless they are made during times of high flow when PG&E's rights are fully satisfied.

A comment letter was submitted by Denny Land and Cattle Company, LLC (Denny) regarding its diversion rights, which are junior to PG&E's water rights (letter from Paul S. Simmons, Attorney for Denny Land and Cattle Company, LLC, Sacramento, CA, to the Commission and Jack Gipsman, U.S. Department of Agriculture, dated December 19, 2002). Denny has the right to divert up to 6,400 acre-feet annually from Goose Creek, tributary to Burney Creek, tributary to Pit River. The diversions can occur from about November 1 to about April 1, and the water is stored in Lake Margaret to provide irrigation for more than 3,400 acres at Goose Valley Ranch, as well as stock water and other uses. Denny's permit further specifies that the diversions to storage can be made "only at such times when water is spilling from Lake Britton (or the elevation of water in Lake Britton is above 2,753 feet [PG&E datum] and rising in elevation) while Pit 3 powerhouse is operating at maximum capacity."

Water Quality

The existing beneficial uses within the Pit River, as determined by the *Central Valley Regional Water Quality Control Board Basin Plan*, 4th Edition, (CVRWQCB, 1998) are municipal and domestic supply, irrigation, stock watering, contact and non-contact recreation, power production, warm and cold freshwater habitat, spawning, and wildlife use. Table 6 shows state standards/objectives for temperature, DO, pH, coliform bacteria, and selected metals and physical parameters. There are no numerical or narrative criteria for nutrients.

Table 6. Applicable water quality criteria for Pit 3, 4, 5 Project waters. (Source: CVRWQCB, 1998)

Parameter	Objective/standard
Temperature	Natural water temperatures of basin waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration does not affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: 0–5 nephelometric turbidity units (NTUs) not to exceed 1 NTU, 0–50 NTU increases not to exceed 20%, 50–100 NTU not to exceed 10 NTU, >100 NTU not to exceed 10%.
Dissolved oxygen	DO concentrations shall not be reduced below the following minimum levels at any time: waters designated WARM—5.0 milligrams per liter (mg/l); waters designated COLD & SPWN—7.0 mg/l; monthly median of mean daily saturation—Not less than 85%; and early life stage intergravel—95th percentile saturation not less than 95%.
pH	The pH shall not be depressed below 6.5 or raised above 8.5 nor changed at any time more than 0.5 from the normal ambient pH levels.
Settleable solids	Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.
Fecal coliform bacteria	This criterion is for protection of bathing waters. Based on a minimum of not less than five samples taken over a 30-day period, the fecal coliform bacterial density shall not exceed a geometric mean of 200 most probable number (MPN)/100 milliliters (ml), nor should more than 10% of the total samples taken during any 30-day period exceed 400 MPN/100 ml.
Cadmium[a]	0.0003 mg/l
Copper[a]	0.01 mg/l
Zinc[a]	0.02 mg/l

[a] Cadmium, copper, and zinc criteria are dependent on hardness. Listed criteria were calculated based on a typical hardness of 55 mg/l CaO_3. The criteria for these three metals is based on dissolved metals, rather than total metals.

Water in the Pit River in the vicinity of the Pit 3, 4, 5 Project is soft with moderate alkalinity, and slightly basic, with pH ranging from 7.2 to 9.0 and averaging about 8. The results of PG&E's water quality monitoring in the project area indicate the alkalinity, conductance, hardness, and concentrations of major cations and anions show no discernable seasonal or long-term trends. Total suspended solids upstream of Lake Britton are higher than downstream, indicating that Lake Britton may be trapping fine-grained sediments.

PG&E states that Lake Britton and Pit River water quality has remained relatively constant based on comparisons of water quality data from 1999 and 2000 with historical measurements. Most historical data are from PG&E's studies associated with the previous relicensing proceeding, such as the *Bald Eagle and Fish Study* (BEFS) (BioSystems Analysis, Inc. and University of California, 1985), Lake Britton cold water feasibility study (Woodward-Clyde, 1985), and reports summarizing data from 1987 through 1997 associated with the annual BCMP. Table 7 summarizes some of the historical data for pH, DO, and turbidity.

Table 7. Selected historical water quality data for the Pit River in the vicinity of the Pit 3, 4, 5 Project. (Source: PG&E, 2001)

	Date					
Location	**pH (units)**		**DO (mg/l)**		**Turbidity (NTU)**	
Pit River upstream	**1984**	**1991–1992**	**1984**	**1991–1992**	**1984**	**1991–1992**
Maximum	8.4	9.1	9.6	11.5	3.1	7.7
Minimum	7.6	8.2	8.6	6.3	0.8	2.2
Mean	8.2	8.8	9.1	8.6	1.4	3.9
Lake Britton at dam		**1987–1992**	**1984**	**1996**	**1984**	
Maximum	--	9.5	26.3	13.6	8.3	--
Minimum	--	7.1	3.8	1.6	0.4	--
Mean	--	8.5	10.4	8.0	1.5	--
Pit 3 reach		**1987–1997**	**1984**	**1987–1997**	**1984**	**1987–1997**
Maximum	--	8.8	11.9	11.6	3.6	8.2
Minimum	--	6.1	6.9	6.4	0.4	0.5
Mean	--	8.1	10.1	9.2	1.0	2.3
Pit 4 reservoir	**1984**		**1984**		**1984**	
Maximum	8.7	--	10.1	--	3.4	--
Minimum	7.6	--	8.0	--	0.7	--
Mean	8.1	--	9.2	--	1.7	–

Table 7. Selected historical water quality data for the Pit River in the vicinity of the Pit 3, 4, 5 Project. (Source: PG&E, 2001)

	Date					
Location	**pH (units)**		**DO (mg/l)**		**Turbidity (NTU)**	
Pit 4 reach		**1987–1997**	**1984**	**1987–1992**	**1984**	**1987–1992**
Maximum	--	8.8	11.8	9.6	1.7	8.0
Minimum	--	6.7	8.4	4.6	0.6	0.5
Mean	--	8.2	10.2	8.2	1.0	2.5
Pit 5 reservoir	**1984**		**1984**		**1984**	
Maximum	8.8	--	20.4	--	2.6	--
Minimum	7.0	--	9.2	--	0.9	--
Mean	8.1	--	10.9	--	1.5	--
Pit 5 reach			**1984**		**1984**	
Maximum	--	--	13.0	--	2.6	--
Minimum	--	--	9.0	--	0.3	--
Mean	--	--	10.4	--	1.0	--

The initiation of minimum flow releases of 150 cfs from the Pit 3 dam in 1987 improved the water quality of Lake Britton while, according to visual observations, reducing downstream water clarity somewhat in the Pit 3 bypassed reach. The improvement in Lake Britton's water quality is due to the flushing of nutrients and algae from Lake Britton, and the associated decrease in downstream water clarity is only noticeable in the upper section of the Pit 3 reach.

The Pit River upstream of the project is heavily diverted for consumptive water uses, with irrigation of agricultural lands accounting for the majority of this diversion, as discussed previously. Water quality declines from the headwaters of the Pit River to Lake Britton as a result of this diversion, runoff from livestock operations, and the agricultural return flow.

PG&E monitored water quality in project waters during 1999 and 2000. Additional water quality related studies within the project area conducted as part of the relicensing program and filed with the Commission after the license application include the *Pit River Region Fish Fillet Muscle Sample for Mercury Analysis* (UC Davis, 2002) and *Water Quality Testing Near Selected Spoil Piles* (Cheslak, 2002). The results of these monitoring activities, as they pertain to key parameters that may be influenced by project operations, are discussed in the following text.

Temperature

PG&E monitored vertical water temperature profiles in Lake Britton during August and September 1999 and June through September 2000. Lake Britton thermally stratifies during the summer, based on monitoring at the deepest part of the lake near the dam (table 8). However, there is no clear break in the boundary between warm surface water and cooler water near the bottom, as is found in many deep lakes, and there is no stratification evident after September. The maximum reading, 22.3 degrees C (72.1 degrees F), was measured at the surface of Lake Britton on June 27, 2000, and the minimum water temperature, 13.3 degrees C (55.9 degrees F), was measured at a depth of 90 feet on September 20, 2000.

Table 8. Lake Britton vertical water temperature profiles at station LB-1[a] during 1999 and 2000. (Source: PG&E, 2001 as modified by staff)

Depth (feet)	Water temperature (degrees C)							
	8/27/99	**9/24/99**	**6/21/00**	**6/27/00**	**7/27/00**	**8/30/00**	**9/20/00**	**Average**
0	20.3	18.1	21.2	22.3	21.2	18.4	18.7	20.0
10	18.5	17.1	19.9	20.6	21.0	18.2	17.7	19.0
20	17.9	16.2	18.9	19.5	19.8	17.1	16.2	17.9
30	17.6	16.1	17.5	18.6	18.6	17.0	15.7	17.3
40	17.0	16.0	15.7	16.1	17.3	16.6	14.8	16.2
50	16.1	14.6	15.2	15.8	16.1	15.4	14.3	15.4
60	15.4	14.1	15.0	15.5	15.9	14.8	13.8	14.9
70	15.2	13.9	14.9	15.1	15.8	14.6	13.5	14.7
80	14.9	--	14.8	14.9	15.5	14.5	13.4	14.7
90	--	--	--	--	15.5	14.5	13.3	14.4

Note: -- means that depth was not sampled.

[a] Measurements at station LB-1 were taken about 2,200 feet upstream of the dam in 1999 and 500 feet upstream of the dam in 2000.

The depth from which water from Lake Britton is drawn for generation or to meet flow requirements influences the water temperature of all project reaches downstream of the Pit 3 dam. The bottom of the intake structure to the Pit 3 powerhouse in Lake Britton is at elevation 2,689.9 feet NGVD, but the elevation of the bottom of the 19-foot-diameter tunnel near the intake structure is at 2,699.9 feet NGVD. Consequently, the majority of water is withdrawn from Lake Britton between elevation 2,700 and 2,719 feet, the elevation of the bottom and top of the tunnel, although some water is also withdrawn from deeper and shallower water (the cone of influence). The bottom of the tunnel near the intake structure is 37.6 feet below the maximum water surface of Lake Britton and 24.6 feet below the normal minimum water surface at 2,724.5 feet NGVD. Lake Britton is typically within 3 to 6 feet of full pool during the summer, when high temperature conditions exist. Therefore, during the summer, most of the water entering the intake is withdrawn from a depth of about 20 to 30 feet, which, according to table 8, is expected to be less than 20 degrees C. The bottom of the sluice pipe used for flow releases to the Pit 3 bypassed reach is at 2,645.5 feet NGVD, 66 feet below the maximum and 79 feet below the minimum water surface elevation, near the bottom of the dam. Therefore, during the summer, water from the sluice gate withdraws water from a depth of about 60 feet, which according to table 8, would be less than 16 degrees C.

Flows released from Lake Britton used for power generation are passed quickly downstream through the project from powerhouse to powerhouse. Pit 4 and Pit 5 reservoirs are small and tend to be isothermal with very short retention times. Consequently, the total average change in temperature from the Pit 3 powerhouse to the Pit 5 powerhouse is relatively small (table 9). The average temperature in Lake Britton at a depth of 15 feet is similar to the temperatures at the downstream project powerhouses, tailwaters, reservoirs, and the flows released into the Pit 4 and 5 bypassed reaches to meet flow requirements. Water released from Lake Britton to meet flow requirements for the Pit 3 bypassed reach is colder because this release originates from near the bottom during summer stratification periods, as shown at the "Pit River below Pit 3 dam" station in table 9. Figure 2 shows the location of water quality monitoring stations during 1999 and 2000.

Table 9. Pit 3, 4, 5 Project average water temperatures based on continuous monitoring in 1999 and 2000. (Source: PG&E, 2001 as modified by staff)

	Temperature (degrees C)				
Station	**June**	**July**	**August**	**September**	**Average**
Pit River above Lake Britton (PRU)	15.9	16.4	15.9	14.1	15.5
Lake Britton at a depth of 15 feet (LB1)	19.4	19.9	19.3	16.5	18.7
Pit River below Pit 3 dam (PR-2)	14.8	15.8	15.5	13.9	15.0
Pit 3 powerhouse tailrace (PR-5)	18.4	18.7	18.2	15.9	17.8
Pit River below Pit 4 dam (PR-7)	18.4	18.8	18.1	15.8	17.8
Pit River above Canyon Creek (PR-8)	18.7	18.9	18.4	16.0	17.7
Pit River above Deep Creek (PR-9)	18.6	19.0	18.3	15.9	17.5
Pit River above Pit 4 powerhouse (PR-10)	17.5	17.7	17.3	15.1	16.7
Pit 4 powerhouse tailrace (PR-11)	18.4	18.9	18.3	16.0	17.9
Pit River below Pit 5 dam (PR-14)	18.7	19.0	18.4	16.3	17.9
Pit River above Nelson Creek (PR-15)	19.0	19.3	18.7	16.3	18.2
Pit River near the Big Bend gage (PR-16)	17.8	18.3	18.0	16.0	17.8
Pit River above the J.B. Black powerhouse	18.6	19.1	18.9	16.4	18.2
Tunnel Reservoir at Pit 5 intake (PR-13/18)	18.6	19.1	18.4	16.4	18.5

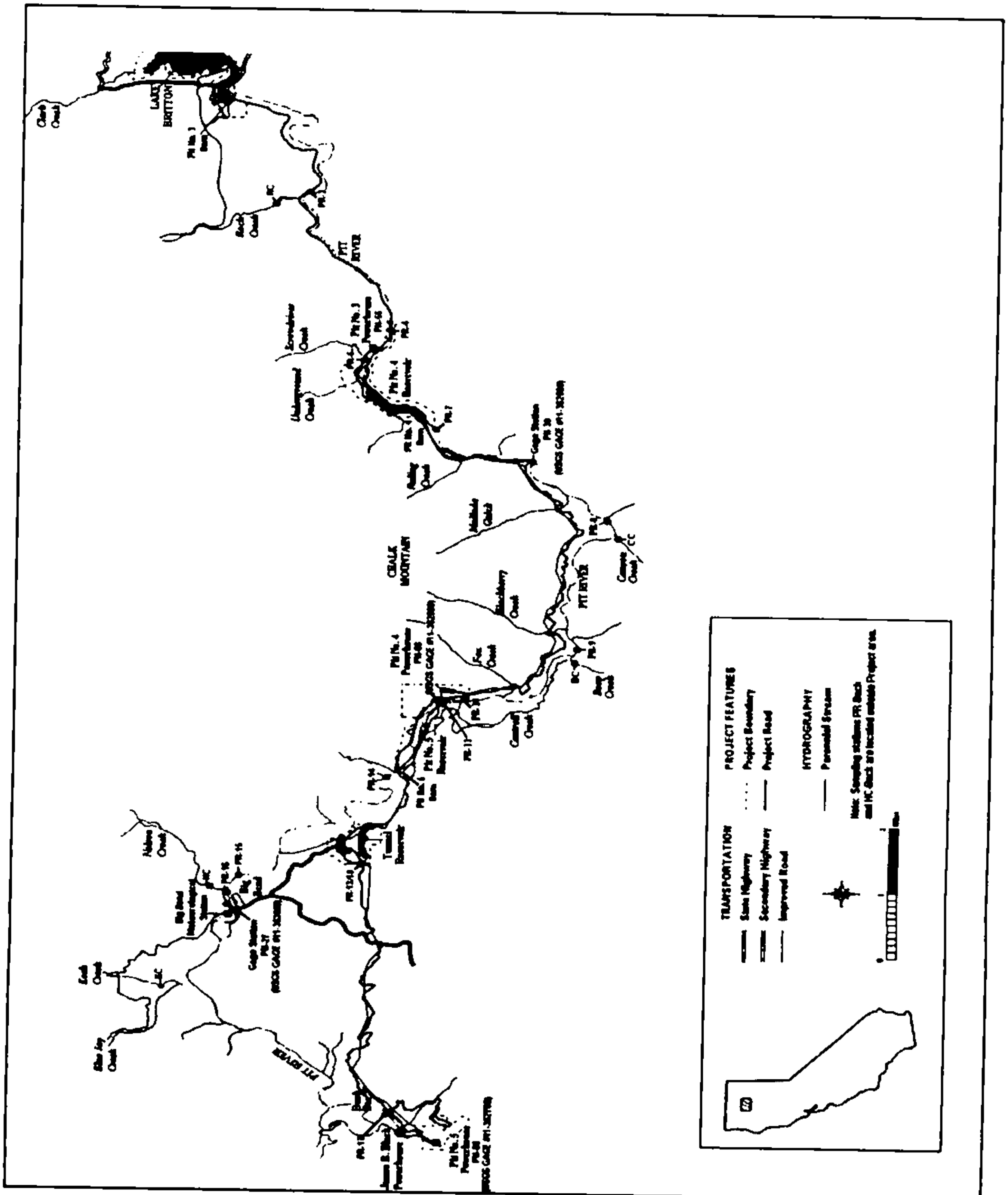

Figure 2. Location of water quality monitoring stations in 1999 and 2000 (sheet 1 of 2). (Source: PG&E, 2001)

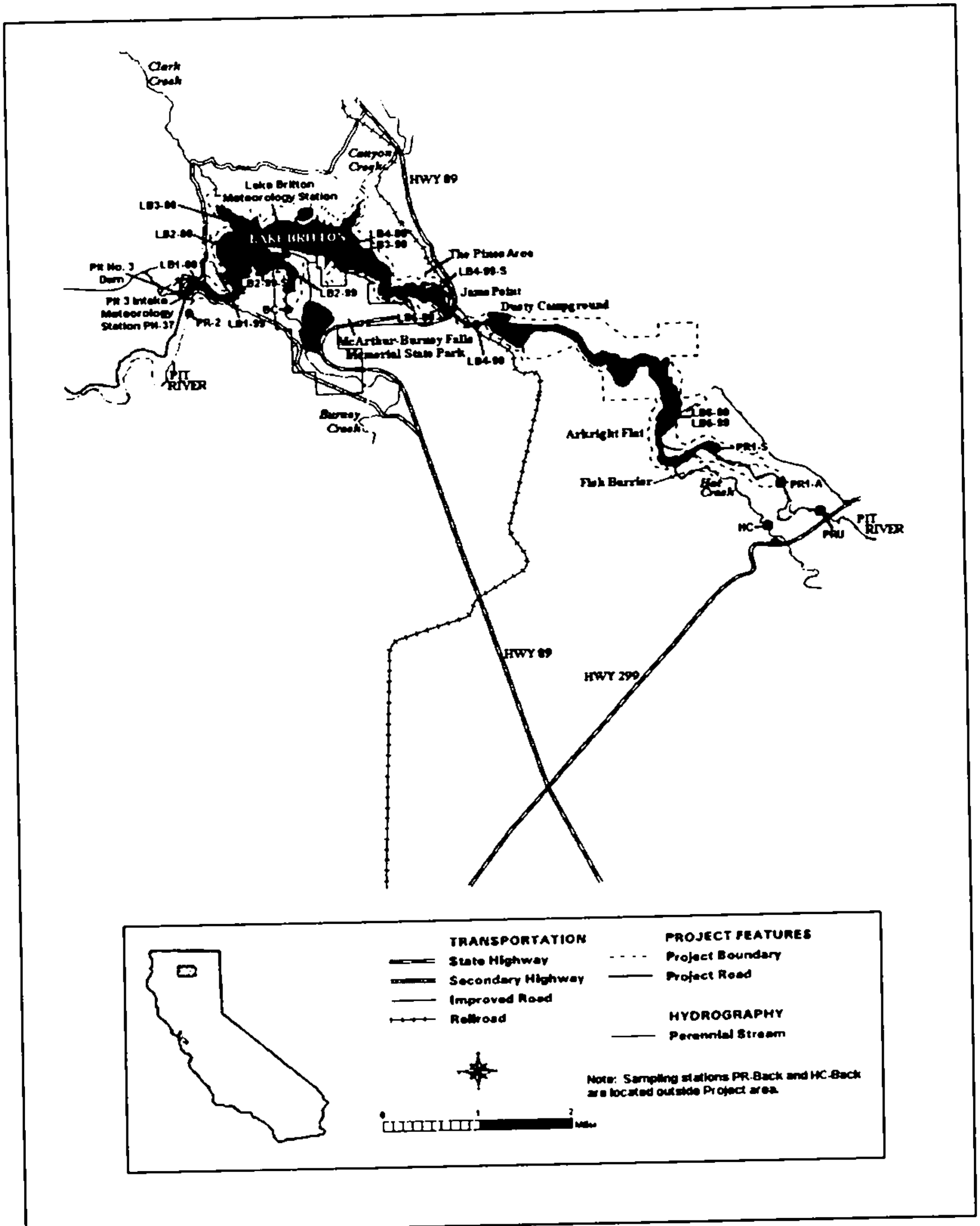

Figure 2. Location of water quality monitoring stations in 1999 and 2000 (sheet 2 of 2). (Source: PG&E, 2001)

Dissolved oxygen

PG&E sampling data indicate that the DO criteria of 7.0 mg/l, or 85 percent saturation, generally is met in Lake Britton except at greater depths during the summer (tables 10 and 11).

Table 10. Lake Britton vertical DO profiles (mg/l and percent saturation) at station LB-1[a] (about 500 feet upstream of the dam) during 2000. (Source: PG&E, 2001, as modified by staff)

Date:	4/20/00		5/9/00		6/21/00		6/27/00		7/26/00		8/30/00		9/20/00	
Depth (feet)	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%
0	9.9	105	8.3	92	8.8	110	8.4	106	8.1	101	8.6	101	9.3	110
5	9.8	102	8.3	91	8.4	104	8.3	106	7.9	98	8.5	100	8.9	105
10	9.6	100	7.9	86	8.5	103	8.5	104	7.8	96	8.4	98	8.9	103
15	8.6	89	7.9	86	8.0	95	8.0	97	8.0	98	7.4	86	7.9	89
20	8.7	89	7.9	85	7.8	92	7.7	93	7.9	96	6.9[b]	79[b]	7.4	84[b]
25	8.8	90	8.1	87	7.5	89	7.4	88	7.0	83[b]	6.7[b]	77[b]	7.3	81[b]
30	8.7	89	8.1	87	7.3	84[b]	7.2	85	6.4[b]	76[b]	6.7[b]	77[b]	6.9[b]	77[b]
40	8.7	89	8.1	87	7.3	81[b]	7.7	86	6.1[b]	70[b]	6.9[b]	78[b]	6.8[b]	75[b]
50	8.8	89	8.1	86	7.4	82[b]	7.5	84[b]	6.9[b]	77[b]	7.1	79[b]	7.0	75[b]
60	8.8	89	8.1	85	7.3	80[b]	7.1	79[b]	7.0	78[b]	7.3	80[b]	7.2	77[b]
70	9.0	91	8.2	85	6.9[b]	75[b]	5.8[b]	64[b]	7.0	78[b]	7.3	79[b]	7.1	75[b]
80	9.0	90	8.0	83[b]	6.5[b]	68[b]	4.6[b]	50[b]	6.7[b]	74[b]	7.2	78[b]	6.6[b]	70[b]

[a] Measurements at station LB-1 were taken about 500 feet upstream of the dam in 2000.

[b] Value is below the standard of 7.0 (mg/l), or 85% saturation.

Table 11. Lake Britton vertical DO profiles (mg/l and percent saturation) at the Highway 299 Bridge (station LB5) during 2000. (Source: PG&E, 2001, as modified by staff)

Date:	**6/21/00**		**6/27/00**		**7/26/00**		**8/30/00**		**9/20/00**	
Depth (feet)	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**
0	8.6	107	8.4	108	8.3	105	8.7	105	8.9	103
5	8.8	107	8.7	109	8.3	104	9	107	8.9	102
10	8.7	104	8.8	109	8.4	104	8.9	104	8.8	101
15	8.6	102	8.7	106	8.5	104	8.8	103	8.7	100
20	8.6	102	8.6	103	8.5	101	8.9	102	8.6	98
25	8.6	101	8.4	101	8.3	98	8.9	101	8.5	96
30	8.5	98	8.3	97	8.2	97	8.8	100	8.4	95
35	8.2	91	8.2	94	8.1	94	8.8	100	8.4	94
40	--	--	8.1	90	8.0	92	8.7	98	8.2	91
45	--	--	6.7[a]	72[a]	7.9	89	8.6	95	7.5	81[a]
50	--	--	--	--	7.2	79[a]	8.1	90	7.6	82[a]

Note: -- means that sampling was not conducted.
[a] Value is below the standard of 7.0 (mg/l) or 85% saturation.

PG&E also measured DO at numerous stations along the Pit River, including one station on the Pit River upstream of Lake Britton and in several tributaries that flow into Lake Britton and the Pit River within the project area (see figure 2 for station locations). Most of the values were within the regulatory standards, with the majority of the lower readings occurring upstream of Lake Britton (table 12).

Table 12. DO values (mg/l and percent saturation) for the Pit River and tributaries measured during June, July, August, and September sampling in 1999 and 2000. (Source: PG&E, 2001, as modified by staff)

Date:	**7/21/99**		**8/24/99**		**9/21/99**		**6/20/00**		**7/28/00**		**9/1/00**		**9/22/00**	
Location	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**
Pit River upstream	7.2	80[a]	8.6	98	7.4	81[a]	8.6	104	7.9	92	8.6	96	8.5	95
Hat Creek	6.7[a]	71[a]	7.5	78[a]	7.6	78[a]	10.8	120	8.4	91	7.5	78[a]	8.1	85
Burney Creek	9.8	94	10.0	98	10.0	96	10.2	101	9.5	91	9.7	95	10.1	97
Pit River 2	8.0	90	9.0	98	9.0	96	9.0	97	8.6	95	8.7	95	9.4	100
Pit River 3	9.0	103	8.4	94	8.0	85	8.6	95	8.9	102	8.8	99	10.0	109
Rock Creek	8.0	90	8.4	94	7.6	83	8.6	95	8.4	98	7.2	81[a]	8.4	94
Pit River 4	8.3	96	8.4	90	9.1	97	8.2	89	9.0	101	7.8	86	9.4	102
Pit River 5	7.3	86	8.6	99	8.0	89	8.2	96	6.5[a]	76[a]	8.6	98	9.0	102
Pit River 7	8.6	102	8.3	95	8.2	86	8.2	92	8.0	90	8.8	96	8.4	90
Pit River 8	8.2	94	8.4	94	7.8	84[a]	9.2	93	9.8	98	9.8	96	9.6	95
Canyon Creek	8.6	85	9.5	95	11.2	109	9.2	93	9.8	98	9.8	96	9.6	95
Pit River 9	8.0	92	8.4	95	8.7	97	8.4	97	8.2	94	9.0	99	8.9	98
Deep Creek	8.4	85	9.0	89	8.4	82[a]	9.4	94	9.8	97	10.0	97	8.9	87
Pit River 10	9.0	106	8.8	101	9.3	101	8.5	96	8.4	94	8.9	97	8.9	97
Pit River 11	8.9	105	8.8	100	9.8	108	7.9	91	9.4	108	9.2	102	9.2	101
Pit River 14	8.5	100	8.9	101	9.2	101	8.6	100	9.0	104	9.4	105	9.3	103
Pit River 15	9.4	108	8.7	98	9.0	100	8.3	100	8.7	105	9.0	102	9.0	103
Nelson Creek	9.4	97	9.1	92	9.2	100	8.5	93	8.6	96	9.2	97	8.0	85
Pit River 16	9.0	99	8.7	96	9.0	99	8.6	101	8.9	104	9.2	102	9.0	100
Kosk Creek	9.4	96	9.2	93	8.8	98	8.4	98	9.0	102	9.6	103	8.0	87

Date:	7/21/99		8/24/99		9/21/99		6/20/00		7/28/00		9/1/00		9/22/00	
Location	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**	**mg/l**	**%**
Pit River 17	8.6	91	8.4	91	8.2	87	8.8	104	8.8	104	9.2	104	9.0	101
Pit River 18	8.5	99	9.1	104	9.6	106	8.4	98	8.8	102	9.0	100	8.8	98

[a] Value is below the standard of 7.0 (mg/l) or 85% saturation.

pH

During the 1999 and 2000 water quality monitoring conducted by PG&E, pH exceeded 8.5 standard units, the maximum applicable water quality criteria, on 13 occasions. The maximum values were 9.0, measured in the Pit River upstream of Lake Britton, and 8.7, measured in Hat Creek (table 13). According to PG&E, these values suggest that the pH of water entering the project area is elevated on occasion and reflective of the alkaline conditions in the watershed, rather than any influence of the Pit 3, 4, 5 Project. Historical data support this conclusion (see table 7).

Table 13. Minimum, maximum, and average pH values (standard units) measured in waters in the vicinity of the Pit 3, 4, 5 Project. (Source: PG&E, 2001, as modified by staff)

	Pit River upstream	**Hat Creek**	**Burney Creek**	**Lake Britton**	**Pit 3 Reach**	**Pit 4 Reach**	**Pit 5 Reach**
Minimum	7.6	7.2	7.4	7.0	7.5	7.5	7.3
Maximum	9.0	8.7	8.2	8.4	8.6	8.5	8.6
Mean	8.1	7.8	7.7	7.7	8.0	8.0	8.1

Coliform bacteria

The state water quality criteria for the protection of waters used for bathing is based on the collection of a minimum of five fecal coliform samples within a 30-day period. PG&E's water quality monitoring for coliform bacteria was not designed to demonstrate compliance or non-compliance with the state criteria, but to provide a general characterization of the quality of project waters. Individual fecal coliform counts that exceed 400 MPN per 100 ml, or mean geometric counts that exceed 200 MPN per 100 ml suggest, but do not confirm, that there may be an exceedance of the state water quality criteria.

In Lake Britton, one station about 500 feet upstream of the dam was sampled for total and fecal coliform during the summer of 2000. The results of this sampling suggest that fecal coliform readings are within the regulatory standards for waters used for bathing, and total coliform readings are generally highest near the surface and lower near the bottom of the reservoir (table 14).

Table 14. Total coliform and fecal coliform counts within Lake Britton at station LB1 during 2000 sampling period. (Source: PG&E, 2001, as modified by staff)

Parameter	Sample date	Surface (MPN/100 ml)	Mid-depth (MPN/100 ml)	Bottom (MPN/100 ml)
Total coliform	6/27/2000	130	17	22
	7/26/2000	140	21	30
	8/30/2000	11	4	30
	9/20/2000	80	50	70
Fecal coliform	6/27/2000	<2	<2	<2
	7/26/2000	<2	<2	<2
	8/30/2000	<2	<2	<2
	9/20/2000	30	30	50

PG&E collected nine samples in riverine project waters (generally separated by at least a month) from 1999 and 2000. The sampling data suggest that the fecal coliform water quality objectives were met for recreational waters that the Basin Plan established (table 15). Potential exceedances were detected in samples collected upstream of Lake Britton and therefore not influenced by project operations and in Hat Creek. Generally, coliform densities were higher upstream of Lake Britton than downstream, but tended to increase with increasing distance downstream. PG&E states that the likely sources of coliform in areas upstream of Lake Britton are the Crystal Lake Fish Hatchery along Hat Creek (which flows into Lake Britton) and grazing and other uses along the upper Pit River. The relatively low counts in the Pit 3 reach are likely due to the majority of the water originating from near the bottom of Lake Britton, where the water temperature is lower and relatively low coliform counts occurred (see table 15). Potential anthropogenic coliform sources in the Pit 4 and 5 reaches include the settlement of Big Bend and several campsites along the river.

Table 15. Total coliform and fecal coliform counts within the Pit River and the Lake Britton tributaries during 1999 and 2000.[a] (Source: PG&E, 2001, as modified by staff)

	Pit River Upstream	Hat Creek	Burney Creek	PR2	PR4	PR5	PR7	PR10	PR11	PR14	PR17	PR18
Total coliform (MPN/100 ml)												
Minimum	13	23	17	8	8	2	2	8	4	4	11	8
Maximum	1,600	900	500	170	900	70	170	>1,600	500	500	900	900
Geometric mean	148	101	60	31	88	14	46	160	73	111	107	82
Arithmetic mean	396	210	117	51	224	23	76	>480	153	196	234	196
Fecal coliform (MPN/100 ml)												
Minimum	4	4	<2	<2	<2	<2	<2	<2	<2	2	4	2
Maximum	900	240	130	8	30	11	30	23	23	50	17	8
Geometric mean	25	23	<4	<3	<7	<3	5	<6	<4	10	4	7
Arithmetic mean	123	46	<21	<4	<11	<3	8	<9	<5	15	5	9

[a] See figure 2 for station locations; these results are based samples collected on 7/20/99, 8/24/99, 9/28/99, 2/1/2000, 4/18/2000, 6/20/2000, 7/25/2000, 8/29/2000 and 9/19/2000.

Metals

PG&E monitored total metal concentrations in Lake Britton at a station about 500 feet upstream of the dam (LB1) from June through September 2000 and at various points along the Pit River and its tributaries from July through September 1999 and during February, April, and June through September 2000. Basin Plan criteria include dissolved metal concentrations due to the possible influence on aquatic organisms (see table 16). PG&E's monitoring program measured total metal concentrations; dissolved metal concentrations are typically equal to or less than total metal concentrations. All of these readings were single measurements and, therefore, in some cases (e.g., silver, copper, and mercury), they cannot be directly compared to certain U.S. Environmental Protection Agency (EPA) criterion, which are stated in terms of a 4-day average value. However, single values can provide an indication of potential water quality problems if they exceed the applicable 4-day standard. We summarize the single metal sample values from Lake Britton that exceeded the indicated criterion in table 16 and those values from riverine reaches upstream and downstream of Lake Britton in table 17.

Table 16. Metal criterion exceedances from single samples collected about 500 feet upstream of the Pit 3 dam, 2000. (Source: PG&E 2001, as modified by staff)

Metal	Criteria (mg/l)	Criterion source	Depth	Value (mg/l)	Date
Silver	0.0012	EPA Freshwater 4-day average	Mid	0.0043	9/20
Copper	0.005	EPA Freshwater 4-day average	Surface	0.0082	6/27
			Mid	0.0083	6/27
			Bottom	0.0077	6/27
Iron	0.3	California Department of Health Services (DHS) secondary	Bottom	0.32	7/26
			Bottom	0.3	6/27
Manganese	0.05	DHS secondary	Bottom	0.067	9/20
			Bottom	0.12	7/26
			Bottom	0.29	6/27
			Bottom	0.059	8/30
Mercury	0.00077	EPA freshwater 4-day average	Surface	0.0056	9/20
			Mid	0.0038	9/20
			Bottom	0.002	9/20
Selenium	0.005	EPA freshwater 4-day average	Bottom	0.005	9/20

Table 17. Metal criterion exceedances from single samples collected in riverine reaches of the Pit River and tributaries, 1999 and 2000. (Source: PG&E 2001, as modified by staff)

Metal	Criteria (mg/l)	Criterion source	Location[a]	Value (mg/l)	Date
Iron	0.3	DHS secondary	Burney Creek	0.37	04/18/2000
			PR17	0.34	02/01/2000
			PR18	0.32	04/18/2000
			PR18	0.38	09/19/2000
			PR4	0.82	02/01/2000
			Pit River, upstream	0.41	04/18/2000
Iron	1.0	EPA freshwater instantaneous maximum[b]	Burney Creek	1.1	02/01/2000
			PR10	1.1	02/01/2000
			PR11	1.3	02/01/2000
			PR14	1.2	02/01/2000
			PR18	1.3	02/01/2000
			PR2	1.3	02/01/2000
			PR5	1.4	02/01/2000
			PR7	1.3	02/01/2000
			Pit River, upstream	1.8	02/01/2000
Manganese	0.05	DHS secondary	PR18	0.5	09/19/2000
			PR2	0.13	07/20/1999
			PR2	0.052	08/24/1999
			PR2	0.062	09/28/1999
			PR2	0.066	06/20/2000
			PR2	0.056	07/25/2000
			PR5	0.052	06/20/2000
Zinc	0.02	RWQCB Basin Plan	PR18	0.024	04/18/2000
			PR18	0.046	09/19/2000

[a] See figure 2 for station locations.

[b] Because this criterion is higher than the DHS secondary criteria for iron, all of the exceedances listed here would also exceed the DHS criteria for iron.

PG&E sponsored a fish fillet mercury monitoring program conducted by the Environmental Mercury Laboratory at the University of California-Davis (UC Davis) on fish collected in three sections of Lake Britton. The results are shown in table 18. UC Davis summarized the results as follows:

1. None of the samples approached or exceeded the U.S. Food and Drug Administration consumption guideline for mercury in fish of 1.00 parts per million (ppm) wet weight.

2. Five of the pikeminnows exceeded the new EPA guideline for mercury in fish tissue of 0.30 ppm wet weight.

3. The mercury levels in the fish are not unusual for Northern California and atmospheric deposition of mercury often results in mercury concentrations of over 1.0 ppm wet weight in game fish.

Table 18. Mercury analysis results from Lake Britton fish fillets, 2000 and 2001. (Source: UC Davis, 2002)

Sample date	**Sample location**	**Fish species**	**Length (inches)**	**Weight (lbs)**	**Mercury (ppm) wet weight**
8/28/2001	Lower Lake Britton	Sacramento pikeminnow	15.7	1.0	0.52
8/29/2001	Upper Lake Britton	Sacramento pikeminnow	14.0	0.9	0.07
8/27/2001	Upper Lake Britton	Sacramento pikeminnow	15.2	1.1	0.51
8/29/2001	Upper Lake Britton	Sacramento pikeminnow	15.3	1.2	0.29
8/29/2001	Upper Lake Britton	Sacramento pikeminnow	15.8	1.1	0.11
8/27/2001	Upper Lake Britton	Sacramento pikeminnow	18.0	1.8	0.48
8/29/2001	Upper Lake Britton	Sacramento pikeminnow	19.6	2.3	0.40
8/29/2001	Upper Lake Britton	Sacramento pikeminnow	22.2	3.6	0.53
8/28/2001	Lower Lake Britton	Smallmouth bass	11.8	0.9	0.05

Sample date	Sample location	Fish species	Length (inches)	Weight (lbs)	Mercury (ppm) wet weight
8/28/2001	Lower Lake Britton	Smallmouth bass	12	0.9	0.08
8/28/2001	Lower Lake Britton	Smallmouth bass	12.4	1.1	0.09
8/28/2001	Lower Lake Britton	Smallmouth bass	14	1.4	0.16
8/29/2001	Upper Lake Britton	Smallmouth bass	14.6	1.7	0.25
8/29/2001	Upper Lake Britton	Smallmouth bass	14.9	1.9	0.22
8/21/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	16.5	2.3	0.07
8/21/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	16.7	2.4	0.07
8/22/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	16.7	2.6	0.07
8/24/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	17	2.3	0.08
8/25/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	17.1	2.5	0.06
8/23/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	17.3	2.6	0.04
8/27/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	17.5	2.7	0.07
8/28/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	17.8	2.6	0.06
8/26/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	18	2.5	0.05
8/21/2000	Hat Creek at Lake Britton confluence	Sacramento sucker	18	3.2	0.06

PG&E also analyzed water and leachate samples for metals and organic compounds near two tunnel spoil disposal sites (spoil piles 4D and 5A) during 2002. These analyses were conducted by sampling the Pit River upstream and downstream of spoil pile 4D and Miners Creek upstream and downstream of spoil pile 5A following rain events. On one occasion, PG&E was able to directly sample a leachate rivulet on spoil pile 5A. Parameters analyzed include benzene, toluene, ethylbenzene, xylene, total extractable petroleum hydrocarbons, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, and mercury. In all cases, organic compounds were below the detection limit. In some cases, metals were detected in at least one of the samples analyzed. Table 19 summarizes those parameters that were detected in at least one sample. If the parameter is not listed in the table, it was not detected. PG&E concludes the following from the results of the spoil pile testing:

1. low levels of arsenic, barium, and vanadium probably represent background levels;

2. one sample showed an elevated level of copper but this was not confirmed in the re-analysis; and

3. neither petroleum hydrocarbons nor metals are leaching into waters of the Pit River or Miners Creek from spoil pile 4D or 5A.

Nutrients

Nutrient loading from upstream agricultural and livestock operation is a concern for Lake Britton. The EPA characterized Lake Britton as borderline eutrophic based on data collected during 1975. PG&E conducted a nutrient assessment in 1999 and 2000 to determine the current status of eutrophication in Lake Britton. PG&E's data indicate that implementation of the 150-cfs minimum flow release from the Pit 3 dam in 1987 has resulted in improved transparency, reduced nutrient levels, and less frequent algal blooms in Lake Britton. For example, in the past 10 years, the average Secchi depth has increased while total phosphorus and chlorophyll *a* concentrations (commonly used as a surrogate for planktonic algal abundance) have decreased. However, observations of discolored water, with associated odor problem, made by the FS staff during August 2002 (forwarded to the Commission by SWRCB letter dated June 18, 2003) indicate that nuisance algal blooms still occur in Lake Britton. The August 2002 bloom was associated with a prolonged period of hot (over 100 degrees F) weather and is not representative of typical conditions. PG&E found that productivity in the lake is generally nitrogen limited, although phosphorus may be limiting at certain times and locations. PG&E concludes that the short residence time inhibits nitrogen-fixing algae, and the high flushing rate also removes nutrients before they can be used for algal production. We consider that the high flushing rate may also limit phytoplankton abundance by: (1) physically flushing phytoplankton downstream, and (2) limiting the internal recycling of nutrients within Lake Britton. An input/output analysis conducted by PG&E indicates that Lake Britton acts as a nutrient sink in the Pit River watershed and that current project operations have improved the overall lake water quality since 1984.

Table 19. Analytes detected in water quality samples associated with spoil piles 4D and 5A, 2002. (Source: PG&E 2002, as modified by staff)

	4D Upstream		4D Downstream		5A Upstream		5A Downstream	5A leachate		
Analyte	**Initial analysis**[a]	**Re-analysis**	**Initial analysis**[a]	**Re-analysis**	**Initial analysis**[a]	**Re-analysis**	**Initial analysis**[a]	**Initial analysis**[a]	**Re-analysis**	**Detection limit (mg/L)**
Total metals										
Arsenic	0.0057	ND	ND	ND	ND	ND	ND	ND	ND	0.0050
Barium	0.010	0.012	0.012	0.013	ND	NA	ND	ND	NA	0.0050
Copper	ND	NA	0.021	ND	ND	NA	ND	ND	NA	0.0050
Vanadium	0.0096	0.012	0.0100	0.0110	ND	NA	ND	ND	NA	0.0050
Dissolved metals										
Arsenic	0.010	0.0063	0.0056	0.0051	0.0058	ND	ND	0.0054	ND	0.0050
Barium	0.0091	0.069	0.01	0.011	ND	NA	ND	ND	NA	0.0050
Vanadium	0.0097	0.0100	0.0095	0.0100	ND	NA	ND	ND	NA	0.0050

Notes: NA = Not analyzed.
ND = Not detected in the sample.

[a] If a parameter was detected in the initial analysis, or the upstream sample at that site, the sample was re-analyzed for the parameter; otherwise, if a parameter was not detected during the initial analysis, there was no re-analysis, except for arsenic.

Other Parameters

PG&E also sampled for other parameters during its 1999 and 2000 sampling efforts. Table 20 shows the results of this sampling.

Table 20. General water quality characteristics of project waters based on sampling during 1999 and 2000. (Source: PG&E, 2001, as modified by staff)

Parameter (units)	Lake Britton and tributaries	Pit 3 reach	Pit 4 reach	Pit 5 reach
Conductivity (µs/cm at 25 degrees)				
Range	94–206	132–162	133–160	121–190
Mean	141	145	146	157
Total alkalinity (mg $CaCO_3$/l)				
Range	40–90	50–80	60–80	50–80
Mean	70	71	73	73
Total hardness (mg $CaCO_3$/l)				
Range	31–63	34– 62	49–57	46–64
Mean	50	52	52	55
Silica (mg/l)				
Range	23–37	23–36	25–36	20–35
Mean	31	30	29	27.7
Calcium (mg/l)				
Range	7.7–12	7.5–12.0	8.3–11	9.5–19.0
Mean	10.1	10.0	10.0	11.8
Magnesium (mg/l)				
Range	4.3–8.0	4.4–7.8	5.8–7.2	5.2–7.1
Mean	6.6	6.6	6.3	6.2
Sodium (mg/l)				
Range	4.1–36.0	7.5–13.0	8.6–12.0	6.6–14.0
Mean	10.5	10	10.6	11.5

Parameter (units)	Lake Britton and tributaries	Pit 3 reach	Pit 4 reach	Pit 5 reach
Potassium (mg/l)				
Range	1.2–6.9	1.4–3.4	1.7–3.2	0.7–4.1
Mean	2.6	2.3	2.3	2.3
Chloride (mg/l)				
Range	0.8–4.7	1.4–4.0	1.7–3.6	2.0–10.0
Mean	2.1	2.3	3.3	4.2
Sulfate (mg/l)				
Range	0.0–6.7	0.8–4.0	1.0–5.0	1.4–8.0
Mean	2.2	2.1	2.5	4.1
Total suspended solids (mg/l)				
Range	1.0–70	1.0–46	1.0–21	1.0–34
Mean	7.8	3.6	3.3	6.2
Turbidity (NTU)				
Range	0.9–9	NA	NA	NA
Mean	2.5	NA	NA	NA

Erosion and Sedimentation

Erosion concerns on project lands are primarily associated with the shoreline of Lake Britton, the 16 tunnel spoil piles created when the project tunnels were excavated, and public use of project lands and roadways.

Lake Britton erosion

Several locations along the shoreline of Lake Britton experience erosion. The cause of the erosion may be wind-induced waves, boat wakes, impoundment fluctuations, or some combination of the above. Erosion sites of primary concern are those that threaten known or potential cultural sites. Because of the sensitive nature of those locations, we have not presented detailed discussions of their location in this section.

Exposed soil on vertical slopes, such as those caused by erosion, could represent nesting habitat for bank swallows. PG&E mapped 6.6 acres of potential bank swallow habitat along the lake margins within 12 vertical feet of the maximum water surface level of 2737.5 feet NGVD (Madsen and Beck, 2001). Video footage taken by PG&E of the Lake Britton shoreline during an October 2000 helicopter flyover revealed that numerous rejuvenated cliff banks have formed by wave action undercutting steep reservoir side slopes. The flyover also revealed that bank swallows only use a limited amount of the potential available habitat, as many of the cliffs identified around the perimeter of the impoundment are composed of bedrock or other materials that are not ideally suited for bank swallow nest construction. No quantification of actual available bank swallow habitat was presented in Madsen and Beck (2001). Further discussion of bank swallow habitat is presented in section 3.3.3, *Terrestrial Resources*.

Erosion related to tunnel spoil piles

PG&E assessed the 16 tunnel spoil piles located within the project boundary to determine their actual and potential susceptibility to erosion (Patzkowski, 2001). Such erosion could contribute to water quality degradation of project waters. Each pile was assigned one of four categories for erosion potential—nil, low, moderate, and high. A nil rating was assigned to areas that appear to experience only minimal erosion and are healed and generally well-vegetated. A low rating was assigned to areas that appear to experience only slight erosion regardless of storm frequency and intensity. Areas assigned a moderate rating appeared to experience substantial erosion on a sporadic basis, such as during a 50- or 100-year storm. The high rating was assigned to areas that experience substantial erosion during each rainy season. Table 21 presents the results.

Table 21. Pit 3, 4, 5 Project spoil pile erosion potential. (Source: Patzkowski, 2001, as modified by staff)

Disposal pile designation and number	Location	Estimated volume (cubic yards)	Erosion potential rating	Remarks
Pit 3 upstream portal pile (3U)	Upstream of intake structure under waters of Lake Britton	341,000	Nil	Pile is submerged under Lake Britton.
Pit 3 adit pile (3A)	Near Camp Nine Flat about 1500 feet northeast of Pit 3 Powerhouse	160,000	Nil	Moderate growth of conifers exists on pile; adit leakage flow is adjacent to site.

Disposal pile designation and number	Location	Estimated volume (cubic yards)	Erosion potential rating	Remarks
Pit 3 downstream portal pile (3P)	On right side adjacent to Pit 3 powerhouse penstocks about 500 feet from Pit River	76,000	Nil	Pile surface is sparsely vegetated with conifers and some oak trees.
Pit 3 Rock Creek crossing pile (3RC)	At end of road at Rock Creek crossing upstream and downstream adjacent to conduit	5,000	Nil	Slopes do not show signs of significant erosion.
Pit 3 Camp pile (3C)	Downstream of Pit 3 powerhouse, Screwdriver Creek flows through upper end of site	Unknown	Nil	Asbestos roofing material was removed to an offsite location in 1999.
Pit 4 adit pile (4A)	Adjacent to Pit River	40,000	Nil overall, low to moderate on slopes	Erosion has occurred on slopes due to drainage down spoil pile slopes.
Pit 4 downstream portal pile (4P)	Adjacent to Pit 4 penstocks about 800 feet from Pit river	354,000	Low to moderate	This is the largest spoil pile in project area, and some gully erosion is evident on slopes.

Disposal pile designation and number	Location	Estimated volume (cubic yards)	Erosion potential rating	Remarks
Pit 4 downstream of stream gage station pile (4G)	Adjacent to Pit River about 1.5 miles downstream of Pit 4 dam, a few hundred feet below stream gaging station above Adit Bar	542,000	Nil to low	This was a former aggregate production site.
Pit 4 excavation disposal pile (4PH)	Downstream of switchyard of the Pit 4 powerhouse	60,000	Nil to low	Slopes of pile are fairly gentle and grass-covered, side-cast slopes above river show signs of erosion.
Pit 4 dam pile (4D)	Adjacent to Pit River below Pit 4 dam	64,000	Moderate to low	Several areas of active gully erosion were caused by concentrated runoff, asbestos roofing shingles were removed from pile in 1999.
Pit 5 upstream portal pile-1 (5U1)	Just upstream of the left abutment of Pit 5 dam on shoreline of Pit 5 reservoir	64,000	Nil overall, low to moderate on slopes	Abundant conifer cover exists with light understory, wild berry vines and weeds present; pile slopes are undercut by wind and/or wave action.
Pit 5 upstream portal pile-2 (5U2)	Downstream of left abutment of Pit 5 dam	63,000	Nil	Area is heavily wooded and ill-defined.

Disposal pile designation and number	Location	Estimated volume (cubic yards)	Erosion potential rating	Remarks
Pit 5 Miners Creek pile (5A)	Along Pit 5 powerhouse access road at its crossing of Miners Creek	287,000	High to moderate	Area has extensive gully erosion.
Pit 5 downstream portal pile (5D)	Adjacent to Pit 5 powerhouse valve house at the head of the penstocks	35,000	Low to nil	Slopes of pile have been repaired, slopes have been graded, and subsurface drains and a rock buttress have been installed.
Pit 5 powerhouse laydown area pile (5L)	Adjacent to Pit River upstream of Pit 5 powerhouse	82,000	Low	Location is used as a laydown area for equipment and materials; limited evidence of erosion exists.
Pit 5 old school site area pile (5S)	Adjacent to Pit River near Bush Bar	160,000	Nil	Area has low, fairly well vegetated slopes with limited evidence of erosion.

The five spoil piles located at Lake Britton and along the Pit 3 reach were rated nil. One of the sites is located under the waters of Lake Britton. Three of the piles are vegetated and show little or no signs of erosion. PG&E removed asbestos roofing material from the Pit 3 Camp pile (3C) in 1999.

The ratings of the five piles associated with the Pit 4 reach range from nil to moderate. The pile located downstream of the stream gage station (4G) appears to be a site graded for construction use because there is no evidence of tunnel or excavation spoil material on site. The rating of nil to low was associated with the toe areas of the fill material. The powerhouse excavation disposal pile (4PH) was given a rating of nil to low. The sidecast slopes above the river are moderately steep and show some signs of erosion, warranting a low-erosion potential rating, but the remainder of the site has a nil rating. The adit spoil pile (4A) was given an overall rating of nil, although the slopes along the river were assigned a rating of low to moderate because they have experienced considerable erosion, which drainage off the site down onto the slope has exacerbated. The downstream portal pile (4P) has a rating of low to moderate because of the existence of some fairly large gullies caused by erosion. The 4P pile contains tunnel spoils plus a noticeable amount of human-made material, including rusty metal, railroad spikes, cable, lumber, and blasting cable.

The pile of most concern in the Pit 4 reach is the dam spoil pile (4D), which is located downstream of the dam along the edge of the river. The pile has several areas of active gully erosion caused by concentrated runoff. Like the 4P pile, the 4D pile contains tunnel spoil plus a noticeable amount of construction debris, such as rusty metal, cable, lumber, and blasting cable. Asbestos roofing and siding materials were removed from the pile in 1999. Although the toe of the embankment is vegetated near the edge of the river channel, the embankment above is very steep and is unable to maintain vegetation. The steep bank on the opposite side of the Pit River from this spoil pile is sloughing into the river. As discussed in *Water Quality* above, PG&E tested the Pit River water upstream and downstream of this spoil pile for organic chemicals and metals to address concerns about potential contamination of the river by leachate from the pile (see table 19). PG&E concluded that no contaminants were leaching from the pile beyond background concentrations.

Six spoil piles are associated with the Pit 5 reach. The upstream portal pile 2 (5U2) and the old school site area near Bush Bar (5S) are both rated nil because of the limited evidence of erosion and fairly well-developed vegetated slopes. The downstream portal pile (5D) is rated low to nil because the slopes have been re-graded and stabilized and subsurface drains and a rock buttress have been installed. The powerhouse laydown area pile (5L) has a low rating because of limited evidence of erosion. The upstream portal pile (5U1), which is located just upstream of the dam on the Pit 5 reservoir, has an overall rating of nil, but the slopes along the river have a rating of low to moderate due to slope undercutting caused by wind and/or wave action.

The pile of most concern along the Pit 5 reach is the Miners Creek spoil pile (5A). The pile is located along the powerhouse access road at its crossing of Miners Creek. The upstream end of the site is underlain with what appears to be mine tailings. Tunnel spoil was placed on top of the mine tailings. The pile also contains construction debris, such as concrete rubble and cement waste in some locations, along with asphalt chunks and road spoil, wood, and tree debris. Other debris found on the pile includes household trash and construction debris, such as rusty metal and cable. The erosion potential rating of the pile is considered high to moderate because of the extensive gully formation, apparent loss of spoil pile materials through erosion, and the proximity of Miners Creek at the toe of the pile.

PG&E sponsored a supplementary investigation of the erosion features of the Miners Creek spoil pile (Geomatrix, 2001). The pile was divided into three sections for discussion purposes (upper, middle, and lower), because of the distinct differences in pile condition and erosion characteristics. At the upper section of the pile, fill was placed adjacent to the creek channel. The investigation showed that surface water flow in Miners Creek adjacent to the pile is intermittent in the upper section and probably sustained all year along the middle and lower sections. Stream flow gradually decreased as it progressed downstream along the upper section, indicating that water infiltrates the materials in the pile and emerges from the pile in the middle and lower sections. Erosion along the upper section was found to be very minor and consists of shallow sloughing.

Geomatrix (2001) concluded that the spoil pile in the upper part of the middle section originally extended across the Miners Creek channel. Evidence of an armored channel along the south side of the current creek channel, which is slightly upgradient from the toe of the spoil pile, supports this conclusion. The upper part of the middle section exhibits the most severe historical erosion. Geomatrix reviewed aerial photographs from 1984 and recent orthophoto and topographic maps and concluded that a large amount of the spoil pile had eroded away over time as the creek attempted to return to the original channel location. Erosion features observed in the middle section included gullies and shallow sloughing. Erosion appeared to be caused by several factors: (1) water runoff from the top of the pile; (2) the bedrock floor in one section of the creek channel appears to direct flow against the base of the pile causing erosion and undercutting of the pile; (3) and discharge of water from beneath the pile from an underground spring may slowly erode the lower part of the pile and undercut it. Geomatrix concluded that erosion at the middle section would likely continue due to the growth of gullies, but that the movement of the creek channel may have stabilized since most of the material that had caused the shift in channel location has eroded away.

Geomatrix (2001) indicated that very shallow sloughing, minor gullying, and fluvial incision have affected the lower section, although the investigators believe that incision has mostly stabilized as the creek returned to its original channel location.

As discussed previously in *Water Quality*, PG&E tested Miners Creek water upstream and downstream of the spoil pile, as well as water emanating from the pile itself, for organic chemicals and metals to address concerns about potential contamination of the river by leachate from the pile (see table 19). PG&E concluded that no contaminants were leaching from the pile beyond background concentrations.

Erosion due to public use of project lands and roadways

The powerhouse access roads are open for public use and interconnect with other local roads. Clark Creek Road in the vicinity of the Pit 3 dam, River Road from the Pit 3 dam to the Pit 3 powerhouse, and the Pit 5 powerhouse access road are paved, but the remainder of the roadways used to access the project facilities are gravel (Foster Wheeler, 2001). PG&E has improved and maintains the gravel road surfaces; however, surface runoff from the roadways has caused erosion in some locations where appropriate drainage measures have not been implemented.

There are also numerous unimproved roads and jeep trails located primarily around Lake Britton. The continued public use of some of the unimproved roads around Lake Britton is of concern where erosion threatens known and potential cultural resource sites in the area. Because of the sensitive nature of those locations, we have not presented detailed discussions of those sites and their locations in this section.

Off-road vehicles (ORVs) traversing project lands have also caused some erosion. Although signage has been placed along project roads to advise the public to keep vehicles on established roadways, and barriers have been installed in some locations, unauthorized ORV use continues.

The informal development of trails on project lands to access the river channel along the Pit 3, 4, and 5 reaches has also produced erosion in some areas. Because of the steep slopes of the Pit River Canyon, many of the trails follow the steep slopes and are susceptible to erosion, slides, and sloughing. PG&E has developed some formal trails (e.g., at the Pit 3 dam). However, most of the existing trails have been established through continued public use, were not developed with erosion prevention in mind, and have not been improved or modified to prevent or reduce soil erosion.

Sediment Transport and Supply

Sediment transport and supply as it pertains to existing and proposed project operations is primarily a function of hydrological processes. Consequently, we discuss existing conditions relative to sediment transport and supply in section 3.3.1, *Water Resources*.

PG&E sponsored a reconnaissance-level evaluation of the fluvial geomorphology of the Pit River near the Pit 3, 4, 5 Project and the effects of historical and ongoing operation of the project (Madsen and Beck, 2001). PG&E reached several conclusions regarding ongoing sediment transport and supply in the various project reaches, which are summarized as follows:

Lake Britton

- Approximately 6,220 acre-feet of sediment accumulated in Lake Britton between 1925 and 2000.
- Sediments deposited in Lake Britton are believed to consist primarily of medium-sized clay, silt, and sand. Approximately 10 percent or less of the material is believed to consist of bedload composed of gravel and larger-sized material.
- Bedload trapped behind the Pit 3 dam formerly would have contributed an estimated 26,000 tons of bedload annually to the lower Pit River.
- The estimated reservoir trap efficiency of Lake Britton ranges from 30 to 71 percent. An estimated 80 acre-feet (139,000 tons) of sediment is currently passed downstream of Lake Britton as suspended load.
- Sediments passing downstream of the Pit 3, dam are primarily finer than coarse silt.

Pit 3 reach

- Rock Creek is now the primary source of bedload to the Pit 3 reach, contributing an average of 600 tons per year.
- Existing base flows of 150–200 cfs are capable of mobilizing sand and small gravel size material in the Pit 3 reach, and flood flows can move boulders up to 0.5 meter in diameter.
- The potential bedload transport capacity of the Pit River in the Pit 3 reach has decreased as a result of project operations, but still exceeds estimated bedload inputs by more than an order of magnitude. The Pit 3 reach continues to be sediment-supply limited.
- The sediment transport capacity of the Pit 3 reach exceeded the supply prior to the project, thus deposits of gravel would have been limited and likely occurred as patches in the lee of large boulders or other obstructions. Trapping of bedload in Lake Britton has likely resulted in some depletion of those patches, particularly upstream of Rock Creek. Localized inputs from landslides or from ephemeral tributaries during high-flow events may occasionally replenish gravel patches in between major flood events.
- The bed material of the Pit 3 reach is composed primarily of boulders greater than 12 inches in diameter that only the largest flow events can mobilize. Thus, the ability of the channel bed to incise is limited, and no evidence of recent incision was noted in the main stem downstream of the Pit 3 dam.
- The combined contribution of suspended sediment from Lake Britton and suspended sediment and bedload from the additional 37.7 miles of area draining to the Pit 3 reach (including Rock Creek, Screwdriver Creek, and Underground Creek) supply approximately 81 acre-feet of sediment to the Pit 4 reservoir each year, on average.

- Sediment trapped in the Pit 4 reservoir includes approximately 950 tons of bedload on an average annual basis.
- Pit 4 reservoir has a trap efficiency estimated to range from 0 to 10 percent, intercepting virtually all of the sediment larger than very fine sand. Of the total of 81 acre-feet, an estimated 76.9 acre-feet (134,000 tons) is passed downstream.

Pit 4 reach

- Lake Britton and the Pit 4 dam trap approximately 26,000 and 950 tons of bedload, respectively; this material formerly would have been delivered to the Pit 4 reach.
- Estimated bedload inputs from the 20.7 miles of additional drainage area between the Pit 4 dam and Pit 5 dam deliver an estimated 520 tons of coarse sediment per year to the Pit 4 reach.
- Review of aerial photographs from 1944, 1961, and 1984 suggests that bedload inputs to the Pit 4 reach are primarily episodic, occurring during large storm events that trigger landslides or debris flows.
- Catastrophic debris flows in tributary streams may deliver large amounts of sediment to the mainstem Pit River. This sediment would temporarily replenish gravel patches lost due to the reduced bedload transport of upstream reaches.
- Alterations in the flow regime resulting from project operations have increased the likelihood that large episodic sediment inputs might be followed by a series of years with no-flood events. Under such a scenario, coarse material at the tributary confluence could steepen the gradient or cause flow to go subsurface during low-flow years until subsequent floods redistributed the material downstream. The Pit 4 reach is particularly susceptible to this type of occurrence because of the numerous small, steep tributary streams and the greater extent of unstable geologic formations.
- Existing base flows of 150–200 cfs are capable of mobilizing sand and small- gravel-sized material in the Pit 4 reach, and flood flows can move boulders over 1 meter in diameter.
- The potential bedload transport capacity of the Pit River in the Pit 4 reach has decreased as a result of project operations, but still exceeds estimated bedload inputs by several orders of magnitude. The Pit 4 reach continues to be sediment- supply limited.
- The sediment transport capacity of the Pit 4 reach exceeded supply prior to the project. Thus, gravel deposits would have been limited and likely occurred as patches in the lee of large boulders or obstructions. Trapping of bedload in Lake Britton and the Pit 4 reservoir has likely resulted in some depletion of those patches, particularly upstream of Canyon Creek. Episodic inputs from landslides or from ephemeral tributaries during high-flow events may occasionally replenish gravel patches in between major flood events.

- The bed surface material of the Pit 4 reach is composed primarily of boulders greater than 12 inches in diameter that only the largest flow events can mobilize. Thus, the ability of the channel bed to incise is limited, and no evidence of recent incision has been noted downstream of the Pit 4 dam.
- The total quantity of sediment delivered to the Pit 5 reservoir annually is estimated to be about 77.7 acre-feet, including approximately 0.3 acre-foot (520 tons) of bedload.
- The Pit 5 reservoir has a trap efficiency estimated to range from 0 to 2 percent. Of the total inflow of 77.7 acre-feet, an annual average of 76.9 acre-feet (134,000 tons) is passed downstream.

Pit 5 reach

- Lake Britton, the Pit 4 reservoir, and the Pit 5 reservoir annually trap about 26,000 tons, 950 tons, and 520 tons, respectively; this material would formerly have been delivered to the Pit 5 reach.
- Estimated bedload inputs from Kosk Creek and Nelson Creek contribute an estimated 15,900 and 5,700 tons of bedload, respectively. This is almost as much as was previously delivered to upstream reaches, and equivalent to approximately 44 percent of the pre-project bed load material. Inputs from Kosk Creek and Nelson Creek have likely increased as a result of upstream land management activities.
- Catastrophic debris flows in tributary streams may deliver large amounts of sediment to the mainstem Pit River upstream of Nelson Creek and downstream of Kosk Creek.
- Two large anthropogenic sediment sources were identified within the Pit 5 reach. One of the sources was a landslide resulting from a failure of the penstock leading to the James B. Black powerhouse (McCloud Pit Project) in 1978 that triggered a debris flow and altered the configuration of the channel in the vicinity of Little Joe Flat. The second is a large spoil pile in the headwaters of Miners Creek that consists of tailings produced during the construction of the Pit 5 tunnel. Sediment transport modeling suggests delivery of the spoils material from Miners Creek is currently low.
- Existing base flows of 100–200 cfs are capable of moving sand and small-gravel-sized material in the Pit 5 reach, and floods can move boulders between 0.5 and 1 meter in diameter.
- The potential bedload transport capacity of the Pit River in the Pit 5 reach has decreased as a result of project operations, but is still almost double current estimated inputs.
- Bedload transport modeling indicates that the potential transport capacity downstream of Nelson Creek is lower than upstream reaches. Thus, transport capacity and bedload supply are closer to equilibrium; the model results are supported by the more extensive occurrence of depositional features (bars and islands) downstream of Nelson Creek.

- Because of high inputs from Kosk and Nelson creeks, the potential transport capacity and supply of bedload downstream of Kosk Creek continue to be closer to equilibrium. Consequently, accumulations of gravel and sand are more common than in upstream reaches.
- The bed surface material of the upper Pit 5 reach is composed primarily of boulders greater than 12 inches in diameter that only the largest flows can mobilize. Therefore, the ability of the channel to incise is limited, and no evidence of recent incision was noted downstream of the Pit 5 dam.
- Some evidence of winnowing of bar top sediments was noted between Nelson Creek and Kosk Creek. It is unclear whether this is a result of sediment starvation associated with project operations or natural incision and armoring, occurring as a result of long-term incision through Quaternary landslide deposits.
- The total quantity of sediment passing through the Pit 5 powerhouse annually is estimated to be about 247.7 acre-feet per year, equivalent to approximately 75 percent of the pre-project sediment load.

3.3.1.2 Environmental effects:

Water Quantity

Reservoir water levels and flows in the bypassed reaches

Although reservoir water level management, minimum flows to the bypassed reaches, spring freshet flows, flow shaping, and ramping rates associated with the beginning and end of controlled releases from project dams are hydrological functions, their consequences primarily influence habitat for aquatic and riparian biota and recreational resources. Therefore, we discuss these measures in section 3.3.2.2, *Aquatic Resources*, section 3.3.3.2, *Terrestrial Resources*, and section 3.3.5.2, *Recreational Resources*.

Flow and water level monitoring plan

In its October 9, 2002, letter to the Commission, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop a flow measurement plan for the Pit 3 and 4 Project bypassed reaches which the FS would approve. The FS makes a similar Section 10(a) recommendation for the Pit 5 bypassed reach. The plan would include:

- a description of existing and proposed flow measurement gages or devices and a detailed proposal for measuring flow in each of the project reaches with existing or proposed devices;

- a description of existing and proposed provisions for making mean daily flow data continuously available to the public from the USGS via the Internet, and for making hourly and 15 minute gage data publicly available through the USGS; and

- evidence of gage calibration and historical and recent cross-sectional data, if applicable.

In the interim, the FS would require that PG&E maintain and document continual compliance with the specified Pit 4 and 5 minimum flows at the USGS gages below Pit 4 dam and at the Big Bend Bridge, respectively. The FS states that interim monitoring measures on the Pit 3 reach, prior to approval of the above plan, should be based on the best available methods. The FS final 4(e) condition No. 17 specifies the same provisions.

In its October 9, 2002, letter to the Commission, Interior recommends as a Section 10(j) measure, that PG&E develop a gaging plan for the reservoir and bypassed reaches in consultation with the resource agencies and stakeholders. The plan would describe how reservoir elevations and inflow to Lake Britton, and flows in the stream reaches below the Pit 3, 4 and 5 dams are to be measured. The plan would include but not be limited to:

- description of existing and proposed site specific locations of flow gages;

- type of instrumentation and recording output;

- frequency of data downloads;

- means for accessing data, e.g., station telemetered or not, standards met;

- entity responsible for maintenance and records;

- plans for dissemination of data;

- flow phone availability;

- rationale for number of gages in place and their locations; and

- descriptions of need and proposed plan for installing, operation and maintaining new gages.

In its November 25, 2002, letter to the Commission, PG&E notes that, currently, flow released from the Pit 3 dam into the Pit 3 bypassed reach can be estimated based on the percent opening of the Lake Britton low-level opening and the level of the lake, but the accuracy of this estimation may not be suitable to verify compliance with the minimum flows required under the term of a new license. PG&E states that it would evaluate the feasibility of installing a flow-release system at Lake Britton, which would be of acceptable accuracy to verify compliance with minimum flow requirements. PG&E notes that based on site visits by PG&E and USGS staff during the last decade, it is evident that no site on the Pit 3 reach would be suitable to meet typical USGS standards for accuracy without major channel modifications. PG&E comments that it may be possible to achieve precise flow measurements in the Pit 3 bypassed reach with a large scale bed disturbance that would require construction of a full-length control structure and installation of a USGS-type gaging station. However, PG&E points out that in order to construct the control structure and associated gaging station, an access road would need to be constructed from River Road to the upper end of the bypassed reach. Construction of this access road would be a major undertaking given the high and extremely steep slope adjacent to the river channel. PG&E indicates that construction of this access road could result in adverse environmental effects.

The PRCT agreement specifies that flows in the Pit 3 bypassed reach would be measured as the sum of spillway flow calculated from hourly reservoir elevation to account for spill volume and the hourly mean release from a calibrated release valve at the dam, or by other means acceptable to the USGS. Flows in the other two bypassed reaches would be measured at existing USGS gages. The FS and FWS signed the PRCT agreement and we presume this agreement supercedes their previous recommendations pertaining to flow measurements for compliance purposes.

Our Analysis

Various entities, some with mandatory conditioning authority, recommend in section 3.3.2.2, *Aquatic Resources*, section 3.3.3.2, *Terrestrial Resources*, and section 3.3.5.2, *Recreational Resources*, various measures that pertain to flow releases and the water surface elevation of project reservoirs: (1) minimum flow recommendations in all three bypassed reaches with provisions for flow shaping; (2) establishment and implementation of appropriate up and down ramping rates; (3) the release of dry-year freshet flows in a controlled manner; (4) implementation of measures that would minimize, to the extent feasible, the effects of uncontrolled high-flow releases to the bypassed reaches; and (5) restrictions to the water surface elevations at Lake Britton. The Commission would need to be able to verify compliance with the flow and water-level restrictions that may be included in any license that may be issued for this project.

PG&E currently operates the following five flow gaging stations in conjunction with USGS:

- gage no. 11362300: Pit 3 powerhouse near Burney, CA;
- gage no. 11362600: Pit 4 powerhouse near Burney, CA;
- gage no. 11362700: Pit 5 powerhouse near Big Bend, CA;
- gage no. 11362500: below Pit 4 dam; and
- gage no. 11363000: at Big Bend, CA.

The water surface elevation of Lake Britton is currently monitored and reported by PG&E gage no. PM37 (letter from R. Shiffman, Senior License Coordinator, PG&E, San Francisco, CA, to the Commission, dated December 6, 2002). PG&E's continued operation and maintenance of the five flow gaging stations and PG&E gage no. PM37 should help to document compliance with flow requirements that may be required in any new license that may be issued for this project. However, direct measurement of flows in the Pit 3 bypassed reach is currently not possible because there is no gaging station.

Flow compliance monitoring at the Pit 3 bypassed reach would necessitate development of a new measuring scheme. The ideal location for a flow gaging station for compliance monitoring is adjacent to the channel immediately downstream of the flow release point, which in this case would be the Pit 3 dam. A stage/discharge relationship could be developed and accurate flow measurements measured on a continuous basis. However, the Pit 3 bypassed reach from the dam to the confluence of Rock Creek is bordered by very steep slopes that rise over 100 feet from the river and the channel itself would likely require the construction of a weir to establish an accurate stage/discharge relationship because of its braided, coarse, boulder-dominated substrate. Installation of a flow gaging station adjacent to the bypassed reach would result in environmental consequences associated with the construction of the gage station itself, the associated access road, and provision of electricity to operate the gaging station instrumentation (e.g., potential erosion and sedimentation, destabilization of existing steep slopes, disturbance of aquatic habitat, disturbances to bald eagles, potential degradation of the local visual quality, and potential disturbance of cultural sites). The PRCT approach to reasonably and accurately measure the flow released to the bypassed reach by considering such techniques as establishing calibrated head (depth of the release point at various Lake Britton water levels) and gate setting discharge relationships would avoid the environmental effects associated with constructing a new gaging station and is likely to provide data sufficient for compliance monitoring within a reasonable tolerance limit.

We consider recommendations to provide available flow information to the public to be primarily related to recreational resources (as discussed in section 3.3.5.2, *Recreational Resources*), because it would primarily benefit boaters and anglers.

Water Use

Although PG&E originally proposed to increase minimum flows into the Pit 4 and Pit 5 reaches, it did not propose to increase minimum flows into the upstream Pit 3 reach. Consequently, PG&E's minimum flow proposal could have been implemented without changing the status quo with respect to the amount of inflow needed for generation and minimum flows at the Pit 3 development. However, now PG&E proposes, through the PRCT agreement, to release minimum flows to the Pit 3 bypassed reach ranging from 280 to 350 cfs (see section 3.3.2.2, *Aquatic Resources*, for a discussion of proposed and recommended minimum flows). The additional water to meet the higher minimum flow requirements at the Pit 3, Pit 4, and Pit 5 dams could come from reduced generation at their associated powerhouses. The additional water for the Pit 4 and Pit 5 bypassed reaches could also come from passing more water through the Pit 3 powerhouse. In the latter instance, this could be achieved by increasing generation during off-peak periods, which would result in a more rapid drawdown of Lake Britton. If PG&E takes this approach to meeting its proposed flow regime, it ultimately could lead to more frequent occurrences of Lake Britton water levels approaching levels that are suboptimal for shoreline spawning fish (discussed in section 3.3.2.2, *Aquatic Resources*) and recreational use (discussed in section 3.3.5.2, *Recreational Resources*). To compensate for this more rapid drawdown of Lake Britton, PG&E could either curtail generation at the Pit 3 powerhouse or seek to increase flow into Lake Britton. As discussed in more detail in section 3.3.2.2, *Aquatic Resources*, other parties, including the FS, Interior, and CDFG originally recommended higher minimum flow releases at all three project dams.

The PRCT agreement establishes an operating protocol for all project developments, including the Pit 3 dam. The protocol would entail deflating at least one of the Pit 3 dam spillway bladder gates within 24 hours following the cessation of the first spill event after November 1, but no later than December 1. The bladder gate would remain deflated until April 20 or until there is not flow passing the Pit 3 dam in excess of the required minimum flow for the Pit 3 bypassed reach, whichever is later. The expected result of implementing this protocol would be an increased frequency of spillage at the Pit 3 dam, which could enhance the ability of upstream water users to divert flow from the Pit River, if their ability to do so is linked to periods of spill at the Pit 3 dam.

To meet these proposed or recommended minimum flow regimes, PG&E would need to either: (1) while utilizing the same quantity of inflow, reduce generation flows by the amount necessary to meet the new minimum flow requirement; (2) through the exercise of its senior water rights, to the extent that they exist, meet the increased minimum flow requirements through the utilization of additional inflow, while keeping generation flows unchanged; or (3) implement a flow utilization plan intermediate to (1) and (2), above. In our developmental analysis (chapter 4.0), we assume that the first approach would be taken by PG&E.

PG&E, by letter dated January 22, 2003, submitted a report that quantified the effects on upstream water users if option (2) is implemented (Gallo and Jensen, 2003). PG&E estimated that implementation of the FS minimum flow alternative would result in an annual decrease of stored upstream surface water of 43,400 acre-feet, Interior's minimum flow alternative would reduce stored surface water by 68,200 acre-feet, and CDFG's minimum flow alternative would reduce stored surface water by 78,400 acre-feet. According to that report, the associated loss in agricultural production would be $7,767,776, $12,150,512, and $13,967,744, respectively, assuming that the crops irrigated are 64.6 percent alfalfa, at $100 per ton, and 36.4 percent native pasture grasses, at $70 per ton.

The FS, CDFG, South Fork Irrigation District (SFID), the University of California at Alturas/Modoc County, and others, in their comments on the draft EIS, presented alternative interpretations of the potential environmental (socioeconomic and ecological) impacts that would result if increased minimum flow requirements at the Pit 3, 4, 5 Project were met by PG&E exercising its senior water rights.

Our Analysis

The relative socioeconomic values of the use of the river water for agriculture or for power generation are, in the first instance, matters for appropriate state authorities to resolve. The Commission's examination under Part I of the FPA is to determine how (if at all) the project can best use its state-determined water rights in the public interest, giving equal consideration to developmental and environmental values.

Any water rights disputes that may arise from new higher minimum flow requirements would be for the SWRCB to resolve. If necessary, the license requirements bearing on this matter can be made subject to amendment once the state resolves the matter.

To estimate the quantity of water associated with new minimum flow recommendations, we developed an operational model to analyze flow duration data in combination with the operating characteristics of the project turbine-generator units. This model predicted the additional water required to satisfy those recommendations (table 22).

Table 22. Quantity of additional water required to meet various minimum flow alternatives at the Pit 3, 4, 5 Project. (Source: Staff)

	Pit 3 (acre-feet)	Pit 4 (acre-feet)	Pit 5 (acre-feet)
No-Action	0	0	0
PG&E Proposal (original)	0	32,630	98,182
FS Recommendation (original)	125,607	197,072	264,373
Interior Recommendation (original)	276,555	349,448	385,410
CDFG Recommendation (original)	356,340	459,909	496,871
PRCT Agreement	21,410	61,799	193,761

Denny is concerned that increased stream flow requirements might cause the operation of the Pit 3, 4, 5 Project to be modified in such a way that Denny would be limited in its ability to exercise its diversion rights (letters from Paul S. Simmons, Attorney for Denny Land and Cattle Company, LLC, Sacramento, CA, to the Commission and Jack Gipsman, U.S. Department of Agriculture, dated December 19, 2002). The ranch currently produces revenues of over $2.5 million annually, supporting the local and regional economy, and Lake Margaret itself provides recreation, aesthetic, and wildlife benefits.

Denny's ability to divert flow is limited to those periods when spillage occurs at the Pit 3 dam at Lake Britton. There would be no change in the frequency of spillage with PG&E's originally proposed and our originally recommended minimum flow regime (discussed elsewhere in this document). However, with the higher minimum flows originally recommended by the FS, Interior, and CDFG, spillage could occur less frequently at the Pit 3 dam. This could have an adverse effect on Denny's ability to divert water to Lake Margaret. We currently do not have sufficient information to be able to quantify the effect of less frequent spillage on Denny. The PRCT rationale statement indicates that with the operating protocols specified in the PRCT agreement, there would be a slight increase in the frequency and duration at the Pit 3 dam. This could result in a slight enhancement of Denny's ability to divert flow.

As a result of negotiations with upstream water users, PG&E has withdrawn its water right complaints related to the existing operation of the Pit 3, 4, 5 Project that it had filed with the SWRCB (letter from R. Livingston, Lead Director, Power Generation, PG&E, to C. A. Rich, Complaints Unit, SWRCB, Sacramento, dated February 12, 2004). PG&E also developed a "commitment" in consultation with upstream water rights holders that provides assurance that PG&E would not initiate new water right complaints for specified uses of water consistent with state law (letter from R. Livingston, Lead Director, Power Generation, PG&E, to E. Anton, Chief, Division of Water Rights, SWRCB, Sacramento, dated February 13, 2004). Specifically, this commitment states the following:

> PG&E will not initiate any new complaint or claim of water rights harm against any holder of a pre-1914 appropriative, riparian, or permitted or licensed appropriated right, for any diversion or use of water upstream of Lake Britton (but not including any diversion in the Fall River or Hat Creek watersheds), so long as said diversions and use by the holder of the right do not exceed the amounts of the holder's historical diversions and use before 1985, and are consistent with the holder's water rights.

PG&E states that this commitment would go into effect after issuance of a new license (and resolution of any associated appeals) with instream flow and other operating requirements that are consistent with the PRCT agreement or requirements that would not materially decrease annual generation more than the PRCT agreement.

Water Quality

<u>Water Quality Plan</u>

The FS recommended, as a preliminary Section 4(e) condition, that PG&E develop a water quality plan in consultation with applicable federal and state agencies within 1 year of license issuance. The plan would include provisions to do the following:

(1) address sanitation facilities and public information at appropriate key recreation locations to eliminate water contamination effects on recreationists and aquatic habitats on National Forest System lands;

(2) monitor water temperature in project reservoirs and bypassed reaches so that effects of any changes in project flows on beneficial uses can be documented;

(3) develop appropriate ramping rates to reduce suspended sediments downstream of project dams;

(4) address aquatic conservation strategy (ACS) objectives within Northwest Forest Planning area and other FS planning objectives elsewhere in the project; and

(5) address how project operations and maintenance (O&M) would meet water quality BMPs by specifically addressing developed and dispersed recreation, roads, vegetation manipulation, prescribed fire and wildland fire planning and fire suppression, and watershed practices.

Interior recommended, as a Section 10(j) measure, that PG&E develop a water quality monitoring plan in consultation with the FWS, FS, CDFG, and SWRCB within 6 months of license issuance. The plan would include measures to ensure compliance with the state of California Water Quality Control Plan requirements for DO, biological oxygen demand (BOD), turbidity, conductivity, and pH in all reservoir and stream reaches within the project boundaries.

Interior also made a Section 10(j) recommendation that PG&E develop a water temperature maintenance and monitoring plan in consultation with the FS, FWS, CDFG, and SWRCB within 6 months of license issuance. This plan would describe measures to be taken to maintain mean daily water temperatures of 20 degrees C (68 degrees F) or less in the three bypassed reaches, to the extent that PG&E can control such temperatures (including implementing Interior's recommended minimum flows and measures to manage the cold water in deeper portions of Lake Britton). Interior further specifies that PG&E should install equipment needed to monitor compliance with this criteria within 6 months of license issuance.

In response to our recommendations in the draft EIS, PG&E, by letter dated June 19, 2003, agreed that a water temperature monitoring program could provide valuable information that may be helpful in understanding observed biological responses to changed conditions as a result of implementation of new license conditions. PG&E suggested that taking periodic checks of DO profiles near the Pit 3 dam may also be valuable.

The FS in its final 4(e) condition No. 22, would require that PG&E develop a water quality and temperature monitoring plan in consultation with the FS, SWRCB, CDFG, and FWS. The plan would provide for, but not necessarily be limited to, the following measures: (1) continuous water temperature monitoring; (2) periodic measurements of DO; (3) periodic Lake Britton temperature and DO profiles; and (4) documentation of procedures used to meet water-related BMPs.

In its biological opinion on the effects of the proposed action on the federally listed bald eagle, submitted to the Commission by letter dated October 15, 2003, the FWS includes condition 2.B that pertains to development and implementation of a water quality monitoring plan. The condition specifies that within 1 year of license issuance, PG&E should file with the Commission, for approval, a water quality monitoring plan, in cooperation with the FWS, and other interested stakeholders. The plan would include, but not be limited to, sampling of water, sediment, invertebrates, and fish, with the appropriate temporal, spatial, and taxonomic composition to adequately represent conditions. The plan would also be designed to adequately characterize areas of methylmercury production, as well as mercury loading into the ecosystem. The former goal should include a focus on identifying those aspects of project operations and management that may affect methylmercury dynamics in the Lake Britton ecosystem. FWS states that the production of methylmercury in the aquatic environment can be influenced by numerous biotic and abiotic factors, although microbial methylation by sulfate-reduction bacteria is regarded as the most important pathway for mercury bioaccumulation. Additional ecosystem characteristics, such as temperature, DO, nutrient loads, sediments, and water level fluctuations that can cause oscillating redox cycles, are also important factors influencing methylmercury production, according to the FWS. Although FWS acknowledges that the dams associated with the Pit 3, 4, 5 Project are not the source of the mercury in the aquatic ecosystem, FWS concludes that it is possible that the way in which the dams are operated may be contributing to the production of methylmercury and exacerbating the contamination of the aquatic food chain. The FWS states that although no definitive conclusions can be drawn at this time, it may be that weekly water level fluctuations in Lake Britton is enhancing methylmercury production. FWS suggests implementing a water quality plan, as it relates to benefits to the bald eagle and its foraging base, can achieve the Bald Eagle Recovery Plan Task: 2.222, Monitor Levels of Pollutants and the Effects They May Have on Eagles.

Our Analysis

Although we agree with the FS about the need to address project-related activities that may influence water quality, in many cases, we consider it more appropriate to address such measures in more focused plans. For example, we conclude the need for and specific placement of sanitation facilities associated with recreational use, as originally recommended by the FS, would be best addressed in a recreation management plan. We also conclude that public information dissemination regarding measures that could be taken to protect water quality would be best addressed in an interpretive and education plan. Both of these measures (included in items (1) and, in part, (5) of the FS's original recommendations) are discussed in detail in section 3.3.5.2, *Recreational Resources*. We discuss a plan to develop appropriate ramping rates, item (3) of the FS's original recommendations (and now an element of the PRCT agreement), primarily in section 3.3.2.2, *Aquatic Resources*. Similarly, BMPs that pertain to the inter-relationship of the specific items specified in item (5) of the FS's original recommendations and water quality would be addressed in focused plans. Vegetation manipulation would be addressed in a vegetation management plan (discussed in section 3.3.3.2, *Terrestrial Resources*); prescribed fire and fire planning and suppression would also be addressed in part by the vegetation management plan, as well as the fire management and response plan (discussed in section 3.3.6.2, *Land Use and Aesthetic Resources*); and the prevention of water quality degradation from project roads would be addressed in a road and facilities management plan (also discussed in section 3.3.6.2, *Land Use and Aesthetic Resources)*. We acknowledge that many of these plans are inter-related, which influenced our conclusion that an overarching LHMP (discussed in section 3.3.6.2, *Land Use and Aesthetic Resources*), which would include most of the plans referenced above, would facilitate cross-referencing of plans by PG&E, the Commission's staff, and other interested stakeholders.

Our review of available water quality information (tables 7 through 15) indicates that project waters are generally in compliance with applicable state water quality criteria (table 6). Table 9 indicates that water temperature in the bypassed reaches are typically less than 20 degrees C (68 degrees F). Some DO values measured in the deeper portions of Lake Britton (tables 10 and 11) were below the applicable criterion of 7 mg/l or 85 percent saturation. Such DO stratification is typical of many deeper lakes, especially those that are eutrophic, such as Lake Britton, regardless of whether they are natural lakes or created reservoirs. The only evidence that this low DO and project operations may influence the DO of the river reaches is a single sample measured at station Pit River 5, which is a short distance downstream of the Pit 3 powerhouse tailrace (table 12). The location of the invert of the intake to the Pit 3 powerhouse on Lake Britton would typically withdraw water from mid-depths, based on our review of Exhibit F drawings in the license application. This would infrequently result in relatively low DO water being released from the Pit 3 powerhouse. There is no evidence that such local reductions in DO or temperature in project-influenced waters have adversely affected aquatic biota.

Proposed and recommended flow regimes under a new license that may be issued for this project have the potential to influence the temperature of project waters. This, in turn, could alter the quality of the habitat for temperature sensitive aquatic biota. Consequently, we discuss the influence of flow on water temperature in section 3.3.2.2, *Aquatic Resources*. Water temperature also influences the suitability of habitat for foothill yellow-legged frog, which we discuss in section 3.3.3.2, *Terrestrial Resources*.

The predicted water temperature consequences of different flow regimes are based on water quality modeling that PG&E performed. Measurements taken during the 2002 controlled release study were used to validate the accuracy of PG&E's water temperature modeling (Jones and Stokes, 2003). The temperature of project bypassed reaches is influenced not only by releases from project powerhouses and project dams, but also by inflow from tributaries and from numerous hot and cold springs that occur along these reaches. Such complex interactions may confound a traditional modeling approach. We therefore agree with the FS and Interior that it is appropriate to monitor the water temperature of project waters (primarily in the bypassed reaches) to ensure that the flow regime specified in any new license that may be issued for this project does not adversely influence the temperature regime so as to affect aquatic biota that are of importance. If project operations seem to result in conditions that could result in the mean daily water temperature of project operations exceeding 20 degrees C (68 degrees F), it may be possible to temporarily modify project operations to maintain cooler water in the project reaches by increasing generation, which would decrease the amount of warmer surface water passing over spillways, or increasing flows from low level gates, which would increase the portion of cooler water from deeper portions of the project reservoirs. Because the water temperature and DO of all three project reaches is influenced by water withdrawals from Lake Britton, both at the dam (from the release valve near the base of the dam and from spillage) and at the Pit 3 powerhouse intake, periodic temperature and DO profiles taken near the dam, as FS recommends and PG&E now proposes, would enable documentation of the relationship of Lake Britton water quality to the observations of temperature and DO in the downstream reaches.

Project operations also have the potential to increase turbidity and suspended solids due to erosion and sedimentation. We consider it appropriate to include monitoring for such parameters in site specific plans that are designed to minimize effects, such as an erosion control plan and spoil pile management plan, discussed later in this section; the site-specific design for any recommended new recreational facilities, which could be included in a recreation management plan (discussed in section 3.3.5.2, *Recreational Resources*); or shoreline stabilization procedures that are addressed in an HPMP (discussed in section 3.3.7.2, *Cultural Resources*).

The FS preliminary 4(e) condition would require a water quality plan that addresses sanitation facilities and public information to eliminate water contamination effects on recreationists and aquatic habitat, which implies that there is currently a coliform problem in project waters. We see no evidence that the state's fecal coliform standards are violated under existing conditions. General project operations do not have the ability to influence the prevailing conductivity or pH of project waters. We therefore question the need for monitoring coliform, pH, and conductivity.

We did not recommend in the draft EIS that PG&E develop and implement a general multi-parameter water quality monitoring plan as originally recommended by Interior. During the August 28, 2003, Section 10(j)/FS clarification meeting, FWS pointed out that although high mercury levels may be widespread in water bodies throughout California, such high levels are not acceptable and FWS is concerned that Lake Britton acts as a settling basin to concentrate mercury (see meeting summary issued by the Commission on September 22, 2003). In response, PG&E stated that Lake Britton is not operated as an annual storage reservoir and on a weekly basis all the water entering the lake leaves the lake. PG&E stated that for these reasons Lake Britton does not have the potential to concentrate mercury and that proposed changes in operation would not lengthen retention times. FWS identified recreational angling as a potential project nexus to mercury concerns. FWS also pointed out that since bald eagles primarily prey on fish, high mercury levels could adversely influence bald eagles.[5] The FWS stated that algal blooms, due to their effects on pH and DO levels, could have a major effect on the bioavailability of mercury, by increasing methylation rates. PG&E stated that since Lake Britton has a short residence time, reservoir operations do not contribute to algal blooms and upstream sources (e.g., municipal, agricultural) are likely the primary causes of nutrient input and algal growth.

Within the hypolimnion, anaerobic conditions can cause the mercury associated with sediments and settling particles to be reduced to dissolved gaseous mercury and diffused into the water. At the hypolimnion/epilimnion interface, sulfide and dissolved gaseous mercury react with oxygen to produce sulfate and inorganic mercury. Sulfate and reducing microorganisms can then produce methylmercury (Watras, et al., 1995). However, as shown in table 10, although some readings within the deepest area of Lake Britton were below the applicable DO criteria, no measured values approach anaerobic conditions. Consequently, we conclude that methylmercury production at the hypolimnion/epilimnion interface of Lake Britton is likely to be minimal.

Higher pH levels act to buffer acidic deposition, including mercury compounds, making mercury less susceptible to methylation (Miskimmin, et al., 1992). Lake Britton and the Pit River in general, are alkaline with pH values typically near 8.0 (see tables 7 and 13). Therefore, conditions in Lake Britton are not suitable for excessive methylmercury production.

Highly productive aquatic systems typically do not generate high mercury levels due to the efficiency of converting food to biomass within the food chain (Harris and Bodaly, 1998). We consider Lake Britton to be such a system, given that it appears to be acting as a nutrient sink, based on our review of water quality (i.e., nutrient and chlorophyll *a*) and aquatic biota sampling (see section 3.3.2.1, *Aquatic Resources*).

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[5] Predators that are near the top of the food chain, such as piscivorous fish (e.g., smallmouth bass and Sacramento pikeminnow) tend to have higher mercury levels than animals near the bottom of the food chain (such as Sacramento sucker [see table 18], which is the dominant prey of bald eagles in the Lake Britton area; see section 3.3.5.1, *Threatened and Endangered Species*, table 38).

Fine-grained sediments and other suspended solids tend to decrease the amount of dissolved mercury in the water column because mercury and other heavy metal molecules adsorb to such particles and settle to the bottom of the lake or reservoir. Once at or near the bottom of the reservoir, the mercury is largely unavailable for bioaccumulation in the food chain and out of the region where mercury methylation is likely (Rudd and Turner, 1983). The concentration of total suspended solids is higher in water upstream of Lake Britton that in water downstream of the Pit 3 dam, which suggests that Lake Britton is serving to trap fine grained particles with mercury that may be adsorbed to such particles, thus making mercury less available to aquatic ecosystems downstream of Lake Britton.

Short term reservoir fluctuations can affect mercury bioaccumulation by enhancing the mobilization of inorganic or methylmercury from riparian sources. Daily or weekly water level fluctuations of reservoirs which have substantial areas of riparian wetlands may act to flush methylmercury into the reservoir. Lake Britton does not have substantial riparian wetlands which could be affected by the existing and proposed normal 3 to 6 foot weekly water level fluctuation. Erosion of the shoreline at a reservoir such as Lake Britton, is sometimes exacerbated by waves and water level fluctuations and can increase the mercury concentration and loading within the reservoir if mercury is present in the eroded soil. However the effects of any resultant increase of mercury in the water column would be negated to some extent by the increased suspended solids, which would enhance conditions for mercury adsorption and eventually settle to the bottom.

The sampling results shown in tables 16 and 18 indicate that there is mercury in the water column of Lake Britton and that some mercury is accumulating in fish tissue. This is a common phenomena in lakes and reservoirs in northern California and elsewhere. The nearby coastal mountains are naturally rich in mercury, which historically was processed to produce quicksilver. This mercury was taken to the Sierra Nevada and Klamath mountains where it was used in gold mining, resulting in the release of large amounts of mercury into California's surface waters (COEHHA, 2003).

FWS initially raised the mercury issue during our August 28, 2003, Section 10(j)/FS clarification meeting. We discussed whether there was a relationship between mercury levels in Lake Britton and project operations. Since mercury is present in many northern California lakes, we asked a representative from the SWRCB how this issue would typically be addressed. He explained that in most cases, if high mercury levels are found in fish tissue, the SWRCB would request CDFG to conduct more intensive fish monitoring. Following this monitoring, the California Office of Environmental Health Hazard Assessment (COEHHA) would be responsible for issuing a lake advisory, if needed. He stated that SWRCB would not likely consider high mercury fish tissue concentrations to be a "reasonable controllable factor" by a hydropower licensee (see meeting summary issued by the Commission on September 22, 2003).

We conclude that the presence of mercury in Lake Britton is the result of factors beyond PG&E's control. The presence of Lake Britton, which serves as a sink for fine-grained particles, is likely serving to prevent the transport of mercury to aquatic ecosystems downstream of Lake Britton, which we consider to be a positive attribute of the Pit 3, 4, 5 Project. The mercury monitoring program outlined in the FWS biological opinion is likely to be very costly, yet it is unclear what specific action the Commission could require of PG&E based on the monitoring results. We see no evidence that project operations are influencing the amount of mercury that is in project waters.

Hazardous Substances Plan

In its October 9, 2002, letter to the Commission, the FS recommended, as a preliminary Section 4(e) condition, that PG&E file with the Commission, a hazardous substances plan (HSP) approved by the FS for oil and hazardous substances storage and spill prevention and cleanup. The FS recommended that, as a minimum, PG&E should develop an HSP that:

- outlines PG&E's procedures for reporting and responding to releases of hazardous substances, including names and phone numbers of all emergency response personnel and their assigned responsibilities;
- maintain in the project area a cache of spill cleanup equipment suitable to contain any spill from the project;
- semi-annually inform the FS of the location of spill cleanup equipment on National Forest System lands and the location, type, and quantity of oil and hazardous substances stored in the project area; and
- inform the FS immediately of the nature, time, date, location, and action taken for any spill affecting National Forest System lands and PG&E adjoining fee title property.

Our Analysis

In accordance with EPA's regulations (40 CFR §112.1), an HSP (also frequently referred to as a spill prevention control and countermeasure plan) is required to be in place for any facility where unburied storage capacity exceeds 1,320 gallons of oil or a single container has a capacity in excess of 660 gallons. According to Exhibit F-27 of PG&E (2001), there are two 16,000 gallon oil tanks associated with the Pit 5 powerhouse. This oil is likely used for cooling the nearby transformers. Additional oil tanks are shown on Exhibit F-16 and F-18 in the vicinity of Pit 4 powerhouse.

PG&E, under EPA's regulations, is required to develop and implement a HSP, independent of this relicensing procedure. This plan would be designed to reduce the possibility of an oil or other hazardous substance spill and reduce the effects on the local area and the Pit River if a spill occurs. This plan would likely include the measures outlined above by the FS. In its comments on the draft EIS dated May 19, 2003, the FS concurred that its recommended HSP would be redundant with other water quality protection plans that are in place or would be in place following the issuance of a new license, and deleted its recommended HSP from its revised and final 4(e) conditions.

Erosion and Sedimentation

Erosion at Lake Britton and from public use of project lands and roadways

Wind generated waves and wakes from boating use on Lake Britton create eroding banks that may result in local degradation of water quality from sedimentation, affect bank swallow habitat, and endanger known and unknown cultural sites along the shoreline of the lake. Recreationists who frequent the numerous informal trails along the shoreline of Lake Britton and project roads to the Pit River contribute to ongoing erosion of those trails.

Although PG&E does not propose any stand-alone measures that address erosion and sedimentation control along the shore of Lake Britton, erosion monitoring and control measures are included in PG&E's revised HPMP, submitted to the Commission by letter dated October 11, 2002. Measures that PG&E proposes at known cultural sites are addressed in section 3.3.7.2, *Cultural Resources*, and include such measures as stabilizing project-related active shoreline erosion sites using filter fabric and riprap, revegetating with native plants such as willows, alders, and chokeberries, and installing gates or boulders to restrict vehicular access to sensitive areas. Signs identifying sensitive areas were also proposed to be placed on or near existing trails at selected locations.

In its October 9, 2002, letter to the Commission, the FS recommended several measures in specific plans that would serve to address shoreline erosion at Lake Britton and, in some cases, other project waters. For example, in its wildlife mitigation and monitoring plan, the FS recommended continuation of the existing boat speed restrictions at upper Lake Britton, west of the gasline crossing. Although primarily designed to minimize disturbances to bald eagles, this speed restriction also would serve to reduce the effect of boat wakes on erodible shoreline sites. The FS recommended, in its recreational construction and reconstruction measures, stabilization of existing recreational trails and inclusion of erosion control measures in the design of any new trails. In its road and facilities management plan, the FS recommended that PG&E should construct, operate, and maintain project facilities, including reservoir shorelines, to maintain natural fluvial and colluvial sediment transport to the project reaches to the extent feasible. In addition, the FS recommended, in its road and facilities management plan, that PG&E address measures to control erosion related to project facilities, including reservoirs.

Interior, in its October 9, 2002, letter to the Commission, made similar recommendations for erosion control. Interior specifically recommended development of an erosion control plan for reservoirs and bypassed reaches, including remedial measures to correct known erosion sites. Interior also recommended that specific erosion control measures be included in its recommended vegetation management plan and recreation management plan.

Interior, in its October 9, 2002, letter, and the FS and the Tribe, in their October 10, 2002, letters to the Commission, recommended that PG&E finalize and implement an HPMP that would include shoreline stabilization measures to protect cultural resources, as appropriate.

In response to Interior's request that PG&E develop a specific erosion control plan, PG&E, in its November 25, 2002, letter stated that the proposed HPMP currently identifies areas where project-related erosion is occurring within the area of potential effect (APE) and has identified appropriate management of these effects, such as stabilization and access restrictions. PG&E expressed a willingness to work with appropriate agencies and the Tribe to seek their input on whether or not additional erosion control measures are warranted elsewhere.

The FS final 4(e) condition No. 16 would require that PG&E notify the FS, within 3 days, in the event a project facility requires, or a project-related activity results in the need for, emergency site stabilization, erosion protection, or sedimentation management and affects National Forest System land or resources. Any such temporary measures would be implemented a soon as practicable, and the FS would be notified of the steps taken. PG&E would obtain FS approval prior to implementing any permanent remediation measures.

Our Analysis

Most of the project-related erosion and sedimentation concerns would be addressed as specific components of other plans that PG&E proposes to develop and implement or in additional plans that we recommended in the draft EIS be developed and implemented. For example, we recommended in the draft EIS that site-specific erosion and sedimentation measures that pertain to new and existing recreational sites where enhancements are proposed should be included in a recreation management plan. Publicizing recreational restrictions, such as signage that encourages recreationists to stay on marked trails and to obey designated boating speed limits would help to minimize erosion at project-induced trails and at Lake Britton and would be addressed in the recreation management plan. We discuss the measures that we suggest be included in the recreation management plan in sections 3.3.5.2, *Recreational Resources* and 5.2, *Comprehensive Development and Recommended Alternative*. Measures designed to minimize erosion and sedimentation associated with project-related roads, including those in the vicinity of Lake Britton, are discussed in sections 3.3.6.2, *Land Use and Aesthetic Resources* and 5.2, *Comprehensive Development and Recommended Alternative*. Specific measures that would be designed to protect cultural sites from erosion would be included in the HPMP, which is discussed in section 3.3.7.2, *Cultural Resources*.

The erosion control measures discussed above should ensure that existing and future project-related erosion sites are identified and stabilized, as appropriate, and monitored. Such measures would be incorporated into other existing plans, for the most part. The revised HPMP included in PG&E's October, 11, 2002, letter specifies protective measures that should prevent erosion at cultural sites within the APE. We consider PG&E's suggestion that it would be willing to work with agencies and the Tribe to seek input on whether or not additional erosion control measures are warranted to protect cultural sites elsewhere within the APE to be a reasonable offer. Including the results of such consultation in the final HPMP would allow sensitive cultural sites that may be eroding to be treated in an appropriate and confidential manner. However, some erodible sites along the shoreline of Lake Britton may not be addressed in the plans that are recommended for implementation (e.g., any sites not associated with recreational sites or cultural sites).

<u>Erosion related to tunnel spoil piles</u>

Primary concerns of resource agencies that relate to spoil piles center on possible contamination of project waters from erosion or leachate, potential contamination from non-native materials in the piles, effects that spoil pile 4D may have on the river channel and adjacent embankments, and influences that the Miners Creek spoil pile (5A) may have on project waters due to ongoing erosion. In addition, spoil piles 4D and 4P have been suggested as potential scenic vista sites and the current appearance of these piles is not aesthetically pleasing (the proposed scenic vista is discussed in section 3.3.5.2, *Recreational Resources*).

In its October 11, 2002, letter, PG&E proposes to develop a remediation plan for the Miners Creek spoil pile (5A) with provisions for slope stabilization, water quality protection, and revegetation. In addition, PG&E proposes to develop a spoil pile management and maintenance plan for the other spoil piles. PG&E's proposal did not list site-specific measures.

The FS, in its October 10, 2002, letter recommended that PG&E develop plans to address the effects of the project spoil piles. The FS stated that of the 16 spoil piles created during the construction of the project, only three are of substantial concern to the FS because they influence National Forest System lands (spoil piles 4A, 4D, and 4P). The FS stated that these three piles "...create a visual nuisance, have an identified (by PG&E) risk of erosion, are an obstruction to recreational use and access, provide a seed bed for noxious weeds, are a sediment source for materials into the river, smell (rotted trash rack vegetation), and are potentially a source of hazardous waste contamination." In addition, the FS noted that spoil pile 4D "...has significantly washed into the river since its placement in 1954, causing a shift in the rivers course creating a landslide of material into the river on the opposing canyon wall (as per FS observations and PG&E reports)...". However, the FS made no specific recommendations pertaining to the erosion site on the opposing canyon wall. Specifically, the FS preliminary 4(e) conditions recommended that PG&E address its concerns regarding spoil piles on National Forest System lands by doing the following:

- remove all road spoil piles not currently located in approved areas on National Forest System lands to a location either off National Forest System lands or to a FS-approved disposal site;

- revegetate areas where road spoil has been removed with approved native seed to reduce noxious weed invasion (see the FS recommendations pertaining to noxious weeds in section 3.3.3.2, *Terrestrial Resources*);

- remove all visible non-native materials, including construction debris, from the surface of all spoil piles on National Forest System lands;

- develop a plan that addresses erosion control, slope stability, revegetation, and compliance with visual quality objectives for native material spoil piles that remain on National Forest System lands;

- for spoil pile 4P, the one site on National Forest System lands considered for future disposal of project-related native material, develop a stabilization and rehabilitation plan that incorporates future placement of road spoils, site leveling, slope revegetation, and other erosion prevention measures; and

- develop a pit plan for spoil pile 4P that shows current conditions with calculations that show the amount of material that could be accommodated in the future and proposed reclamation measures, and submit the pit plan to Shasta County and the FS.

In addition, the FS indicated that if spoil pile 4P is developed into a vista point for the public, additional visual-related measures may be necessary. Finally, the FS recommended pursuant to Section 10(a) that PG&E develop a Miners Creek spoil pile rehabilitation plan (this spoil pile in not located on National Forest System lands).

As previously noted, Interior recommended development of an erosion control plan in its October 9, 2002, letter to the Commission, with provisions to address various erosion problems. One area that Interior specified should be addressed in the erosion control plan is the erosion associated with the spoil piles. Interior cited the conclusions of PG&E's spoil pile inventory and analysis that only 7 of the 16 spoil piles were considered to have no erosion potential. Interior noted that the remaining 9 sites lie along the Pit 4 and Pit 5 bypassed reaches and have the potential to erode and deposit variable-sized sediment as well as remnants of old building material into the river.

In its November 25, 2002, letter responding to comments and recommendations made by various parties in response to the Commission's REA notice, PG&E affirmed its commitment to develop a spoil pile management plan consistent with the FS Section 4(e) condition. Specifically, PG&E indicates that the plan would identify spoil disposal sites, provide for stabilization of existing spoil piles, and provide for erosion control measures to prevent damage to the Pit River and tributary streams. PG&E would develop this plan in consultation with the FS and other interested agencies.

The FS final 4(e) condition No. 20.a would require that PG&E develop a tunnel spoil pile management plan that would address the following for piles of native material approved by the FS to be left on National Forest System Lands: (1) stabilization/erosion control (using only certified weed-free straw); (2) revegetation; (3) noxious weed management; (4) foreign material treatment, including removal of visible non-native materials; (5) monitoring of water quality (as per pre-licensing study protocol) and adherence to BMPs; (6) consideration of visual quality; (7) utilization of material (especially site 4P); and (8) other measures (i.e., recreational overlook improvements at Pit 4 dam site 4D, dispersed camping at the adit pile 4A, road closure at 4D). Specific measures pertaining to spoil pile 4P are similar to the preliminary 4(e) recommendations.

Our Analysis

PG&E's consultant made the following recommendations regarding the treatment of the Miners Creek spoil pile (Geomatrix, 2001):

- modify surface drainage on top of spoil pile (e.g., line and construct ditches) to remove standing water and effectively transport surface water off of the pile (e.g., pipe with energy dissipater to the creek); consider placing riprap to bolster the steep slopes produced by gullying;
- armor the toe of the spoil pile that is most susceptible to undercutting by the creek and portions of the creek channel;

- consider cleaning or modifying the debris along the Miners Creek channel in the middle and lower sections of the affected reach and establish a stable longitudinal profile and channel cross section (e.g., lower flow depths) that more effectively passes flows with minimal erosion; and

- monitor erosion by establishing a baseline survey of existing conditions to monitor rate and level of erosion, especially after substantial storms.

We conclude that the approach recommended by PG&E's consultant for the Miners Creek spoil pile is appropriate and reasonable. A similar approach, modified to reflect site-specific conditions, would also be appropriate for the other spoil piles with ratings higher than "nil."

PG&E, in its November 25, 2002, letter, commits to consult with the FS and other interested agencies to develop and implement a spoil pile management plan that is generally consistent with the FS preliminary Section 4(e) condition. We conclude that this commitment, coupled with PG&E's October 11, 2002, commitment to develop a remediation plan for the Miners Creek spoil pile with provisions for slope stabilization, water quality protection, and revegetation and a spoil pile management and maintenance plan for the other spoil piles, should resolve issues pertaining to project spoil piles. We conclude that implementation of PG&E's proposed and the FS's recommended spoil pile management plan should stabilize project-related spoil piles, thus preventing erosion and sedimentation in project waters and facilitating site restoration.

We conclude that it is not likely that stabilization of spoil pile 4D would result in any changes to the eroding bank on the opposite bank of the Pit River. Based on our on-site observations during our May 22, 2002, site visit, we consider it likely that surface runoff and Pit River flows would continue to cause erosion and bank sloughing at this site. It may not be practical to stabilize this slope, and the major effort that would be needed to stabilize this bank could result in more environmental harm than allowing the slope to remain in its current state. We expect that heavy equipment would be needed to install substantial bulkheads to prevent further bank erosion, and providing access to this site for such equipment would entail instream work during low flow periods that would be disruptive to aquatic habitat. Some natural bank sloughing occurs along rivers that are not influenced by hydroelectric projects, and can serve as a local source of spawning gravel.

Sediment Transport and Supply

Although sediment transport and supply in project waters is primarily a hydrological process, its consequences primarily influence aquatic habitat. Consequently, we discuss this issue in section 3.3.2.2, *Aquatic Resources*.

Dredging of Project Waters

In its October 10, 2002, letter to the Commission, the FS recommended that PG&E notify the FS in advance of any planned or proposed dredging of project waters that would occur on or affect National Forest System lands. Notification would include information on the purpose of the dredging, dredging locations and extent, approximate amount, composition and size of dredged spoils material, proposed start and end dates of dredging and disposal activities, and proposed disposal method and location. PG&E would not begin dredging until the FS approved the plan. The FS noted that dredge materials may provide suitable material for use in a gravel placement program.

The FS final 4(e) condition No. 19 is similar to its preliminary recommendation, but specifies that in the event that it is necessary to dredge any project forebay or reservoir, PG&E would hold a consultation meeting with the FS at least 90 days prior to anticipated dredging to determine if there is a potential to impact National Forest System lands or resources. A dredging plan would then be developed that addressed the items specified in the previous paragraph as well as the selected method of dredging (along with alternatives considered) and mitigation measures and disposal site stabilization plans.

Our Analysis

Dredging of waters at hydroelectric facilities may be required at some point in the life of the project, perhaps to increase storage capabilities, remove sediment buildup in front of project intakes or discharge gates, or lower the tailwater elevation to increase hydroelectric performance. According to PG&E's November 25, 2002, letter to the Commission, there has been only one dredging operation over the life of the project. This dredging, which occurred in 1998 following a flood and land slides, entailed removal of about 30,000 cubic yards of sediment from the Pit 5 powerhouse tailrace. The Pit 5 powerhouse is not on National Forest System lands. Based on our on-site observations on May 22, 2002, it appears that this material was deposited at spoil pile 5S.

Dredging activities, if needed during the term of a new license, can be undertaken with minimal effects on water quality as long as best management practices are in place to control sedimentation and downstream transport of fine-grained sediment that may be resuspended at the dredging site. Similarly, dredge spoil can be disposed of in an environmentally acceptable manner that minimizes the potential for reintroduction of sediments to project waters, as long as an appropriate disposal site is selected and spoil pile stabilization and restoration measures are well designed prior to the initiation of dredging.

We present the estimated cost of all measures that pertain to water resources in chapter 4.0, *Developmental Analysis*, and make our final recommendations regarding these measures in section 5.2, *Comprehensive Development and Recommended Alternative*.

3.3.1.3 Unavoidable adverse effects: None.

3.3.2 Aquatic Resources

3.3.2.1 Affected environment: Project waters support a warmwater fishery, primarily in Lake Britton, and a coldwater fishery for native rainbow trout that is focused in the three bypassed reaches. Both the project reservoirs and the bypassed reaches support a diverse assemblage of native and introduced species of fish (table 23), many of which are important prey items for bald eagles.

Table 23. Fish species identified in recent surveys of waters in the Pit 3, 4, 5 Project vicinity. (Source: PG&E, 2001, 2002a)

Species	Lake Britton	Pit 3 Reach	Pit 4 Reser-voir	Pit 4 Reach	Pit 5 Reser-voir	Tunnel Reser-voir	Pit 5 Reach	Pit 6 Reser-voir
Native Species								
Rainbow trout	X	X	X	X	X	X	X	X
Sacramento sucker	X	X	X	X	X	X	X	X
Sacramento pikeminnow	X	X	X	X	X	X	X	X
Hardhead	X	X	X	X	X	X	X	X
Tui chub	X							
Speckled dace	X	X	X	X	X	X	X	X
Tule perch	X	X	X	X	X	X	X	X
Bigeye marbled sculpin	X	X		X	X	X	X	X
Pit sculpin	X	X	X	X	X	X	X	X
Rough sculpin	X	X	X			X		
Pit Klamath brook lamprey	X	X			X	X	X	X

Species	Lake Britton	Pit 3 Reach	Pit 4 Reser-voir	Pit 4 Reach	Pit 5 Reser-voir	Tunnel Reser-voir	Pit 5 Reach	Pit 6 Reser-voir
Pit roach	X	X	X	X	X	X	X	X
Introduced Species								
Brown trout	X	X		X				
Channel catfish	X							
Brown bullhead	X							
Black bullhead	X							
Green sunfish	X					X		X
Bluegill	X		X		X	X		
Largemouth bass	X		X			X		
Smallmouth bass	X		X			X		
Black crappie	X		X		X	X		
White crappie	X		X		X			
Carp	X			X				
Golden shiner	X		X			X		

The three bypassed reaches support a substantial fishery for native rainbow trout. The fishery in the Pit 3 reach compares favorably with five other northern California streams that the CDFG manages for wild trout: (1) upper Sacramento River, (2) upper Klamath River, (3) McCloud River, (4) Fall River, and (5) Hat Creek. From 1995 to 1996, the catch rate in the Pit River was second only to the upper Klamath River (figure 3), and the Pit River ranked first in average length and percent of fish more than 12 inches long (figure 4). Angler satisfaction with fish numbers, fish size, and overall experience also rated very high in the Pit 3 reach (figure 5). Although the Pit 3, 4 and 5 reaches are unpopular with some anglers because of rough terrain and difficult wading conditions, others are drawn to the relatively remote, rugged, and undeveloped nature of the canyon and the quality of angling. PG&E's angler surveys indicate that all three reaches support relatively high catch rates, especially for larger sized trout. The Pit 3 reach attracts the most anglers because of easier access, special regulations designed to enhance the fishery by reducing harvest (i.e, limit of two trout 18 inches or greater, and gear restricted to barbless, artificial flies and lures), and promotion by the angling public.

The historical fish assemblage in the Pit River, including spring-run chinook salmon and steelhead, also may have included smaller numbers of fall-run and winter-run chinook salmon. By 1923, the spring run in the Pit River was estimated at only 150 to 200 fish. Construction of the Pit 3 dam in 1925 blocked salmon and steelhead runs to upstream spawning areas, such as Hat and Burney creeks. By 1925, numerous factors (including commercial fishing and construction of the Anderson-Cottonwood dam in 1917 at RM 298, about 15 miles south of Redding) during the previous 50 years substantially reduced salmon in the Sacramento River system. In 1940, anadromous fish runs in the Pit River were terminated entirely with the completion of Shasta dam.[6]

The following section provides a brief description of the aquatic habitats and fisheries resources in the vicinity of the Pit 3, 4, 5 Project.

Lake Britton and Upstream Waters

Lake Britton is the largest of the project reservoirs, with a surface area of approximately 1,293 acres. The reservoir is approximately 8 miles long, but in most places it is less than 0.5 mile wide. The upper end of the reservoir is shallow, with a bottom formed of fine substrates. Substantial aquatic vegetation occurs in this area, but the reservoir becomes deeper and generally steep sided toward the dam. Hat Creek, a major spring-fed tributary with an average summer flow of about 480 to 500 cfs (FERC, 2001) enters Lake Britton near its upstream end. Burney Creek, another large tributary that contributes about 150 cfs, enters the south side of Lake Britton about 1 mile from the dam. Flows from the upper Pit River are influenced by upstream diversions for consumptive uses (e.g., irrigation) and releases from the Pit 1 Project, and average approximately 1,500 cfs during the summer months upstream of Lake Britton and about 2,000 cfs at Lake Britton (see table 5). The estimated mean annual flow at Lake Britton is 2,944 cfs (see tables 3 and 4). Other sources of inflow to Lake Britton are relatively minor, with a combined inflow of approximately 54 cfs during the summer months. We estimate the minimum hydraulic retention time of Lake Britton to be 4.5 days during average March inflow, and, under typical flow conditions during July and August, we estimate the hydraulic retention time to be approximately 10 days.

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6 In its scoping comment letter dated June 21, 2002, FWS indicates it is not aware of any comprehensive plans to restore anadromous fish runs upstream of Shasta Lake.

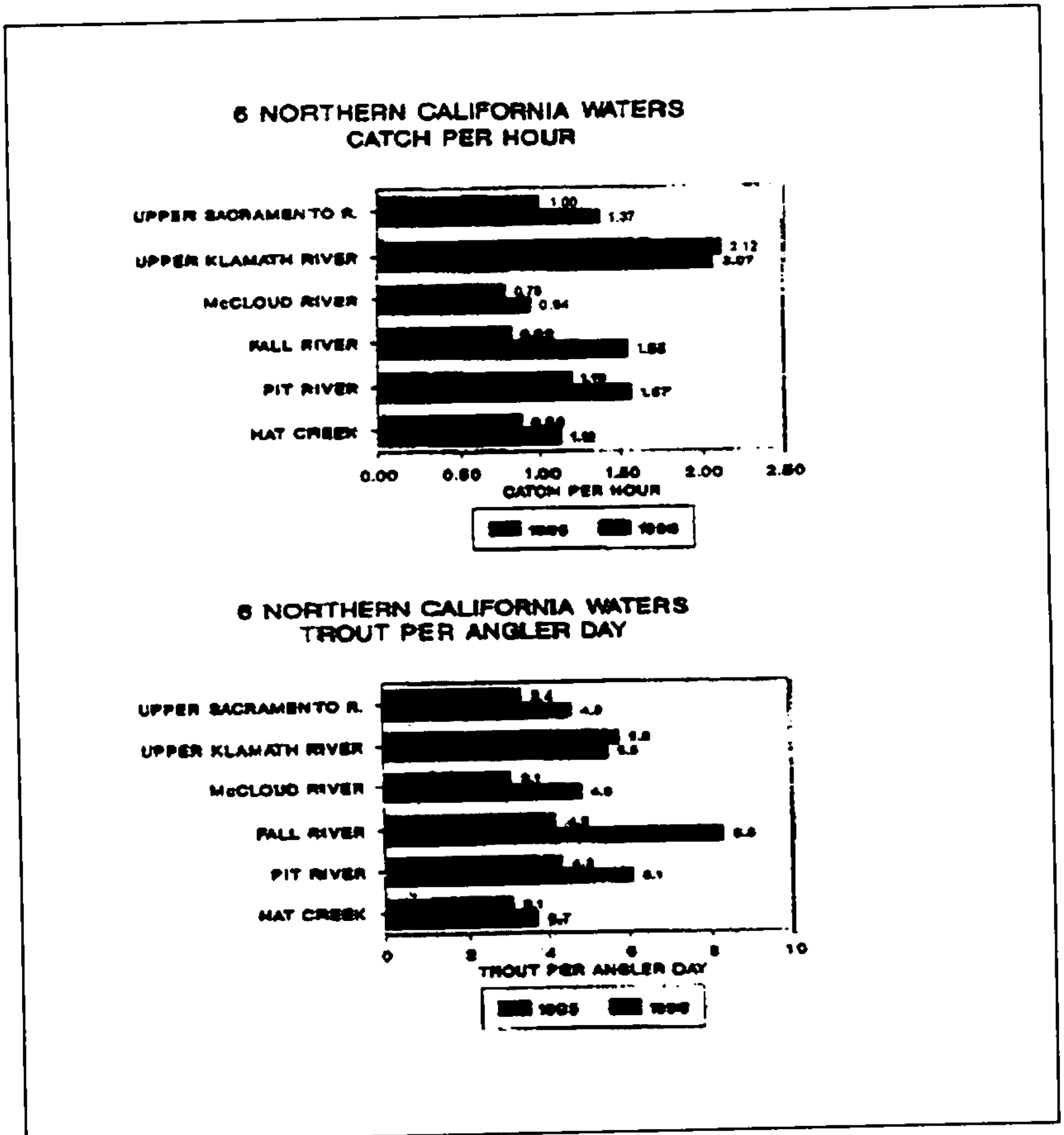

Figure 3. Angling success for six Northern California wild trout streams during 1995 through 1996. (Source: CDFG Wild Trout Project, unpublished data, as cited in PG&E, 2001)

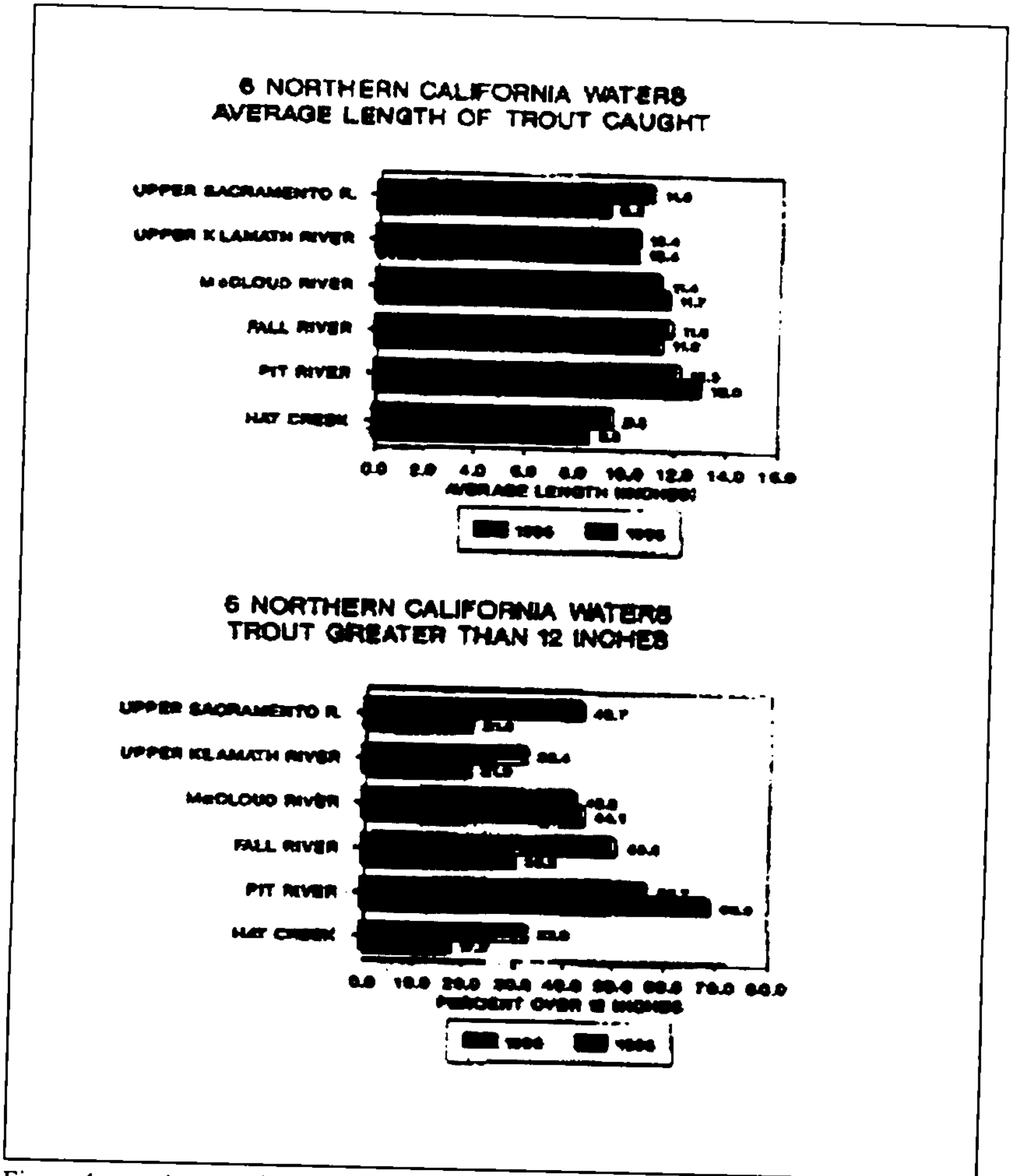

Figure 4. Average length of trout caught and percentages of catch greater than 12 inches for six Northern California wild trout streams during 1995 through 1996. Note: Pit River catch data are from the Pit 3 reach, which is managed as a wild trout area. (Source: CDFG Wild Trout Project, unpublished data, as cited in PG&E, 2001)

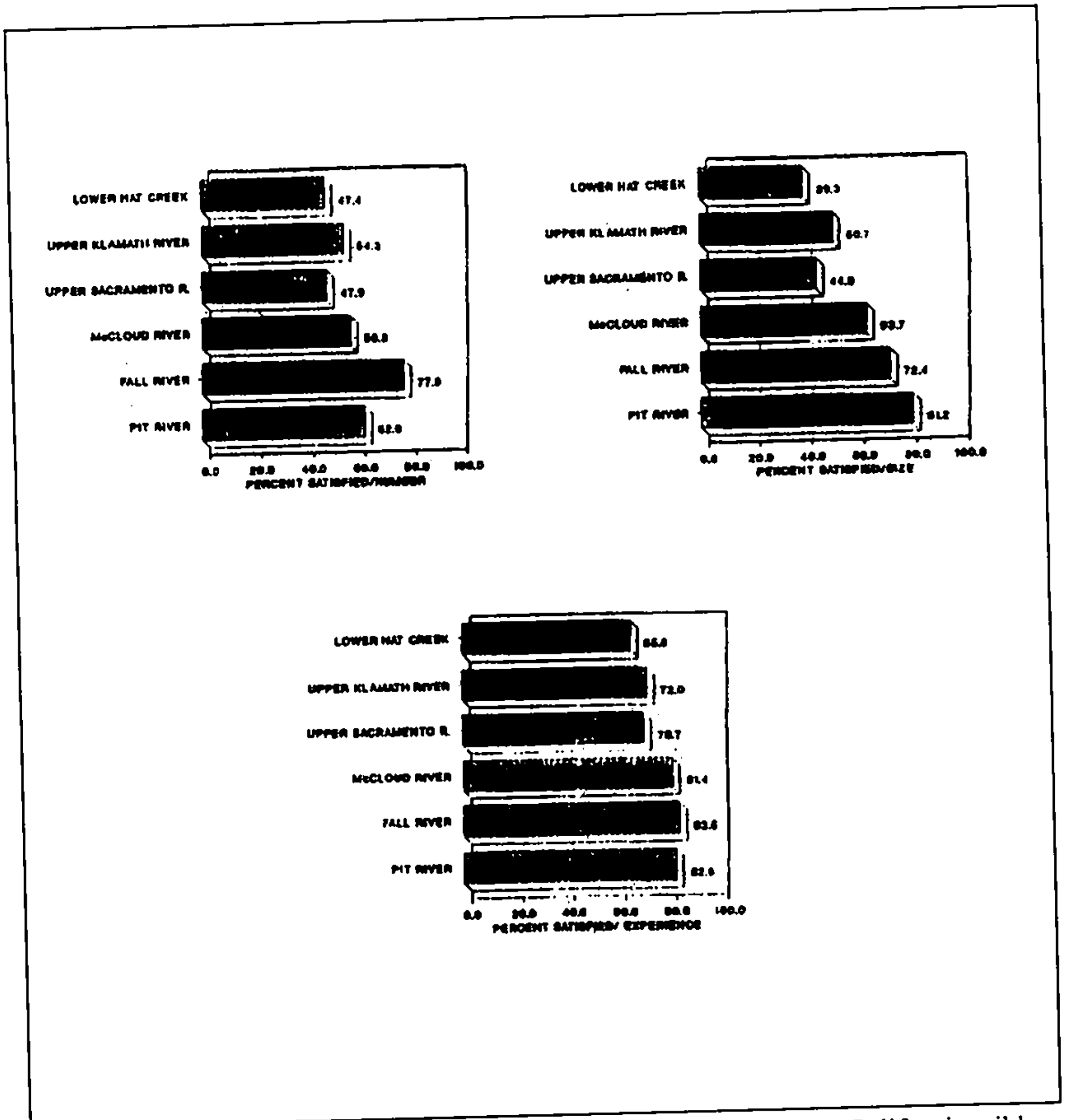

Figure 5. Comparisons of angler satisfaction among six Northern California wild trout streams during 1995 through 1996. Note: Pit River data are from the Pit 3 reach, which is managed as a wild trout area. (Source: Deinstadt and Berry, 1999)

The Pit 3 powerhouse is operated in a peaking mode when Lake Britton is not spilling at the Pit 3 dam, which is generally from June through November or December. As part of the peaking operation, the level of Lake Britton fluctuates with power demand on a daily and weekly basis. Often, this involves a drawdown of 3 to 7 feet from Monday through Friday and refill during weekends. However, this pattern is variable, especially during hot weather when demand for electricity is particularly high. Reservoir levels from June 1999 to September 2000 varied over a range of about 6 feet, between elevation 2,731 and 2,737 feet NGVD. Before inflatable bladder-type flashboards were installed in 1989, extensive drawdowns were necessary in the late spring to maintain flashboards.

Lake Britton contains all the species of fish found in recent surveys of project waters (table 23). The reservoir supports recreational fisheries for largemouth bass, smallmouth bass, black crappie, brown bullhead, black bullhead, channel catfish, rainbow trout, and brown trout. PG&E has conducted fisheries sampling in Lake Britton in most years since 1983. Its findings include the following:

- Native nongame species tend to dominate the fish population in the upper portion of the reservoir, while introduced centrarchids (bass and sunfish species) dominate the lower portion of the reservoir. The abundance of the three main bald eagle prey species (i.e., sucker, hardhead, and pikeminnow) varies among the years but no trends in abundance are apparent.

- The number of adult sucker observed during sampling at the mouth of Hat Creek has been consistently high over time.

- Trout (primarily wild rainbow trout, with smaller numbers of brown trout) are found almost exclusively in areas of inflowing, cooler water, such as the mouths of Clark Creek, Fish (or Salmon) Creek, and especially Hat Creek.

- Rough sculpin (state-listed as threatened) are generally found near the mouths of Hat Creek and Salmon Creek in the upper portion of the reservoir.

- Smallmouth bass have become well established in Lake Britton, with increasing numbers of adults and young-of-year occurring over time. This species was introduced illegally in about 1985.

- Young-of-year production of largemouth bass, bluegill, black crappie, and green sunfish was generally very high from 1988 to 2000, as compared with 1983 to 1984. The lack of a drawdown to replace flashboards during the centrarchid spawning season has contributed to increased production during some, or most, years since 1989.

- The increased number of young-of-year largemouth bass in recent years has not resulted in a greater number of larger largemouth bass, although the number of adult smallmouth bass has increased.
- Cabling of fallen trees to the shoreline has been effective in creating habitat for adult largemouth bass, smallmouth bass, black crappie, and bluegill.

Increased numbers of certain nongame fishes may occur in the Pit River and Hat Creek upstream of Lake Britton, as a result of the populations supported by the reservoir. The number of Sacramento sucker and possibly tui chub and hardhead reportedly increased in lower Hat Creek after the construction of Lake Britton and adversely affected trout populations. CDFG maintains a barrier, which was constructed just upstream of Lake Britton following a chemical treatment in 1969, to prevent non-game fish from migrating into Hat Creek. PG&E states that this barrier is a non-project feature even though it is located within the Pit 3, 4, 5 Project boundary (letter from J. Holeman, Sr., Project Manager, PG&E, San Francisco, CA, to the Commission, dated July 12, 2002). High densities of Sacramento sucker are now confined to the very short section of Hat Creek between the barrier and Lake Britton. High densities of Sacramento sucker also occur in the Pit River immediately upstream of Lake Britton. This section of river is relatively warm and appears to provide marginal trout habitat. Many suckers, hardhead, and pikeminnow in Lake Britton spawn in the Pit River upstream of the reservoir.

Pit 3 Reach

The Pit 3 reach extends approximately 6 miles from the Pit 3 dam to the Pit 4 reservoir. The reach is confined to a steep-walled canyon and is characterized by short, deep riffles and pocket water, interspersed with sections of run and very large pools. Before July 1987, flows in the reach during nonspill periods originated from springs along the reach and from Rock Creek, a tributary. Since then, a low-level, year-round flow of 150 cfs has been released from Pit 3 dam. Accretion from springs, which totals about 50 cfs, begins approximately 0.5 mile below the dam and extends along much of the reach. Approximately 3.5 miles downstream of the Pit 3 dam, flow from Rock Creek enters the river, contributing about 9 cfs during the summer. In the past, a diversion dam intercepted Rock Creek flows and redirected them into the Pit 3 tunnel. The diversion dam was located approximately 1 mile upstream of the confluence of Rock Creek with the Pit River. The diversion dam was removed in 1987 to increase spawning and rearing habitat for trout in the Pit 3 reach; the removal of the diversion dam also increased the amount of flow contributed from Rock Creek.

The Pit 3 reach is the coolest of the three reaches during the summer. Throughout the reach, the maximum water temperature in the summer months is generally 16 to 19 degrees C (60.8 to 66.2 degrees F). In addition to maintaining lower summer temperatures, the low-level minimum flow release has transformed the Pit 3 reach from the clearest to generally the most turbid of the three reaches. The turbidity, which causes a greenish tint, results largely from planktonic algae originating in Lake Britton. As in other reaches, water clarity increases in a downstream direction, in part because of inflow of springs and tributaries. Associated with the turbid water is a flow of nutrients from Lake Britton that did not occur before the initiation of the 150-cfs minimum flow in 1987.

Rainbow trout dominate the fish community in the Pit 3 reach, with large numbers in runs and pools as well as in riffles. Adult Sacramento pikeminnow are generally less abundant than in the Pit 4 and Pit 5 reaches, although large numbers of them occur in several of the large pools, and Sacramento sucker have increased in number since the release of water from Lake Britton. Biomass estimates for the six dominant species collected in the project reaches during fisheries surveys in 2002 are shown in table 24.

In 1989, the catch limit in the Pit 3 reach was reduced to two fish,[7] and in 1990, it was modified to a limit of two trout 18 inches or longer, and gear was restricted to barbless, artificial flies and lures. Estimated catch rates in the Pit 3 reach have ranged between 0.76 and 1.57 fish per hour (table 25). Angler surveys that PG&E conducted from 1988 through 1992 suggest that catch rates in the Pit 3 reach have declined in recent years. PG&E suggests that the fish are becoming more selective in their feeding as a result of more fish being released due to the restricted harvest and gear limitations. However, this trend is not evident in survey data that CDFG collected from 1993 through 1999 (table 25).

Table 24. Biomass of dominant fish species in the Pit 3, 4, and 5 reaches in June and July 2002. (Source: PG&E, 2002)

Species	Biomass (kg/hectare)		
	Pit 3 reach	**Pit 4 reach**	**Pit 5 reach**
Rainbow trout	8.13	4.32	1.57
Sacramento sucker	4.74	6.64	10.46
Sacramento pikeminnow	2.16	0.48	0.99
Hardhead	5.01	5.00	1.29
Tule perch	0.04	0.00	0.15
Pit roach	0.14	0.31	0.30

7 Catch limits in the Pit 4 and Pit 5 reaches are 5 fish per day.

Table 25. Estimated angler catch rates in the Pit 3, 4, and 5 reaches. (Source: PG&E, 2001)

Year	Catch rate (fish per hour)			
	Pit 3 (CDFG)	Pit 3 (PG&E)	Pit 4 (PG&E)	Pit 5 (PG&E)
1988	--	1.11	1.10	0.60
1989	--	1.13	0.82	0.72
1990	--	1.15	0.67	0.52
1991	--	0.92	0.56	0.65
1992	--	0.93	0.64	0.45
1993	1.03	--	--	--
1994	1.09	--	--	--
1995	1.19	–	–	–
1996	1.57	–	–	–
1997	1.24	–	–	–
1998	1.04	–	–	–
1999	1.37	0.88	1.07	1.19
2000	--	0.76	1.67	1.29

Pit 4 Reservoir

Pit 4 reservoir has a surface area of about 105 acres. The water surface of the reservoir fluctuates several feet because of peaking operations when the reservoir is not spilling. Due to its short retention time, approximately 0.2 to 0.3 day, the reservoir does not stratify.

Many species collected at Lake Britton also have been collected at Pit 4 reservoir (table 23). It is likely that all species in Lake Britton occur, at least occasionally, in Pit 4 reservoir. Common species include Sacramento sucker, Sacramento pikeminnow, hardhead, tule perch, and smallmouth bass. Centrarchids tend to be much less abundant, relative to native species, in Pit 4 reservoir than they are in Lake Britton. Pit 4 reservoir has less habitat diversity than Lake Britton, because the reservoir has fewer coves and fallen trees and less aquatic vegetation. The lower water retention time, and lower production, combined with less appropriate physical habitat, appear to render Pit 4 reservoir less suitable for centrarchid production. The number of smallmouth bass collected in the reservoir generally increased after they were first collected in 1987, peaked in 1995 and 1996, and then declined.

From 1983 to 1984, studies were conducted to determine whether nongame species made spawning runs out of Pit 4 reservoir into the Pit 3 reach. Migrations of Sacramento sucker, Sacramento pikeminnow, and hardhead into the Pit 3 reach were detected, although some Sacramento sucker and hardhead spawned at "Sucker Bar" in the Pit 4 reservoir, located several hundred yards below the Pit 3 powerhouse.

Pit 4 Reach

The Pit 4 reach extends approximately 7.5 miles from the Pit 4 dam to the Pit 5 reservoir. Similar to the Pit 3 reach, it is confined to a steep-walled canyon. Large pools are common in the upper portion, while runs and riffles are more numerous in the lower portion. Prior to releases from Lake Britton into the Pit 3 reach, the Pit 4 reach supported the densest algal growth of the three river reaches, with filamentous algae and diatoms covering the substrates. The Pit 4 release was changed in 1987 to a minimum, year-round flow of 150 cfs. Prior to that, flow releases varied by season: (1) 150 cfs from the opening day of fishing season (between April 27 and May 1) through September 30; (2) 100 cfs during October; (3) 75 cfs during November; (4) 50 cfs from December 1 through March 31; and (5) 100 cfs from April 1 until the opening day of the fishing season.

The Pit 4 reach is warmer than the Pit 3 reach during the summer. Mean daily temperatures in the Pit 4 reach during July are commonly 19 to 20 degrees C (66.2 to 68 degrees F) in the upper three-fourths of the reach, and then the temperature decreases by 1 to 2 degrees C for the remainder of the reach due to inflow from tributaries and springs. Canyon Creek enters the Pit 4 reach 3.2 miles downstream of the Pit 4 reservoir, contributing 7 cfs during July and August, and Deep Creek enters the Pit 4 reach about 5.4 miles downstream of the Pit 4 reservoir, contributing another 12 to 14 cfs. Accretion from spring flows adds approximately 7 cfs upstream of Canyon Creek and between 1 and 14 cfs downstream of Canyon Creek.

The fish community in the Pit 4 reach is dominated by Sacramento sucker, hardhead, and rainbow trout. Fisheries surveys conducted by PG&E in 2002 show that the Pit 4 reach supports about half the biomass of rainbow trout that the Pit 3 reach supports (table 24). However, angler catch rates in the Pit 4 reach appear to be comparable with the Pit 3 and 5 reaches, ranging from 0.56 and 1.67 fish/hour (table 25).

Pit 5 Reservoir

Pit 5 reservoir has a surface area of approximately 32 acres. It is long, narrow, and riverine in character. It is generally steep-sided, except along the riffle below the Pit 4 powerhouse and along several side channels. The water surface of the reservoir fluctuates several feet because of peaking operations when the reservoir is not spilling. The Pit 5 reservoir does not stratify due to its very short retention time.

Thirteen species of fish have been collected by electrofishing in the Pit 5 reservoir. Of these, three were introduced species (coho salmon, white crappie, and black crappie), each represented by a single individual, and coho salmon have not been collected in recent surveys. Of the native species, juvenile hardhead and Sacramento sucker usually dominated. Annual qualitative sampling in the riffle at the head of the reservoir indicates substantial populations of adult Sacramento sucker and rainbow trout. Some Sacramento sucker and hardhead spawn downstream of the Pit 4 powerhouse at the head of the Pit 5 reservoir. The riverine nature of the Pit 5 reservoir appears to render it unsuitable for introduced centrarchids.

Tunnel Reservoir

Tunnel Reservoir, also known as the Pit 5 open conduit, has a surface area of approximately 48 acres. Water from the Pit 5 tunnel no.1 enters the east end of the reservoir below the water surface, creating the appearance of a large upwelling spring. At the west end of the reservoir, water enters the Pit 5 tunnel no. 2, which leads to the Pit 5 powerhouse. The south side of the reservoir has several shallow coves with extensive beds of aquatic vegetation, including some tules.

Fish populations in the Tunnel Reservoir are dominated by nongame native species, including Sacramento sucker, Sacramento pikeminnow, hardhead, and tule perch. Pit roach are common also, and bigeye marbled sculpin and Pit sculpin are common along the riprapped north side.

The Tunnel Reservoir was drained in 1986, as part of maintenance of the Pit 5 tunnel. Recent surveys indicate that fish populations are recovering, and the incidence of adult-sized fish suitable as forage for bald eagles is increasing. Smallmouth bass have not become well established in the Tunnel Reservoir.

Pit 5 Reach

The Pit 5 reach extends approximately 9 miles from the Pit 5 dam to the Pit 6 reservoir. The upper portion has a very high percentage of riffle habitat and very few large pools. The middle portion near Big Bend flows through a more open canyon, which then narrows somewhat along the lower portion. Boulder and cobble are the dominant substrates, but smaller substrates, including gravel, are more common than in the Pit 3 and Pit 4 reaches. The Pit 5 reach supports less algae than the other two reaches, although diatoms are fairly abundant. Since 1987, the flow release in the Pit 5 reach has been a year-round release of approximately 100 cfs from fixed ports at Pit 5 dam to provide a flow of 120 cfs or more at USGS gage no. 11363000 at Big Bend. Before 1987, flow releases varied by season: (1) 100 cfs (measured at the dam) from May 1 through October 31; (2) 50 cfs (measured at the dam) during November; and (3) 50 cfs (measured at USGS gage no. 11363000) from December 1 through April 30.

Water temperatures in the Pit 5 reach are similar to those in the Pit 4 reach, except that diel fluctuations are greater, and temperatures in the lower portion are influenced by a higher volume of tributary inflow, which reduce summer temperatures by about 2 to 3 degrees C. Nelson Creek enters the Pit 5 reach about 4 miles downstream of the Pit 5 dam, just upstream of USGS gage no. 11363000. This creek provides mean inflows of 32 cfs in July and 25 cfs in August. Kosk Creek enters the Pit 5 reach about 2 miles downstream of Nelson Creek, with mean flows of 67 cfs in July and 47 cfs in August. Both Nelson and Kosk creeks provide spawning and rearing habitat for trout in the Pit 5 reach, and both deliver a substantial amount of bedload sediments, including gravel, into the Pit 5 reach. Accretion flows from springs average approximately 14 to 21 cfs upstream of Nelson Creek and between 9 and 29 cfs downstream of Nelson Creek.

The Pit 5 reach fish community is dominated by Sacramento sucker, supporting less than half of the biomass of rainbow trout that the Pit 4 reach supports (table 24). However, angler catch rates for trout in the Pit 5 reach seem comparable with the Pit 3 and Pit 4 reaches, ranging from 0.45 to 1.29 fish/hour (table 25). Recent angler surveys (conducted from 1988 to 1992 and 1999 to 2000) indicate that the Pit 5 reach tends to produce a higher percentage of trout over 14 inches than the Pit 3 or Pit 4 reaches.

Pit 6 Reservoir

Pit 6 reservoir, which has a surface area of about 270 acres, represents the tailwaters of the Pit 5 powerhouse. It is very narrow and steep-sided, with limited littoral habitat. Water surface elevations fluctuate in response to peaking flows entering from the Pit 5 powerhouse at the head of the reservoir and from the J. B. Black powerhouse (McCloud-Pit Project, FERC No. 2106), which is on the Pit 5 reach a few hundred yards upstream of the reservoir. The McCloud-Pit Project diverts water from the McCloud River and delivers it into the Pit River at the J. B. Black powerhouse.

Pit 6 reservoir was sampled by electrofishing on three occasions during 1983 to 1984. Overall, hardhead, Sacramento sucker, and tule perch were the most numerous species. Most collected fish were juveniles, with the exception of tule perch. Among the Sacramento sucker, hardhead, and Sacramento pikeminnow, only one fish was large enough to be suitable eagle prey.

Special-Status Aquatic Species

PG&E's consultation with the FS, FWS, and CDFG showed that 12 aquatic species with special status could occur in the project area. One of these, the Shasta crayfish, is federally listed as endangered (see section 3.3.4, *Threatened and Endangered Species*). The fish, crustaceans, and molluscs (table 26) include federal endangered and species of concern; sensitive species in FS Region 5; FS Survey and Manage (SM) species;[8] and state-listed threatened, endangered, or species of concern. We evaluated the likelihood of occurrence of these species in the project area based on their historical range, known occurrences, habitat associations documented in the literature, and the results of PG&E's field surveys. Table 26 provides a summary of the known distribution of each species in the project area and of the habitat requirements for each species.

The rough sculpin, a federal species of concern and state listed as threatened, has been collected from Lake Britton, the Pit 3 reach, Pit 4 reservoir, and Tunnel Reservoir. The Shasta crayfish is known to occur in Sucker Springs Creek, a tributary to the Pit River upstream from Lake Britton, in the Pit River near Pit River Falls, and in the Hat Creek and Fall River drainages, but has not been found in any of the project waters. Bigeye marbled sculpin, Pit roach, and hardhead, which are designated by CDFG as species of special concern, are widespread in project reservoirs and river reaches. The hardhead is also designated as sensitive by the FS. As indicated in table 26, the following special-status molluscs have also been found in the project area: California floater, montane peaclam, scalloped juga (snail), topaz juga (snail), nugget pebblesnail, potem pebblesnail, globular pebblesnail, and the Great basin rams-horn (snail).

For their analysis of the impacts of relicensing the Pit 3,4 and 5 project, the FS selected the rainbow trout as a Management Indicator Species (MIS) (FS letter to the Commission dated May 19, 2003). MIS do not necessarily have special status, but are important in representing certain habitats and other species or guilds associated with such habitats. The FS uses MIS to evaluate the effects of various management actions on fish populations.

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8 The SM species are those that occur in late-successional or old-growth forests within the range of the northern spotted owl, and that would not be adequately protected by the standards and guidelines that the FS uses to protect the northern spotted owl. SM taxa include a number of rare lichens, liverworts, mosses, fungi, terrestrial molluscs, salamanders, arthropods, and a few vascular plants. The FS has developed specific survey protocols and mitigation measures for these species.

Table 26. Special-status aquatic species that could occur or are documented to occur in the project area. (Source: PG&E, 2001; Brock and Hutchins, 2003)

Species	Status[a]	Occurrence and habitat
Rainbow trout *Oncorhynchus mykiss*	MIS	Documented in all project reaches and reservoirs. Associated with coldwater habitat; gravel required for successful spawning.
Rough sculpin *Cottus asperrimus*	FSC, ST	Documented in Lake Britton, the Pit 3 reach, Pit 4 reservoir, Pit 4 tailrace, and Tunnel Reservoir. Associated with muddy streams and reservoirs, often associated with aquatic vegetation.
Shasta crayfish *Pacifastacus fortis*	FE, SE	Not likely to occur in the project area, closest known occurrences are in springs and tributaries upstream of Lake Britton, including Sucker Springs Creek, the Pit River near Pit River Falls, Hat Creek, and Fall River. Not found in PG&E's biota surveys conducted in the Pit 3, 4 and 5 bypassed reaches. Primarily lives in cool, clear, spring-fed headwaters that are characterized by clean volcanic cobbles and boulders on top of gravel or sand.
Bigeye marbled sculpin *Cottus klamathensis macrops*	CSC	Documented in all reaches and reservoirs, except the Pit 4 reservoir. Associated primarily with large, clear, cool, spring-fed streams.
Pit roach *Hesperoleucus symmetricus mitrulus*	CSC	Documented in all reaches and reservoirs. Omnivorous species that is most common in deep mud/rock bottomed pools in second- or third-order streams. Feeds primarily on filamentous algae, secondarily on insects and crustaceans.
Hardhead *Mylopharodon conocephalus*	FSS, CSC	Documented in all reaches and reservoirs. Omnivorous species that is typically most abundant in larger middle and low elevation streams where summer temperatures exceed 20 degrees C (60 degrees F).

Species	Status[a]	Occurrence and habitat
California floater (mussel) *Anodonta californiensis*	FSS, CSC	Documented in the Pit River upstream of Lake Britton and in the Pit 4 and Pit 5 reaches. Prefers the shallow areas of clean, clear lakes, ponds, and large rivers. Prefers lower elevations and a soft, silty substrate in which to burrow.
Montane peaclam *Pisidium ultramontanum*	FSS, CSC	Documented in the Pit River upstream of Lake Britton. Generally found on sand-gravel substrate in spring-influenced streams and lakes.
Scalloped juga (snail) *Juga (Calibasis) occata*	FSS	Documented in Lake Britton and all reaches. Prefers large rivers, restricted to swift, unpolluted, well-oxygenated areas with gravel boulder substrate, generally at low elevations.
Topaz juga (snail) *Juga (Calibasis) acutifilosa*	FSS	Documented in Blue Spring in the peninsula between the confluence of Hat Creek and the Pit River at the upstream end of Lake Britton. Prefers well-oxygenated cold flowing large spring water with stable gravel to boulder substrates.
Nugget pebblesnail *Fluminicola seminalis*	FSM	Documented in Lake Britton, Tunnel Reservoir, and all reaches. Prefers gravel-cobble substrate and clear, cold, flowing water. It is typically found in large streams and rivers, but is also found in large spring pools with soft, mud substrates.
Potem pebblesnail *Fluminocola* n. sp. 14	FSM	One or more locations known to the Pit River may be situated on FS land; likely there are others yet to be discovered. Occurs on muddy-silty substrate associated with small-sized coldwater springs and flowing runs. Sites are often shaded. Grazing on decomposing deciduous leaves is a feeding strategy.

Species	Status[a]	Occurrence and habitat
Globular pebblesnail *Fluminocola* n. sp. 18	FSM	Documented at one small spring-fed tributary to the Pit 4 bypassed reach and in the Pit 5 reach. Reported to occur in small springs and spring headwaters, and may be phototropic. It is found on the sides and undersides of stones in shaded areas.
Great basin rams-horn (snail) *Helisoma newberryi newberryi*	FSS	Documented in Lake Britton. Also occurs in upstream areas, including large spring pools and their quiet outflows of Fall River and Hat Creek. Occurs in larger lakes and slow rivers including larger spring sources and spring-fed creeks. Characteristically burrows in soft mud.

[a] FE = federal endangered
FSC = federal species of concern
FSS = FS sensitive species, Region 5
FSM = FS Survey and Manage species
MIS = FS Management Indicator Species
SE = state endangered
ST = state threatened
CSC = state species of concern

3.3.2.2 Environmental effects:

Minimum Flows in the Bypassed Reaches

Minimum flows in the Pit 3, 4, and 5 bypassed reaches have the potential to affect aquatic resources including a popular rainbow trout fishery, the production of native non-game species that are important prey for bald eagles, and several sensitive fish and mollusc species. Minimum flow levels may also substantially influence other resources including water quality in Lake Britton (see section 3.3.1, *Water Resources*), bald eagle foraging opportunities (see section 3.3.4, *Threatened and Endangered Species*), wading conditions for anglers (see section 3.3.5, *Recreational Resources*), and project generation (see section 5.2, *Comprehensive Development and Recommended Alternative*). Several stakeholders provided recommendations regarding minimum flows in each reach. Most parties indicated that they considered their original recommendations to be preliminary, pending the outcome of controlled flow studies that were initiated in the summer of 2002. This section addresses the potential effects of the proposed minimum flows on aquatic resources. Additional recommendations related to flushing flows and ramping rates are addressed in later parts of this section.

PG&E, in its October 11, 2002, letter to the Commission, initially proposed to continue its current minimum flow release of 150 cfs at the Pit 3 dam, to increase the minimum flows released at Pit 4 dam from 150 cfs to 200 cfs, and to increase the minimum flows released at Pit 5 dam from 100 cfs to 250 cfs. In its letter, PG&E identified resource goals for each reach associated with its flow recommendations. PG&E's goal for the Pit 3 reach is to maintain existing conditions, which support an excellent rainbow trout population and associated fishery, native non-game fishes (particularly Sacramento sucker, which are important as eagle forage), aquatic molluscs that are dependent on cold water primarily from spring inflows, and eagle foraging habitat. PG&E's goals for the Pit 4 reach are to improve conditions for rainbow trout by increasing physical habitat throughout the reach and by lowering water temperatures slightly between the Pit 4 dam and Deep Creek, maintaining shallow, low-velocity habitat for foothill yellow-legged frogs and eagle foraging, maintaining suitable habitat for coldwater or spring-dependent aquatic molluscs in areas of spring inflow, and maintaining angler fishability. PG&E's goals for the Pit 5 reach include improving conditions for rainbow trout by increasing physical habitat throughout the reach and by lowering water temperatures between the Pit 5 dam and Nelson Creek. PG&E indicates that angler fishability may be reduced in the "boulder garden" section upstream of Nelson Creek, but may be improved in other portions of the reach. PG&E also stated that increased flows in the Pit 4 and Pit 5 reaches may increase or decrease populations of non-game species (depending on the species), and that eagle foraging habitat and within-channel riparian vegetation (willow and sedge) may be reduced in the Pit 5 reach. Minimum flows currently recommended by PG&E in accordance with the PRCT agreement are summarized in table 27, together with flows previously recommended by PG&E, the Interior, CDFG, and the FS.

In its October 9, 2002, letter to the Commission, Interior made a preliminary recommendation for a minimum flow release of 600 cfs from April through October and 800 cfs from November through March for all three of the bypassed reaches (table 27). Interior stated that increasing minimum flows during the summer months would improve water quality conditions in Lake Britton, improve temperature and DO conditions over large areas of the bypassed reaches, and increase the amount of habitat available to adult rainbow trout, adult Sacramento sucker, adult Sacramento pikeminnow, and adult hardhead. The 800-cfs minimum flow recommended from November through March is designed to mimic the natural hydrograph and to provide riparian benefits including halting the encroachment of riparian vegetation into the stream channel, providing for seed dispersal and recruitment, and establishment of a healthy riparian forest.

CDFG, in its October 3, 2002, letter to the Commission, recommended a variable flow regime based on the Tennant method (Tennant, 1976), which provides a general guideline that 30 percent of the unimpaired flow would provide good to optimal habitat conditions for most aquatic organisms. CDFG developed monthly flow recommendations (table 27), which apply to all three of the project bypassed reaches, based on 30 percent of the median flow for each month, rounded to the nearest 50 cfs. CDFG noted that observations of controlled flow releases made in the summer of 2002 indicate that flows at the lower end of the proposed flow regime provided increases in wetted perimeter, including side channel and backwater habitats. CDFG also concluded that PG&E's temperature modeling indicates that its recommended flows would help to maintain temperatures acceptable for rainbow trout rearing during adverse (warm and dry) years.

The FS specified minimum flows for the bypassed reaches in their preliminary 4(e) conditions dated October 9, 2002. Its preliminary conditions included year-round minimum flows of 400 cfs for the Pit 3 reach and 450 cfs for the Pit 4 reach. The FS also recommended flows of 500 cfs for the Pit 5 reach. The recommendation for the Pit 5 reach was made under Section 10(a) of the FPA because minimum flows in that reach do not affect National Forest System lands. The FS used several approaches to develop and support its flow recommendations. First, it noted that at least two investigators Tennant (1976) and Hatfield and Bruce (2000) found that the amount of physical habitat available to aquatic species in western streams typically attains its highest level of availability at flows of approximately 30 percent of a stream's mean annual discharge, while flows in the range of 10 to 20 percent of mean annual discharge typically provide moderate levels of habitat. Second, based on observations of controlled flow releases of 150, 250, 400, 600, 800,

Table 27. Monthly minimum flow releases (cfs) recommended by PG&E, Interior, CDFG, the FS, and under the PRCT agreement for the Pit 3, 4, and 5 bypassed reaches.

	PG&E[a]			Interior[b]	CDFG[c]	FS[d]			PRCT[e]		
Month	Pit 3	Pit 4	Pit 5	Pit 3, 4 and 5	Pit 3, 4 and 5	Pit 3	Pit 4	Pit 5	Pit 3	Pit 4	Pit 5
Oct	150	200	250	600	700	400	450	500	280	350	350
Nov	150	200	250	800	750	400	450	500	280[f]	350[f]	350[f]
Dec	150	200	250	800	800	400	450	500	300[f]	375[f]	400[f]
Jan	150	200	250	800	1,000	400	450	500	350[f]	450[f]	450[f]
Feb	150	200	250	800	1,050	400	450	500	350[f]	450[f]	450[f]
Mar	150	200	250	800	1,350	400	450	500	350[f,g]	450[f,h]	450[f,i]
Apr	150	200	250	600	1,050	400	450	500	350/ 300[g]	450[h]	450/ 400[i]
May	150	200	250	600	950	400	450	500	300[g]	450[h]	400[i]
June	150	200	250	600	700	400	450	500	300[g]	450/ 375[h]	400[i]
July	150	200	250	600	650	400	450	500	300	375	400
Aug	150	200	250	600	600	400	450	500	300	375	400
Sept	150	200	250	600	600	400	450	500	280	350	350

[a] Source: letter to the Commission dated October 11, 2002.

[b] Source: letter to the Commission dated October 9, 2002.

[c] Source: letter to the Commission dated October 3, 2002.

[d] Source: letter to the Commission dated October 9, 2002.

[e] Source: letter to the Commission dated October 29, 2003.

[f] The PRCT agreement minimum flow regime is triggered by when spill first occurs, which is not known in advance. For the purposes of this table and our developmental analysis, we assume that spill typically occurs on December 31, which would trigger an increase in the winter minimum flow; the actual date of this increase would depend on when spill occurs in a given year. Spill may not occur at all during a dry or critically dry year.

[g] If a spill occurs between March 16 and June 15 following cessation of winter spills, 450 cfs would be provided for at least 14 days, then 400 cfs for at least 10 days, then 350 cfs for at least 10 days, then the 300 cfs summer minimum flow.

[h] If a spill occurs after March 15, the minimum flow would decline in three steps as follows: from March 16 through April 30, 600 cfs; from May 1 through May 31, 550 cfs; from June 1 through June 15, 500 cfs.

[i] If a spill occurs between March 16 and June 15 following cessation of winter spills, 550 cfs would be provided for at least 14 days, then 500 cfs for at least 10 days, then 450 cfs for at least 10 days, then the 400 cfs summer minimum flow.

1,200, and 1,800 cfs that were conducted during the summer of 2002, their staff reported that flows in the 250 to 600 cfs range appeared to substantially enhance habitat conditions for faster-water species (e.g., trout and suckers), while providing a diverse array of edge and slow-water habitats for juvenile lifestages and other slower-water species. Third, they noted that increasing the base flow would serve to reduce the magnitude of annual variations in flows, potentially reducing the adverse effects of large increases in flow caused by spills or unit outages. Finally, they concluded that higher flow releases should lower water temperatures in the Pit 4 and Pit 5 reaches, improving conditions for trout.

The FS also specified a preliminary condition requiring PG&E to consult with the FS and other applicable agencies to consider "shaping" the minimum flows upon completion of the outstanding summer 2002 two-dimensional habitat mapping and fishability study results. Shaping may include within year changes (i.e., slightly higher flows in the spring and lower flows in the summer and fall) and between year changes (i.e., slightly higher flows in wet years and lower flows in dry years). Where shaping occurred, instantaneous minimum flows would not exceed 1,000 cfs and would not go below 300 cfs.

Although not recommended as a preliminary condition, the FS also discussed an alternative flow regime as an example that might be considered during future negotiations or adaptive management. The example involved setting minimum flows using a fixed percentage of the unimpaired flow determined from the preceding 2 weeks. The FS provided plots of monthly flows that would be determined using this method for the past 20 years based on 17.5 percent of inflow, but specified that this was only an example, and the FS is not recommending these flows as a license condition at this time.

Several other parties made more general recommendations regarding minimum flows. The California Department of Parks and Recreation (CDPR), in its October 9, 2002, letter to the Commission, recommended that at least the current volume of releases from Lake Britton be maintained, which has improved water quality conditions and reduced the odor that occurred during late summer before the current minimum flow release into the Pit 3 reach was initiated. Trout Unlimited and California Trout, in their October 11, 2002, letter to the Commission, did not recommend specific flow levels, but recommended that flows should be designed to reduce water temperatures, increase aquatic insect production, increase and optimize aquatic insect and wild fish habitat, increase riparian vegetation, and increase winter base flows. The Northern California Council of the Federation of Fly Fishers (Fly Fishers), in its October 8, 2002, letter to the Commission, comments that at times flows are inadequate to maintain coldwater habitat, especially in the Pit 4 and Pit 5 reaches.

PG&E filed the PRCT agreement with the Commission by letter dated October 29, 2003, which was the result of negotiations by the stakeholders on flow-related issues. The agreed-to minimum flow regime is shown in table 27. The PRCT flows are intermediate to the flows originally recommended by the agencies and those originally proposed by PG&E. They also differ from the originally proposed flows by being more variable, and thus more representative of the natural hydrograph. Signatory parties included nearly all entities that had previously provided flow-related proposals or recommendations: PG&E, FWS, CDFG, the FS, CDPR, Trout Unlimited, California Trout, and American Whitewater Affiliation (AWA). We presume the PRCT agreement supercedes the previous flow recommendations of these entities. The flow regime specified in the FS final 4(e) condition No. 17 conforms to the PRCT agreement.

Our Analysis

In its reply comments filed by letter dated November 25, 2002, PG&E contends that the Tennant Method, which some of the agencies used as the basis for their initial flow recommendations, is not applicable to the Pit River. PG&E notes that the Pit River has a distinctly different hydrology and channel type than any of the streams that were evaluated in Tennant's study, all of which were alluvial streams located in Montana, Wyoming, and Nebraska. According to Tennant (1976), streams with flows that are less than 10 percent of the mean annual flow from April to September (i.e., Tennant's severe degradation category) would be expected to have few, if any, self-sustaining rainbow trout populations. Because this conclusion is clearly not consistent with the current status of trout populations in the bypassed reaches, we concur with PG&E that the Tennant method, although useful in providing overall perspective on flows, has limited value for establishing minimum flows in the Pit River, especially when there is site-specific habitat versus flow relationship data available. Accordingly, our analysis focuses on the site-specific habitat and temperature models described in the license application.

PG&E evaluated the effects of alternative minimum flow releases on fish habitat and stream temperatures as part of its BEFS (BioSystems Analysis, Inc. and University of California, Davis, 1985). This study, which was summarized in the license application, included an instream flow study that examined the effects of different release flows on the physical habitat available to rainbow trout, Sacramento sucker, Sacramento pikeminnow, and hardhead in each bypassed reach. As described in section 3.3.1.2, *Water Resources*, modeling that incorporated monitoring data collected in 1999 and 2000 was conducted to better define the effects of alternative flow releases on water quality in Lake Britton and in the bypassed reaches.

The BEFS instream flow study used standard Instream Flow Incremental Methodology (IFIM) procedures (Bovee, 1982). Transects were placed in representative riffle and run habitats in the upper and lower segments in each of the three reaches, and one transect was placed in a representative pool in each reach. Depths and velocities measured at target flows of about 50, 100, 150, and 300 cfs were used to model hydraulic conditions up to a maximum flow of 600 cfs. Habitat available to rainbow trout, Sacramento sucker, Sacramento pikeminnow, and hardhead was simulated using depth, velocity, and substrate, both with and without cover as a fourth variable. PG&E reported that model output results with and without cover were similar, and presented the results without cover in the license application. PG&E also presented results for riffle/run and pool habitats both separately and combined for each reach. We limit our discussion to the combined results, which encompasses the effects of different flows on riffle/run and pool types of habitat.

The relationship between Weighted Useable Area (WUA) and flow releases developed during the BEFS instream flow study of the Pit 3, 4, and 5 bypassed reaches are shown in figures 6, 7, and 8, respectively. The habitat available to adult lifestages of most species increased over the range of simulated flows, although, in many cases, the amount of habitat leveled off or diminished at higher flows. For rainbow trout adults, WUA remained fairly stable at flows exceeding 400 cfs, 300 cfs, and 250 cfs in the Pit 3, 4, and 5 reaches, respectively. WUA for Sacramento sucker adults leveled off at flows exceeding 350 cfs in the Pit 3 reach, and the rate of habitat gain decreased substantially at flows exceeding 250 cfs in the Pit 5 reach. WUA for Sacramento pikeminnow adults leveled off at flows over 200 cfs in the Pit 3 reach and at flows over 250 cfs in the Pit 4 reach, and decreased at flows exceeding 200 cfs in the Pit 5 reach. WUA for hardhead adults leveled off at flows over 400 cfs in the Pit 3 reach and the rate of increase declined substantially at flows exceeding 350 cfs in the Pit 5 reach.

Habitat available to fry and juvenile lifestages for each species was generally maximized at release flows less than 200 cfs in all three of the bypassed reaches (figures 6, 7, and 8). For rainbow trout, WUA for fry and juveniles were at maximum levels at flows less than 100 cfs in all three reaches, except that fry habitat in the Pit 3 reach rebounded to similar levels at flows exceeding 300 cfs. Similarly, maximum fry and juvenile habitat for Sacramento sucker was provided by release flows less than 200 cfs for all three reaches with the exception of fry habitat in the Pit 3 reach, which increased to higher levels at flows exceeding about 300 cfs. Habitat for Sacramento pikeminnow fry and juveniles was maximized at flows less than 100 cfs in all three reaches, and the same was true for hardhead, except that habitat for these lifestages increased again at flows exceeding 300 cfs in the Pit 3 reach.

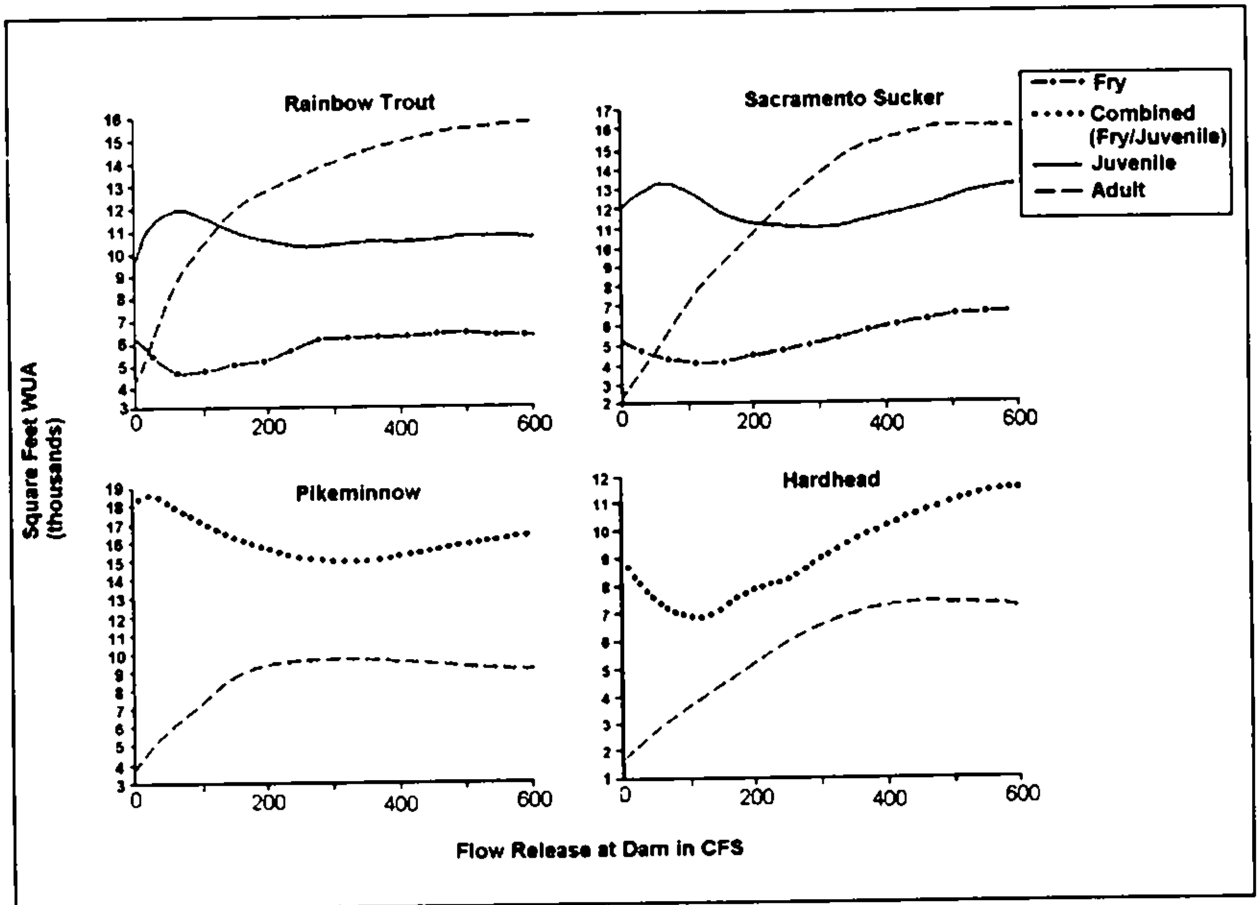


Figure 6. WUA versus release flow for rainbow trout, Sacramento sucker, pikeminnow and hardhead in the Pit 3 reach, all habitat types combined. (Source: PG&E, 2001)

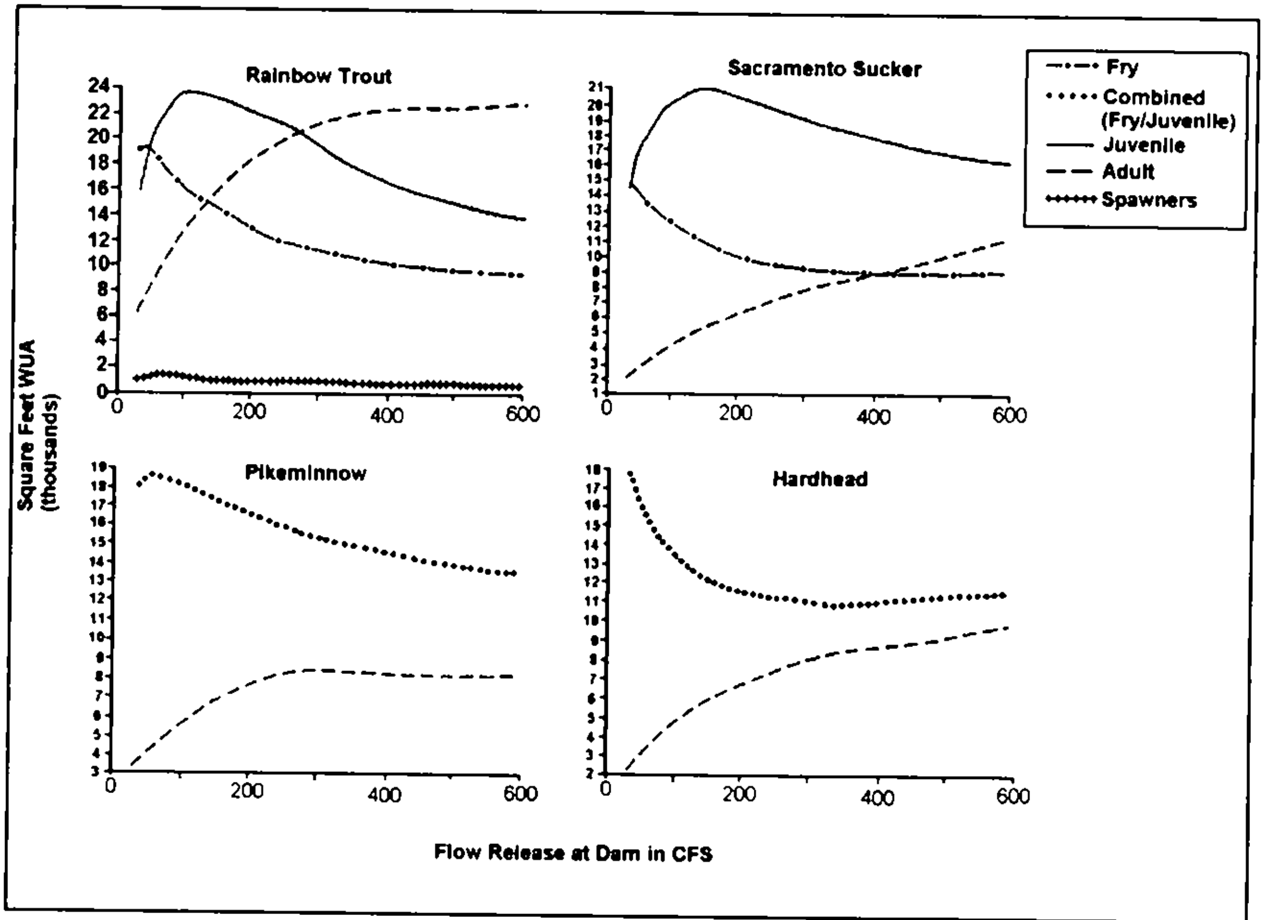


Figure 7. WUA versus release flow for rainbow trout, Sacramento sucker, pikeminnow and hardhead in the Pit 4 reach, all habitat types combined. (Source: PG&E, 2001)

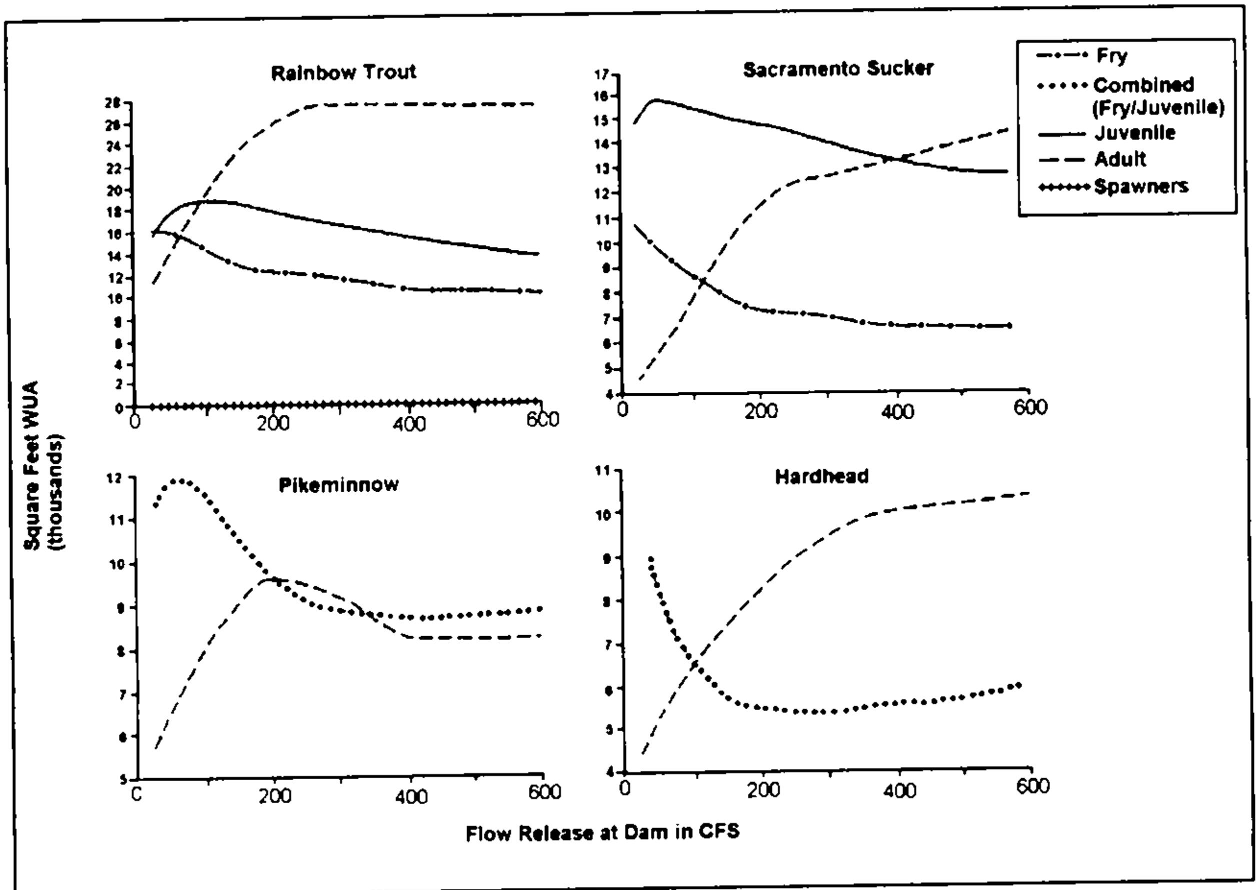


Figure 8. WUA versus release flow for rainbow trout, Sacramento sucker, pikeminnow and hardhead in the Pit 5 reach, all habitat types combined. (Source: PG&E, 2001)

Subsequent to the issuance of the draft EIS, several additional reports were filed by PG&E that have a bearing on the issue of appropriate minimum flows: a re-analysis of the BEFS instream flow data using updated modeling techniques (Hardin-Davis, 2003); a two-dimensional habitat modeling study (Hardin-Davis, 2003); and a habitat mapping study (R2, 2003). We summarized the results of these studies to facilitate discussions during the Section 10(j)/FS clarification meeting that we held in Redding, California, on August 28, 2003 (see meeting summary issued by the Commission on September 22, 2003). Our summaries depict the relationship of habitat to various flows for the Pit 3, Pit 4, and Pit 5 bypassed reaches (tables 28, 29, and 30, respectively). These tables can be used to assess the habitat that would be available with alternative flow regimes. Areas of the table with dark shading represent what we consider optimal conditions for achieving management objectives. We define optimal conditions as follows: (1) July average water temperatures less than 19 degrees C; (2) July maximum water temperatures less than 21 degrees C; (3) habitat greater than 90 percent of the maximum modeled value; and (4) conditions rated optimal by anglers. Areas of the table with light shading represent what we consider good conditions. We define good conditions as follows: (1) July average water temperatures less than 21 degrees C; (2) July maximum water temperatures less than 23 degrees C; (3) habitat greater than 70 percent of the maximum modeled value; and (4) conditions rated acceptable by anglers.

At the Pit 3 bypassed reach, PG&E's originally proposed minimum flow was 150 cfs, the agencies originally recommended minimum flows ranged from 400 to 1,350 cfs, and the PRCT agreement minimum flow ranges from 280 to 350 cfs. At the Pit 4 bypassed reach, PG&E's originally proposed minimum flow was 200 cfs, the agencies originally recommended minimum flows ranged from 450 cfs to 1,350 cfs, and the PRCT agreement minimum flow ranges from 350 to 450 cfs. At the Pit 5 bypassed reach, PG&E's originally proposed minimum flow was 250 cfs, the agencies originally recommended minimum flows ranged from 500 to 1,350 cfs, and the PRCT agreement minimum flow ranges from 350 to 450 cfs. The same general trends that we previously describe based on the original BEFS results are evident in the updated information.

The results of temperature modeling reported in the license application indicate that increasing minimum flow releases would tend to increase summer water temperatures in the Pit 3 reach and increase the uniformity of temperature conditions throughout the length of the Pit 4 and Pit 5 bypassed reaches (figure 9). Temperatures in the Pit 3 reach would increase due to the greater influence of the release flows, which are warmer than the flows contributed from springs located throughout the reach, and due to depletion of the pool of cool water in the deeper portion of Lake Britton. Average summer water temperatures in the Pit 4 and Pit 5 reaches would generally be reduced, except in areas downstream of major tributaries, such as Deep Creek in the Pit 4 reach and Nelson and Kosk creeks in the Pit 5 reach, where temperatures would be increased (figure 9). With the exception of the upper

Table 28. Summary of the relationship of flow to habitat conditions in the Pit 3 bypassed reach. (Sources: PG&E, 2001; Hardin-Davis, 2003; R2, 2003; Whittaker and Shelby, 2003; as modified by staff)

Pit 3 minimum flow resource evaluation														
			WUA and habitat mapping results expressed as percentage of maximum values											
	warm-dry	warm-dry	rainbow trout		rainbow trout		all species		all species		habitat mapping			
Flow	avg. July	min/max July	adults		juveniles		adults		fry and juveniles		shallow/	deep/	deep/	fishing
(cfs)	temperatures °C	temperatures °C	1D	2D	1D	2D	1D	2D	1D	2D	slow[a]	slow[b]	fast[b]	conditions
100				35.0%		76.3%		28.3%						
			72.5%	50.0%		73.7%	70.4%	38.5%					66.7%	
200			80.0%	56.0%		71.1%	78.6%	44.8%					67.7%	
			85.3%	61.5%		73.0%	84.8%	49.6%			85.0%		68.8%	
300				67.0%		75.0%		54.4%			70.0%	88.0%	69.8%	
				69.5%		78.3%		57.7%			62.5%	84.0%	70.3%	spin only
400				72.0%		81.6%		60.9%			55.0%	80.0%	70.8%	
500				75.0%		86.8%		65.5%			55.0%	72.0%	75.0%	
600				78.0%				70.9%			55.0%	66.0%	81.3%	
700														
800				86.0%				81.1%			33.0%	60.0%	85.4%	
900														
1000								89.0%			40.0%	56.0%	89.8%	
1200										85.0%	45.0%	52.0%		
1400										77.6%	45.0%	48.0%		
1600						84.2%				69.7%	45.0%	42.0%		
1800						7.6%				42.4%				

Optimal conditions (July avg. temp < 19 and max. temp < 21 in all locations, habitat > 90 percent of max., rated optimal by anglers).
Good conditions (July avg. temp < 21 and July max temp < 23 in all locations, habitat > 70 percent of max., rated acceptable by anglers).

[a] shallow/slow represents habitat for eagle foraging, FYLF breeding and fry and juvenile lifestages for most species of fish
[b] deep/slow and deep/fast represents habitat primarily for adult and juvenile fish

Table 29. Summary of the relationship of flow to habitat conditions in the Pit 4 bypassed reach. (Sources: PG&E, 2001; Hardin-Davis, 2003; R2, 2003; Whittaker and Shelby, 2003; as modified by staff)

Pit 4 minimum flow resource evaluation														
			WUA and habitat mapping results expressed as percentage of maximum values											
	warm-dry	warm-dry	rainbow trout		rainbow trout		all species		all species		habitat mapping			
Flow	avg. July	min/max July	adults		juveniles		adults		fry and juveniles		shallow/	deep/	deep/	fishing
(cfs)	temperatures °C	temperatures °C	1D	2D	1D	2D	1D	2D	1D	2D	slow[a]	slow[b]	fast[b]	conditions
100			46.7%	32.5%		69.0%	48.2%	41.4%						
	17.5 - 19.5	16.7/28.4	60.0%	37.5%		80.5%	61.5%	49.0%			73.0%		81.1%	
200			71.1%	45.0%		88.5%	72.4%	58.6%			67.0%	87.3%	89.2%	
	17.5 - 19.3		79.4%	52.5%			80.6%	65.7%			64.0%	80.0%		
300			87.8%	60.0%			88.8%	72.7%	89.0%		67.0%	75.0%		types
			91.7%	67.5%				79.3%	86.6%		68.5%	69.3%		
400				75.0%	89.5%			85.9%	84.1%		70.0%	63.5%		spm
														only
500				82.5%	78.9%				80.0%	89.0%	74.0%	64.0%		
600					68.4%				77.3%	86.5%	80.0%	65.0%		
700														
800						89.7%				83.0%		70.0%	83.8%	
900														
1000						89.7%				83.0%		65.0%		
1200						89.7%				81.3%		61.0%		
1400						89.7%				81.8%	87.0%	64.0%		
1600						89.7%		89.6%		80.8%	82.0%	67.0%		
1800						89.7%		87.1%		80.4%				

Optimal conditions (July avg. temp < 19 and max. temp < 21 in all locations, habitat > 90 percent of max., rated optimal by anglers).
Good conditions (July avg. temp < 21 and July max. temp < 23 in all locations, habitat > 70 percent of max., rated acceptable by anglers).

[a] shallow/slow represents habitat for eagle foraging, FYLF breeding and fry and juvenile lifestages for most species of fish

[b] deep/slow and deep/fast represents habitat primarily for adult and juvenile fish

Table 30. Summary of the relationship of flow to habitat conditions in the Pit 5 bypassed reach. (Sources: PG&E, 2001; Hardin-Davis, 2003; R2, 2003; Whittaker and Shelby, 2003; as modified by staff)

Pit 5 minimum flow resource evaluation			WUA and habitat mapping results expressed as percentage of maximum values											
	warm-dry	warm-dry	rainbow trout		rainbow trout		all species		all species		habitat mapping			
Flow	avg July	min/max July	adults		juveniles		adults		fry and juveniles		shallow/	deep/	deep/	fishing
(cfs)	temperatures °C	temperatures °C	1D	2D	1D	2D	1D	2D	1D	2D	slow[a]	slow[b]	fast[b]	conditions
100			50.0%	44.1%		68.6%	53.4%	58.9%					74.4%	
	18.5 - 19.9	16.4/22.6	62.1%	62.1%		83.9%	64.8%	71.7%			87.1%	83.3%	79.1%	
200			74.3%	80.0%			76.3%	84.4%			72.6%	66.7%	83.7%	
	18.8 - 19.8	17.3/21.2	83.3%				85.8%		89.5%	89.6%	75.0%	61.9%	87.2%	
300									85.4%	79.1%	77.4%	59.5%		
						86.0%			79.6%	74.7%	79.8%	53.6%		
400	19.0 - 19.7	17.6/20.7			85.8%	81.8%			73.8%	70.3%	82.3%	47.6%		
500					76.0%	70.5%			75.1%	60.1%	87.1%	45.2%		
600					68.4%	61.8%			72.4%	52.4%		42.9%		
700														
800						46.2%		85.1%		40.8%	64.5%	35.7%		
900														
1000				77.9%		36.4%		71.9%		33.2%	58.1%	35.7%	88.4%	
1200				66.2%		28.8%		61.5%		28.3%	53.2%	33.3%	83.7%	
1400				38.5%		25.5%		55.1%		24.9%	50.0%	33.3%	79.1%	
1600	18.8 - 19.3			30.1%		21.2%		48.6%		22.4%	46.8%	31.0%	74.4%	
1800				43.6%		18.2%		42.7%		21.3%				

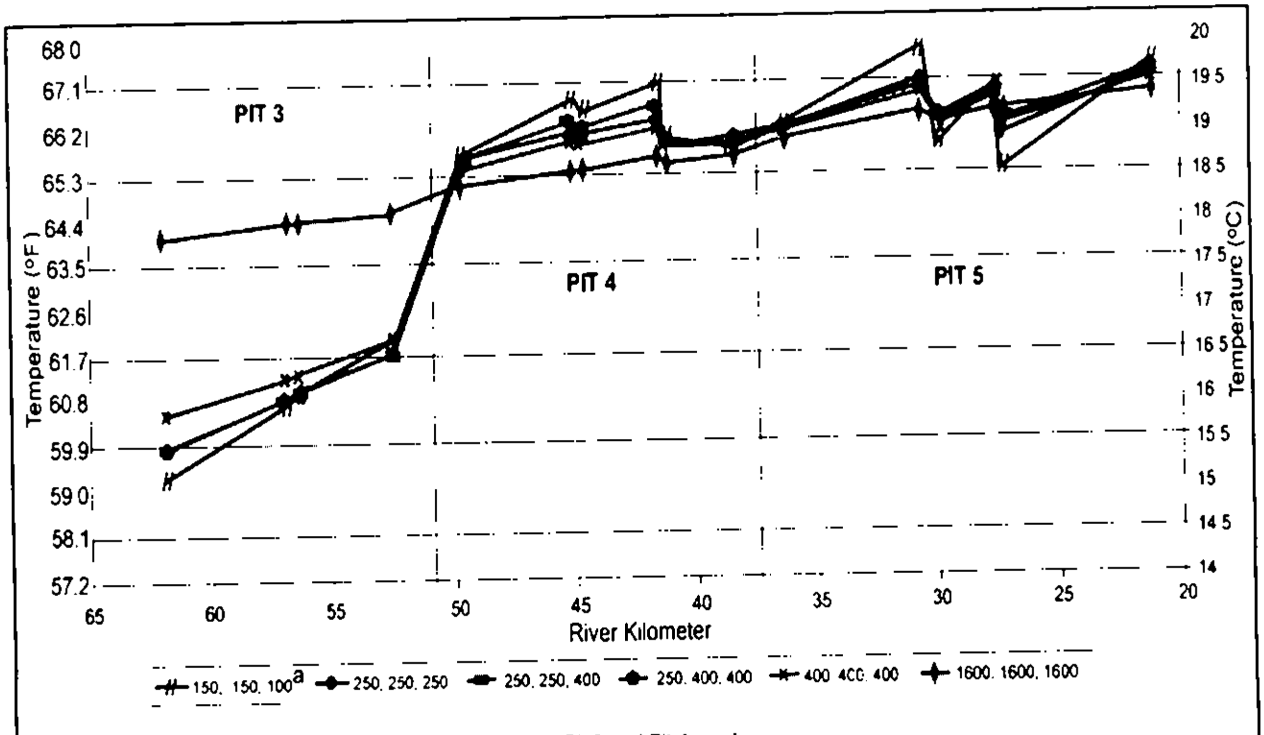
Optimal conditions (July avg. temp < 19 and max. temp < 21 in all locations, habitat > 90 percent of max, rated optimal by anglers).
Good conditions (July avg. temp < 21 and July max. temp < 23 in all locations, habitat > 70 percent of max, rated acceptable by anglers).

[a] shallow/slow represents habitat for eagle foraging, FYLF breeding and fry and juvenile lifestages for most species of fish

[b] deep/slow and deep/fast represents habitat primarily for adult and juvenile fish

Pit 3 reach, daily temperature variations would generally be reduced by higher flows (figure 10). We note that both of these figures present model results for adverse (warm and dry) summer conditions. Trends predicted for normal conditions are similar, but overall temperatures are lower (figure 11). A water temperature model validation study based on measurements taken during the 2002 controlled released study confirmed that the water temperature modeling presented in the license application accurately predicted measured temperatures (Jones & Stokes, 2003).

In general, temperature reductions would tend to favor increased production of trout, while temperature increases would tend to favor the production of non-game species, which are important as bald eagle prey. Preferred temperature ranges given in Moyle (2002) for rainbow trout, Sacramento sucker, Sacramento pikeminnow, and hardhead are around 15 to 18 degrees C (59 to 64.4 degrees F), 20 to 25 degrees C (68 to 77 degrees F), 18 to 28 degrees C (64.4 to 82.4 degrees F), and 24 to 28 degrees C (75.2 to 82.4 degrees F), respectively. Behnke (1992) states that warmwater species of fish may gain a competitive advantage over trout as temperatures approach 21 degrees C (69.8 degrees F), which appears to hold true in the Pit River, with trout comprising the majority of the biomass in the Pit 3 reach and non-game species comprising most of the biomass in the Pit 4 and Pit 5 reaches. The effect of any changes in the extent of diurnal temperature fluctuations on trout growth and interspecific competition is difficult to predict. Moyle (2002) reports that optimal average temperatures for rainbow trout may be 2 to 3 degrees C lower under a fluctuating temperature regime, while Behnke (1992) reports that trout raised under a temperature regime fluctuating between 9 and 18 degrees C (48.2 and 64 degrees F) grew 60 percent faster than trout reared at a constant temperature of 13 degrees C (55.4 degrees F). Wurtsbaugh and Davis (1977) found that rainbow trout survived and grew in a temperature regime that fluctuated between 17.8 and 26.8 degrees C (64.0 and 80.2 degrees F) (mean = 22.8 degrees C [73.0 degrees F]) on a diel basis. However, the growth rate was reduced compared to fish held in a 16.0 to 23.9 degrees C (60.8 to 75.0 degrees F) (mean = 19.5 degrees C [67.1 degrees F]) regime, and the ration needed to maintain body weight increased.



[a] Modeled minimum flows released from the dams at the Pit 3 and Pit 4 reaches was 150 cfs, and 100 cfs at the Pit 5 reach; these releases simulate existing conditions

Figure 9. Simulated average July temperatures in the Pit 3, 4, and 5 bypassed reaches modeled under warm, dry conditions under various flow regimes. (Source: PG&E, 2001, as modified by staff)

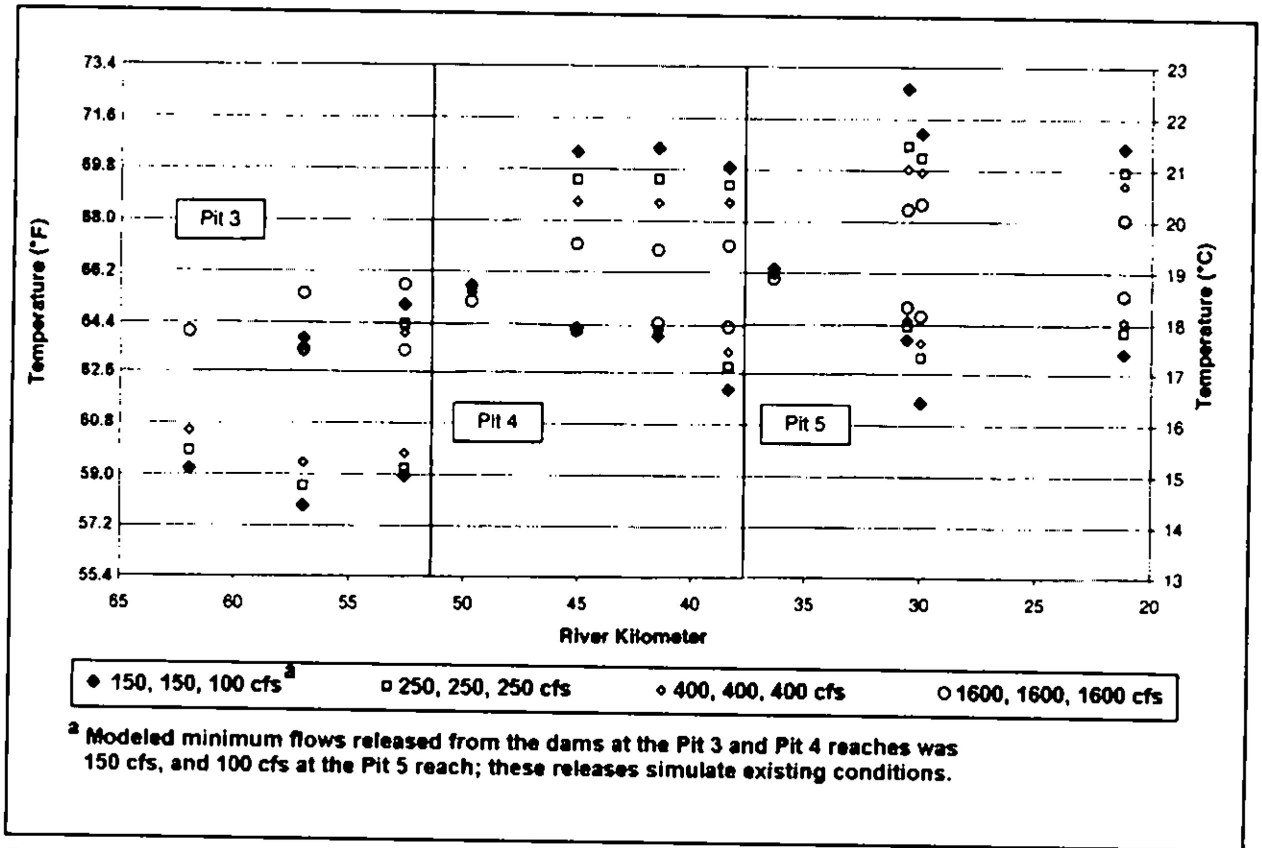
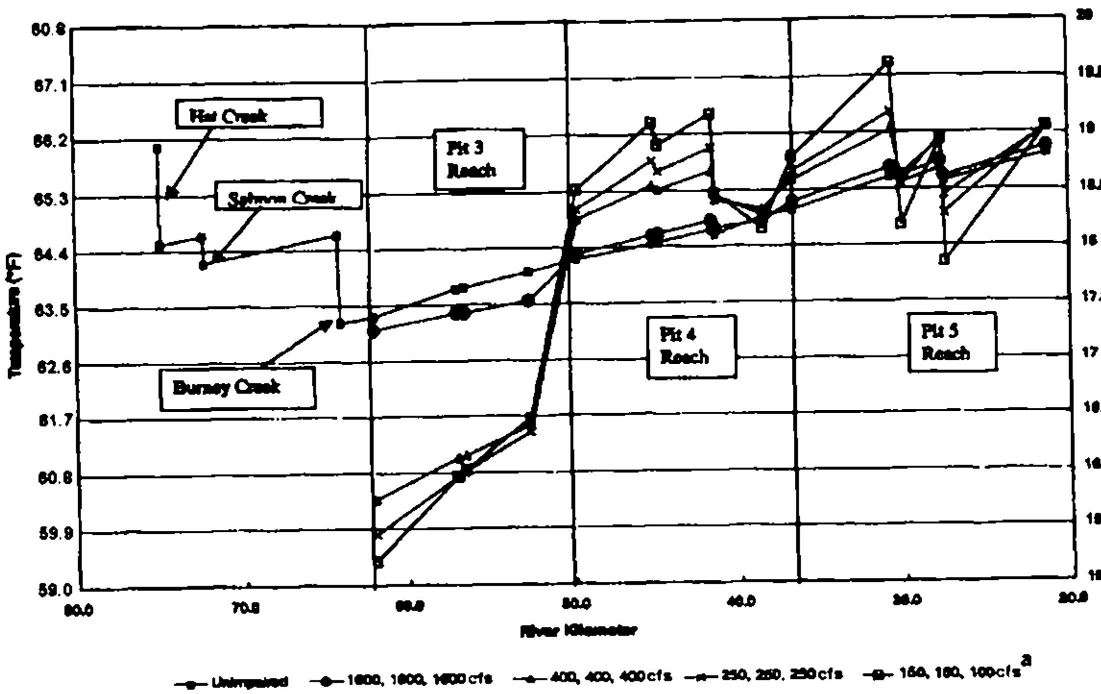


Figure 10. Simulated minimum and maximum July water temperatures in the Pit 3, 4, and 5 bypassed reaches under warm, dry conditions under various flow regimes. (Source: PG&E, 2001)



[a] Modeled minimum flows released from the dams at the Pit 3 and Pit 4 reaches was 150 cfs, and 100 cfs at the Pit 5 reach; these releases simulate existing conditions.

Figure 11. Simulated average July temperatures in the Pit 3, 4, and 5 bypassed reaches modeled under normal meteorology and hydrology and various flow regimes. (Source: PG&E, 2002a)

Pit 3 Reach

We conclude that maintaining the current release flow in the Pit 3 reach (150 cfs), as originally proposed by PG&E, would be consistent with the resource goals stated by PG&E. The current flow regime should allow the Pit 3 reach rainbow trout fishery (which anglers rate as one of the best trout waters in northern California in terms of catch rate, average fish size, and angler satisfaction) to be maintained in its current state. The Pit 3 reach should also continue to produce non-game species, particularly Sacramento sucker, at levels that have proven to support eagle foraging. The Pit 3 reach would also continue to provide suitable habitat for sensitive molluscs. In its current state, the Pit 3 reach supports the highest average diversity of aquatic snails of the three reaches, including two sensitive species (i.e., the nugget pebblesnail and scalloped juga). In addition, the current release flows appear to have proven adequate for improving water quality conditions in Lake Britton, as CDPR reports that the current release flows have reduced the odor that occurred during the late summer before the existing minimum flow was implemented.

Increasing minimum flows in the Pit 3 reach to the range of flows originally recommended by Interior (600 to 800 cfs), CDFG (600 to 1,350 cfs), and the FS (400 cfs) would increase the amount of physical habitat (WUA) available to adult rainbow trout, adult Sacramento sucker, adult Sacramento pikeminnow, and all lifestages of hardhead (figure 6; table 28). These higher release flows may, however, have an adverse effect on wading conditions,[9] which could impede attainment of CDFG's management objectives for the Pit 3 Reach; specifically, maintaining: (1) a catch rate of one trout per hour; (2) an average trout size of at least 12 inches; and (3) an average minimum catch of four trout per angler. Although water temperatures in the Pit 3 reach would increase, they would likely remain generally within the optimum temperature range for trout (15 to 18 degrees C), and would generally not exceed draft management criteria established by the FS to protect the nugget pebblesnail, which recommend that water temperatures be maintained below 18 degrees C (65 degrees F) (see figures 9, 10, and 11 and table 28).

The effects of increasing minimum flow releases on water quality conditions, and associated aquatic habitat, in Lake Britton appear to be uncertain. Although the existing

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[9] Staff experienced wading conditions during a site visit in the lower part of the Pit 3 reach on the afternoon of May 21, 2002. Our opinion is that wading conditions would become considerably more challenging, and crossing the river would become hazardous in many areas, if flows were increased substantially beyond current levels. The results of PG&E's 2002 fishability assessment confirm our observations. At a flow of 395 cfs, it was substantially more difficult to wade or cross the river than at base flows, and, at 610 cfs, wading was quite difficult, and anglers considered it unsafe to cross the river (Whittaker and Shelby, 2003).

minimum flow release has been reported to have improved water quality conditions, PG&E's temperature model predicts that overall (vertically averaged) temperatures in Lake Britton and the temperature of outflows from the Pit 3 powerhouse would probably increase if the minimum flow release were increased to levels greater than approximately 250 cfs, which would deplete the pool of cool water in the deeper part of Lake Britton. If the deep pool of cool water is depleted, it would not be likely to influence the Lake Britton fish community, because most trout are found near the confluence of tributaries, and most other species are found near the shoreline.

The proposed PRCT agreement minimum flow regime (280 to 350 cfs; see table 27) would increase physical habitat in the Pit 3 reach over existing conditions for rainbow trout adult and fry, Sacramento sucker adult and fry, Sacramento pikeminnow adult and fry, and all life stages of hardhead (see figure 6 and table 28). There could be slight decreases in habitat available for juvenile rainbow trout, juvenile Sacramento sucker, and fry/juvenile Sacramento pikeminnow, depending on the habitat simulation technique used (figure 6 and table 28). However, as indicated by the shading in table 28, nearly all predicted decreases in habitat would still be within the range of what we consider to be either good or optimal habitat conditions.

Although implementation of the PRCT agreement minimum flow regime would reduce the ability of anglers to wade portions of the Pit 3 reach, conditions during the fishing season (late April through October) would still be considered acceptable to most anglers (table 28). Implementation of the PRCT agreement minimum flow regime would not be expected to cause water temperatures in the Pit 3 reach to exceed the maximum preferred temperature for rainbow trout, 18 degrees C (see figures 9 and 10). We concur with the FS conclusion that the minor increase in overall ambient water temperature in the Pit 3 reach that would be expected with implementation of the PRCT agreement minimum flow regime may be favorably offset by the reduction in daily water temperature variations, a factor known to be detrimental for the sensitive aquatic mollusc species that occur in this reach (Brock and Hutchins, 2003) (see figure 10).

According to the PRCT rationale statement, the bottom end of the receding hydrograph is believed to be important for the maintenance of the stream channel for fish and aquatic organisms. Therefore, the proposed minimum flows during the winter spill cessation are adjusted to provide a more gradual ramping down of the receding hydrograph to avoid abrupt termination of spill flows. For the Pit 3 bypassed reach, this is accomplished by providing higher proposed minimum flows for a specified number of days as the winter spill recedes. If spill is reinitiated, these ramp-down rates would be applied again.

Pit 4 Reach

We conclude that increasing the minimum flow in the Pit 4 reach from 150 to 200 cfs, as originally proposed by PG&E, is consistent with the resource goals stated by PG&E for the Pit 4 reach. The WUA available to adult rainbow trout would increase by about 10 percent, compared to existing conditions. Although WUA available to fry and juvenile trout could decrease by up to about 10 percent (depending on the habitat modeling approach used), the amount of habitat available to these earlier lifestages should still be adequate to support recruitment to the adult lifestage (figure 7). Regardless of the habitat modeling approach taken, at 200 cfs, fry and juvenile habitat would be good to optimal, with the exception of the habitat mapping approach where shallow/slow habitat is predicted to decrease by 6 percent (table 29). PG&E's temperature modeling supports the conclusion that temperatures upstream of Deep Creek would be reduced with the slightly higher flow (see figures 9, 10, and 11), improving the suitability of temperatures for trout rearing in the upper two-thirds of the reach. This relatively modest increase in flow should not have a major adverse effect on wadeability or on coldwater habitat in areas of spring inflow that provide habitat for molluscs that prefer colder water temperatures, including the nugget pebblesnail and the scalloped juga.

We conclude that increasing minimum flows in the Pit 4 reach to the range of flows originally recommended by Interior (600 to 800 cfs), CDFG (600 to 1,350 cfs), and the FS (450 cfs) would further increase the amount of physical habitat (WUA) available to adult rainbow trout, adult Sacramento sucker, and adult hardhead (figure 7 and table 29). Average water temperatures would become slightly more favorable for trout, especially upstream of Deep Creek (which is located at about river kilometer 42), compared to existing conditions and PG&E's originally proposed releases (see figures 9 and 11). However, the availability of habitat suitable for coldwater molluscs could be reduced due to higher minimum flows overwhelming the localized cooling effects of spring inflows. If localized spring-fed pockets of cool water are washed out, it would limit the availability of coldwater refugia that could be important for trout rearing during the summer. In addition, higher flows could adversely affect wading conditions, which could substantially affect access for anglers in a reach that already has limited access because of its location in a canyon with minimal road proximity. Our opinion, based on inspection of portions of the reach during the May 22, 2002, site visit, is that flows in the ranges that Interior, CDFG, and the FS originally recommended would likely preclude anglers from safely crossing the river in most areas. The results of PG&E's 2002 fishability assessment confirm our opinion about the relationship of flows to wadeability. At a flow of 420 cfs, anglers were only able to cross the river in a few places, and, at 630 cfs, anglers were unable to cross the river (Whittaker and Shelby, 2003).

The proposed PRCT agreement minimum flow regime (350 to 450 cfs; see table 27) would increase physical habitat in the Pit 4 reach over existing conditions for adult rainbow trout, adult Sacramento sucker, adult Sacramento pikeminnow, and adult hardhead (see figure 7 and table 29). Depending on the habitat modeling technique used, the PRCT agreement minimum flows could also increase the amount of habitat for juvenile rainbow trout (see results of 2D modeling shown in table 29). There could be slight decreases in the physical habitat for fry and juveniles of most species modeled, but nearly all predicted decreases in habitat would still be within the range that we consider to be either good or optimal (see shading in table 29). Implementation of the PRCT agreement minimum flow regime would reduce the ability of anglers to wade portions of the Pit 4 reach, but conditions during the fishing season would still be considered acceptable to most anglers (table 29). The temperature in the Pit 4 reach, which routinely exceeds the optimal range for rainbow trout under current conditions (figures 9, 10, and 11) would continue to do so under the PRCT agreement flow regime, but to a lesser degree. We agree with the FS conclusion that upon implementation of the higher minimum flow regime in the Pit 4 reach, sensitive mollusc species would most likely need to adjust their specific site locations but the expected overall increase in habitat for these molluscs should ultimately promote population growth (Brock and Hutchins, 2003).

According to the PRCT rationale statement, control of flows during the winter spill cessation period would be achieved by providing higher minimum flows between specific dates. This is a different approach to control late winter flows than proposed for the Pit 3 reach and is designed to avoid changes in stream flow magnitude and the direction of flow at frog egg deposition sites that could be caused by reinitiation of spills; and would be protective of the foothill yellow-legged frog population in the Pit 4 bypassed reach.

Pit 5 Reach

We conclude that increasing the minimum flow in the Pit 5 reach from 100 to 250 cfs, as originally proposed by PG&E, is consistent with the resource goals stated by PG&E for the Pit 5 reach. WUA available to adult rainbow trout would be substantially increased compared to existing conditions, and similar increases in adult habitat would occur for suckers, pikeminnow, and hardhead (figure 8 and table 30). Juvenile rainbow trout would be optimal at a flow of 250 cfs (table 30). Although WUA available to fry and juvenile lifestages for Sacramento sucker, Sacramento pikeminnow, and hardhead would be reduced, the amount of habitat available to these earlier lifestages would still be good to optimal regardless of the habitat modeling approach used (table 30) and should still be adequate to support ample recruitment to the adult lifestage. PG&E's temperature modeling supports the conclusion that temperatures upstream of Nelson Creek (which is located at about river kilometer 30) would be reduced with the higher flow, although temperatures downstream of Nelson and Kosk creeks could be slightly increased (see figures 9 and 11). Angler fishability could be reduced in some sections and improved in others. Our observations during the site visit held on May 22, 2002, and subsequent observations made on May 23, 2002, indicate that some portions of this reach may become difficult to cross by wading if flows are increased above current levels.

PG&E's 2002 fishability assessment indicates that, at flows of 251 cfs, the depth of water increased by no more than a few inches at most places, and wading became slightly more difficult than at base flows (Whittaker and Shelby, 2003). However, at a flow of 397 cfs, it was much more difficult to wade or cross the river, and at 620 cfs, the river was not crossable at Bush Bar and was too high and fast to wade in most places on the upper portion of the reach.

We conclude that increasing minimum flows in the Pit 5 reach to the range of flows originally recommended by Interior (600 to 800 cfs), CDFG (600 to 1,350 cfs), and the FS (500 cfs) would further increase the amount of physical habitat (WUA) available to adult rainbow trout, Sacramento sucker, and hardhead and would provide about the same amount of habitat for adult Sacramento pikeminnow, compared to the flow originally proposed by PG&E (see figure 8 and table 30). Average water temperatures would become slightly more favorable for trout, especially upstream of Nelson Creek (see figures 9 and 11). However, the availability of habitat suitable for coldwater molluscs could be reduced due to higher minimum flows overwhelming the localized cooling effects of tributary inflows. If localized spring-fed pockets of cool water are washed out, it would limit the availability of coldwater refugia that may be important for trout rearing during the summer. In addition, higher flows would adversely affect wading conditions in most of the reach, especially in the higher range of flows that Interior and CDFG originally proposed.

The proposed PRCT agreement minimum flow regime (350 to 450 cfs; see table 27) would increase physical habitat in the Pit 5 reach over existing conditions for adult rainbow trout, adult Sacramento sucker, adult Sacramento pikeminnow, and adult hardhead (see figure 8 and table 30). Depending on the habitat modeling technique used, the PRCT agreement minimum flows could also increase the amount of habitat for juvenile rainbow trout (see results of 2D modeling shown in table 30). There could be slight decreases in the physical habitat for fry and juveniles of most species modeled, but nearly all predicted decreases in habitat would still be within the range that we consider to be either good or optimal (see shading in table 30). Implementation of the PRCT agreement minimum flow regime would reduce the ability of anglers to wade portions of the Pit 5 reach (table 30). The temperature in the Pit 5 reach, which currently routinely exceeds the optimal range for rainbow trout (figures 9, 10, and 11) would continue to do so under the PRCT agreement flow regime, but to a lesser degree. We conclude that upon implementation of the higher minimum flow regime in the Pit 5 reach, sensitive mollusc species would most likely need to adjust their specific site locations but the expected overall increase in habitat for these molluscs should ultimately promote population growth. According to the PRCT rationale statement, control of flows during the winter spill cessation period would be achieved by using the same approach as would be taken in the Pit 3 bypassed reach.

The current diversity of thermal environments created by spring and tributary inputs at various points within all three bypassed reaches may also be important for supporting the existing diverse assemblage of non-game species of fish, including several state and federal species with special status (rough sculpin, bigeye marbled sculpin, Pit roach and hardhead). Large increases in minimum flow, such as those originally recommended by Interior, CDFG, and the FS, would reduce the range of thermal habitats that are available in each reach, and while the potential effects of such a change on each species is difficult to predict, these effects may well be detrimental. The more modest changes in the flow regime that are reflected in the PRCT agreement reduce the likelihood of unanticipated effects on aquatic biota.

Seasonal and between-year shaping of minimum flows, as originally recommended by the FS and reflected in the PRCT agreement flow regime (which links minimum flows to spill events; during dry years, flows would typically be lower because spill would occur later in the winter, if at all), would probably have beneficial effects for some aquatic species. According to the PRCT rationale statement, the PRCT agreement recognizes that even under pre-project conditions, there are certain years in which the flow in the Pit River would remain relatively constant. Therefore, in non-spill years, the proposed minimum flows remain relatively constant throughout the year and a winter minimum flow is not necessary. Under the PRCT agreement flow regime, flows during late spring, throughout the summer, and during early fall would be relatively low compared to the rest of the year. This would enable the young of key aquatic species (rainbow trout, Sacramento sucker, Sacramento pikeminnow, hardhead, and sensitive molluscs) to mature under comparatively non-turbulent conditions, thus enhancing their chances for survival.

However, implementation of the PRCT agreement flow shaping concept may result in unanticipated negative consequences that were not predicted by the habitat modeling. PG&E, in its reply comments dated November 25, 2002, notes that inputs from tributaries provide a substantial degree of flow variation in the lower portions of each reach, especially in the Pit 4 and Pit 5 bypassed reaches. The combination of stable flows provided by minimum flow releases under the current flow regime and groundwater accretion in the upper portion of each bypassed reach under the current flow regime and the more variable flow regime in the lower portions provide a diversity of flow and temperature regimes that support a diverse assemblage of fishes and invertebrates. Any adjustments made to the current flow regime should be undertaken with caution to avoid unanticipated adverse effects on the diverse and productive aquatic community that exists in all three of the bypassed reaches.

The PRCT agreement flow regime represents a prudent enhancement to the project flow regime based on modeled and observed habitat conditions that minimizes the chances for unanticipated negative consequences. However, addressing the responses of aquatic biota to flow shaping in a biological monitoring and adaptive management plan, discussed later in this section, would enable the benefits and liabilities of flow shaping to be considered and, if needed, provide a basis to make adjustments to the flow regime.

Pulsed (freshet)Flows in the Bypassed Reaches

The FS included a preliminary 4(e) condition in its letter to the Commission dated October 9, 2002, that would require PG&E to provide a controlled high flow release in the Pit 3 and Pit 4 reaches during March in years when natural spills have not exceeded 1,500 cfs for at least 24 hours prior to March 1. The FS made a similar 10(a) recommendation for the Pit 5 reach. The FS specified that a flow of 1,500 cfs should be maintained for a minimum of 2 days, after which flows would linearly decline over a 21- day period. The FS stated that annual high flow events may be needed to limit: (1) the encroachment of riparian vegetation into the stream channel; (2) the establishment of rooted aquatic vegetation (*Elodea*); and (3) the proliferation of invasive species including signal crayfish and bullfrogs. The FS also stated that the absence of scouring floods in dry years can lead to dominance of the insect community by late successional species of aquatic insect grazers that are either heavily armored or that are relatively invulnerable to aquatic insect and fish predators.

Interior recommended, in its October 9, 2002, letter at least two pulsed flow events each year during the January to March period, with maximum duration of 21 days per each event, a minimum peak duration of 2 days, and a minimum peak magnitude of 1,500 cfs.[10] Interior stated that the freshets are needed to provide a more natural seasonal range of flows and to facilitate gravel transport.

The PRCT agreement calls for the release of a freshet flow at least every second year to maintain channel conditions and the riparian community in all three bypassed reaches. However, to protect the foothill yellow-legged frog (discussed in section 3.3.3, *Terrestrial Resources*), freshet flows would not be initiated if mean daily water temperature at PG&E gage PG30 exceeds 11 degrees C for 2 consecutive days in the 2-week period prior to the scheduled release. The temperature criteria could be modified after consultation with the

10 This recommendation was stated in Interior's description of affected resources, but was not included in its list of recommendations made under Sections 10(a) or 10(j) of the FPA. Although not stated, we assume that this recommendation would apply to all water year types, and would include releases from natural high-flow events as well as controlled releases of at least 2 days.

FS, CDFG, FWS, and SWRCB based on available information and monitoring of foothill yellow-legged frog breeding and egg deposition.

Under the PRCT agreement, a freshet flow release would begin between March 1 and March 7 (the exact date would be scheduled so that the peak flow occurs on a weekend to facilitate whitewater boating) unless a spill event occurs during the 17 months prior to March 1. A spill event is defined as follows: (1) it occurs between December 1 and May 31; (2) it has a cumulative volume of at least 25,000 acre-feet; (3) it has a duration of at least 21 days; and (4) it has at least two average daily flows exceeding 1,500 cfs. PG&E would notify the FS, CDFG, FWS, SWRCB, and other interested parties that there is a potential for a freshet flow release if a spill event has not occurred by January 1 of each year. A freshet flow release would have the following characteristics: (1) the duration of the event, including the flow increase, decrease, and the peak, should be at least 21 days; (2) the instantaneous peak flow magnitude should be at least 1,500 cfs; and (3) there should be a 2-day average flow of at least 1,500 cfs. After the peak release, streamflow would decrease in five steps of about equal magnitude and duration over the remaining days of the freshet period, ending at the winter required minimum flow for that reach. The freshet flow requirements would be subject to temporary modification during emergencies. Where facility modification is required to implement this measure, PG&E would complete such modifications as soon as reasonably practicable and no later than 3 years after license issuance. Prior to completion of such facility modifications, PG&E would make a good faith effort to meet the requirements of this measure within the capabilities of the existing facilities. Because the FS and FWS signed the PRCT agreement, we presume that the PRCT agreement supercedes the previous recommendations of these agencies. The FS final 4(e) condition No. 17 (and modified 10(a) recommendation for the Pit 5 reach) is consistent with the PRCT agreement.

Our Analysis

We obtained information on peak flows recorded at USGS gages in the Pit 4 reach (USGS gage no. 11362500) and the Pit 5 reach (USGS gage no. 11363000) from USGS (2002b) to evaluate the existing frequency and magnitude of seasonal peak flow events. Our review of the data for the 26 water years extending from 1975 through 2000 indicates that in the Pit 4 reach, peak flows exceeded 1,500 cfs in 22 years, 3,000 cfs in 18 years, and 10,000 cfs in 12 years. In the Pit 5 reach, peak flows exceeded 1,500 cfs in 21 years, 3,000 cfs in 19 years, and 10,000 cfs in 11 years. In all years except 1992, the peak flow event occurred between November and May, with most events taking place in January, February or March. Although we were unable to locate comparable flow records for the Pit 3 reach, it is likely that annual peak flows have been similar in this reach as well (due to similar powerhouse capacities and limited capacity to store flood flows in project reservoirs).

Our review indicates that flows in the bypassed reaches exceed 1,500 cfs in approximately 8 out of 10 years. This frequency should be sufficient to achieve the objectives that the FS and Interior identify, especially given the relatively frequent occurrence of much higher flow levels, which would likely have a much greater effect on some objectives such as in reducing the establishment of rooted aquatic vegetation and the encroachment of riparian vegetation.

We conducted an additional review of the historical hydrological data to assess how often freshet flow releases might need to occur given the criteria established in the PRCT agreement with the proposed minimum flow regime. Although the past hydrological record is not guaranteed to represent future flow conditions in the Pit River, it should provide a general basis to assess how often such releases could occur under a new license. Our review suggests that freshet flow releases would have been required during water years 1977 and 1991 at the Pit 3 and Pit 5 reaches, and during water years 1977, 1979, 1988, and 1991 at the Pit 4 bypassed reach.

Provision of a spring freshet (flushing) flow in dry years may have both beneficial and adverse effects on aquatic resources in the three bypassed reaches. High flow events would be likely to assist with cleansing and redistributing gravel delivered from tributaries and hillslopes, as well as gravel that would be delivered to sites below each dam if gravel augmentation is undertaken (see discussion in the section "spawning gravel management"). High flows may reduce the encroachment of riparian vegetation, which would probably improve angler access, but also could adversely affect aquatic resources, including reduced cover, increased solar warming, reduced nutrient inputs, and reduced habitat for some species of invertebrates. Any reduction in the establishment of rooted aquatic vegetation could reduce habitat for some invasive species, but this habitat is probably also important to native invertebrates and many native species of fish.[11] We also consider it unlikely that the dry-year spring freshet flows would be effective in controlling populations of signal crayfish. In its reply comments dated November 25, 2002, PG&E notes that: (1) substantial populations of signal crayfish exist in the North Fork Feather River, which experiences higher runoff flows and spring floods than the Pit River; (2) the large, stable substrates in the Pit River provide shelter during high flows; and (3) that signal crayfish were abundant in the Pit 3, 4, and 5 reaches during the 1999 surveys despite the occurrence of a very large (over 40,000 cfs) flood in 1997 and very long period of spills in the spring of 1998.

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[11] In its November 25, 2002, reply comments, PG&E notes that *Elodea* beds are important habitat for many native species, including fish (e.g., tule perch, hardhead and Sacramento pikeminnow juveniles), amphibians (e.g., foothill yellow-legged frog tadpoles), and invertebrates (e.g., molluscs, annelids, aquatic insects, and other arthropods).

The PRCT agreement provides a freshet flow release plan that has defined criteria for when freshet flow releases would be provided. However, the plan does not specify whether facility modifications would be needed at the dams at any of the three bypassed reaches.

We further discuss dry-year spring freshet flows in section 3.3.3, *Terrestrial Resources*.

Ramping Rates

PG&E, in its October 11, 2002, letter proposed to develop a plan for ramping the tail end of spill flows to avoid rapid termination of spills when river flow comes under control of the project.

In its letter dated October 9, 2002, Interior recommended that PG&E develop a ramping rate plan to minimize flow fluctuations uncharacteristic of the natural seasonal stream conditions.

In its October 3, 2002, letter, CDFG recommended that a maximum ramping rate of 1 inch of stage change per hour be incorporated into the bypassed reach flow regime, and that any intentional flow changes be scaled to mimic natural flow variability.

In its October 9, 2002, letter, the FS included a preliminary Section 4(e) measure that would require PG&E to perform "an analysis to operate the Project to minimize impacts to the recession limb of natural spills into the Pit 3 and 4 Project reaches and regulate both the up ramping and down ramping rates of emergency or planned maintenance outages (with the exception of up ramp rates of some emergency spills, which cannot be managed), for the purpose of minimizing negative ecological effects of unnaturally rapid flow and stage fluctuations." The FS further recommended that natural spills be downramped at approximately the same rate as the natural attenuation of inflow, that downramping of all other flow releases be limited to 1 inch of stage change per hour, and that PG&E conduct a safety analysis to determine appropriate upramping rates to ensure river user safety.

As a related condition, the FS would require PG&E to prepare a plan to minimize the negative effects of uncontrolled high flows into the Pit 3 and 4 bypassed reaches. The FS also recommended the plan address uncontrolled high flows into the Pit 5 reach. The plan would include proposed measures for minimizing the magnitude and duration of both planned and emergency outage spills. As part of the plan, PG&E would conduct a feasibility study for providing flow continuation devices at the project powerhouses to provide continuation of flow through the penstocks in the event of turbine shutdowns. The FS also recommended that it be notified 90 days prior to any planned or scheduled maintenance outages at the Pit 3 or 4 powerhouses.

The PRCT agreement includes a ramping rate plan that would limit upramping and downramping rates to 0.5 foot/hour or less for freshet flow releases, recreational releases (if implemented), and releases following spills influenced by powerhouse outages (in accordance with operational protocols specified in the agreement). If PG&E anticipates that the storage capacity of a project reservoir would be exceeded during the summer or fall (i.e., an out-of-season spill event), PG&E would make a good faith effort to initiate stream flow releases that ramp up to the expected spill flow in at least three steps and ramp down following the out-of-season release at a rate of 0.5 foot/hour or less. PG&E would be considered to be in compliance with the ramping rate criteria if at least 75 percent of the actual incremental changes in flow are less than or equal to the specified ramping rate and all of the actual incremental changes in flow are less than 150 percent of the specified ramping rate. Where facility modification is required to implement this measure, PG&E would complete such modifications as soon as reasonably practicable and no later than 3 years after license issuance. Prior to completion of such facility modifications, PG&E would make a good faith effort to meet the requirements of this measure within the capabilities of the existing facilities.

The PRCT agreement also calls for PG&E to take all reasonable, controllable actions necessary to control non-emergency out-of-season spill events such that discretionary releases do not exceed twice the required minimum flow at the Pit 3, 4, and 5 dams, including, as a first priority, use of project storage capacity. If an out-of-season spill occurs, PG&E would take reasonable, controllable actions to minimize the magnitude, duration, and potential adverse ecological effects of the spill. Such measures would include the ramping rates specified in the previous paragraph and consultation with the FS, CDFG, SWRCB, and FWS to determine reasonable actions that may be needed to mitigate for identified adverse ecological effects of the spill. PG&E would also maintain a record of any out-of-season spills and provide it to the resource agencies and the Commission on an annual basis, which would include the affected reach, the hourly discharge, the maximum flow magnitude, the dates and duration, the cause, and the mitigation provided. Where facility modification is required to implement this measure, PG&E would complete such modifications as soon as reasonably practicable and no later than 3 years after license issuance. Prior to completion of such facility modifications, PG&E would make a good faith effort to meet the requirements of this measure within the capabilities of the existing facilities. Because FWS, CDFG, and the FS signed the PRCT agreement, we presume that the PRCT agreement supercedes the previous recommendations of these agencies.

The FS final 4(e) condition No. 17 (and modified 10(a) recommendation for the Pit 5 reach) is consistent with the PRCT agreement. The FS final 4(e) condition No. 18 (and modified 10(a) recommendation for the Pit 5 reach) is consistent with the PRCT agreement to manage out-of-season spills. However, the FS adds a provision that it be notified in writing 90 days prior to any planned or scheduled maintenance outages at the Pit 3 and 4 developments, which would include a description of the specific measures that would be taken to minimize the magnitude and duration of spills and appropriate selection of the seasonal timing of the planned outage spill to minimize negative ecological effects. The FS stipulates that planned maintenance outages at either the Pit 3 or 4 developments should not proceed without formal written approval of the FS.

Our Analysis

PG&E did not evaluate the potential effects of upramping and downramping on angler safety or fish stranding in its license application, but conducted studies on fishability and wadeability and on fish stranding as part of the 2002 controlled flow tests. The stranding evaluation was conducted by electrofishing pools that became isolated at six representative potential stranding sites immediately following the highest test flow evaluated in each reach (1,793 cfs for the Pit 3 bypassed reach, 1,818 cfs for the Pit 4 bypassed reach, and 1,894 cfs for the Pit 5 bypassed reach), including one site in the Pit 3 reach, three sites in the Pit 4 reach, and two sites in the Pit 5 reach (Spring Rivers, 2003a). There was no controlled downramping following the high flow release. A total of 54 fish were collected, consisting of 4 rainbow trout, 24 Sacramento sucker, 2 Pit sculpin, 6 hardhead, 6 Sacramento pikeminnow, 4 speckled dace, 7 tule perch, and 1 bluegill. Not unexpectedly, the most fish were collected in the pools with the largest surface area: 17 fish in an isolated pool near Delucci Ridge (a short distance upstream of Rock Creek) in the Pit 3 bypassed reach with a surface area of 282 square meters; and 33 fish in an isolated pool near Nelson Creek in the Pit 5 bypassed reach with a surface area of 120 square meters. Fish in the remaining isolated pools ranged from 0 to 3 and the size of the areas surveyed in each pool was 75 square meters or less. PG&E estimated collection efficiency to be close to 100 percent for all species except for larval cyprinids, of which it was estimated that about two-thirds were collected. PG&E estimated that the six sampling sites represented about one-third of all areas with potential stranding habitat. PG&E concluded that the bypassed reaches appeared to have a low stranding potential, but that the more often that flows are peaked and dropped, the more fish would be stranded.

The results of the stranding study suggest that the number of fish lost from stranding is very small in comparison to the total population. Although much of the habitat in all three bypassed reaches is not amenable to fish sampling and associated population estimates, PG&E collected fish by electrofishing and gill netting representative portions of the upper and lower ends of each reach during the summer of 2002 and estimated the densities of the more commonly caught species (PG&E, 2002). The most commonly stranded fish according to PG&E's study was the Sacramento sucker. At the Pit 3 reach, six Sacramento suckers were stranded. The average density of Sacramento suckers in Pit 3 pool habitat was 143 per hectare, run habitat, 18 per hectare, and riffle habitat, 29 per hectare. At the Pit 5 reach, 17 Sacramento suckers were stranded, all at the site near Nelson Creek. The average density of Sacramento suckers in Pit 5 pool habitat was 161 per hectare; run habitat, 64 per hectare; and riffle habitat, 40 per hectare. Based on these results, we conclude that it is unlikely that stranding could cause a noticeable effect on the populations of any of the species of fish that are present in the Pit River. As a result, we find that the benefits of implementing a restrictive ramping rate, such as the 1-inch per hour rate originally recommended by CDFG and the FS, appears to be limited.

PG&E, in its letter to the Commission dated November 25, 2002, indicates that spills resulting from planned outages are infrequent. In its June 21, 2002, response to our April 9, 2002, AIR, PG&E states that "...planned annual outages are never scheduled in a manner that would require any spill...". PG&E notes that maintenance that requires unit outages is planned so that storage in Lake Britton is used to prevent spill. Drawdowns to accommodate extra storage typically occur during the spring, prior to the start of the recreational season. Unplanned outages that resulted in spillage occurred four times between August 1992 and April 2002.

Although they may currently be infrequent, uncontrolled spill events have the potential to adversely affect beds of attached algae,[12] aquatic macroinvertebrates, sensitive aquatic molluscs,[13] fish, native amphibians, and terrestrial molluscs through scouring, displacement, and stranding. We note that although PG&E has been able to draw down Lake Britton during the spring to avoid spillage during planned outages, CDFG management objectives for Lake Britton now call for enhancing the warmwater fishery that has developed. One measure that CDFG recommended to further its management objectives is to restrict spring drawdowns of Lake Britton to 3 feet from full pond to enhance centrarchid spawning (as discussed later in this section in *Spring Reservoir Levels*). The operating protocol for the Pit 3 development, specified in the PRCT agreement could also restrict PG&E's ability to use storage as a means to control spill events. Implementation of these

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12 In its report "Effects of High Test Flows on Attached Algae", Spring Rivers (2003b) found that short-term flow peaks that occur during the summer season (one of which occurred during the summer of 2002) are likely to result in broad scale detachment of algal beds, which support numerous species of invertebrates and provide food for several species of fish including Sacramento sucker, rainbow trout, and probably hardhead and Pit roach.

13 In its report "Effects of High Test Flows on the Malinda Gulch Mussel Bed" study, Spring Rivers (2003c) indicates that untimely flow peaks could adversely affect the reproductive success of mussels, including the California floater.

measures may increase the frequency of spillage events during planned outages. We recognize that PG&E does not have the ability to control large magnitude flow events (and associated fluctuations) that exceed the hydraulic capacity of the turbines.

We conclude that advanced notification of the FS of planned out-of-season spill events is appropriate. We also conclude that advanced notification of other appropriate resource agencies (the FWS, CDFG, CDPR, and SWRCB) and other affected entities (e.g., the community of Big Bend) of any planned powerhouse outages that may result in anticipated but relatively sudden changes of flow to the bypassed reaches is appropriate. Such advanced notification would enable environmental factors to be considered, as well as potential schedule adjustments, prior to implementation of the scheduled maintenance. We recognize that there could be an element of uncertainty associated with such advanced notifications, because PG&E would most likely need to have control of the inflows to the project before implementing scheduled maintenance if uncontrolled spillage is to be avoided. Unusual rain events and warm weather that cause premature melting of the snow pack could increase flow in the Pit River to the point that PG&E could not achieve needed flow control.

The PRCT agreement provides a ramping rate plan and a plan to minimize out-of-season spill events. However, these plans do not specify whether facility modifications would be needed at the dams at any of the three bypassed reaches to implement these measures. We consider it important to establish whether facility modifications would be needed and, if so, at which development, the cost of such facilities, and the advantages that the new facilities would provide over using the capabilities of the existing facilities.

Whitewater Boating Flow Releases

The AWA, Shasta Paddlers, and Chico Paddleheads, in their October 9, 2002, letter to the Commission, recommended that scheduled whitewater boating flows be provided in the Pit 3, 4, and 5 bypassed reaches. In the Pit 3 reach, AWA, Shasta Paddlers, and Chico Paddleheads recommended that flows in June should start at 900 cfs and taper down to 600 cfs at the month's end. In the Pit 4 and Pit 5 reaches, they recommended releases of 1,800 cfs on the fourth weekend in June; 1,700 cfs on the second and fourth weekends in July; 1,500 cfs on the second and fourth weekends in August; and 1,250 cfs on the second and fourth weekends in September. On each weekend, the whitewater flow would be provided on Saturday at the Pit 4 reach and on Sunday at the Pit 5 reach.

The FS included a preliminary Section 4(e) condition that would require PG&E to provide a controlled high-flow release in the Pit 3 and Pit 4 reaches during March in years when natural spills have not exceeded 1,500 cfs for at least 24 hours prior to March 1. The FS made a similar 10(a) recommendation for the Pit 5 reach. These flow releases, in addition to spills associated with natural high-flow events, could provide whitewater boating opportunities. The FS specified that a flow of 1,500 cfs would be maintained for a minimum of 2 days, after which flows would linearly decline over a 21-day period (see our previous discussion of *Pulsed (freshet) Flows in the Bypassed Reaches*).

Several parties expressed concern about the potential effects of whitewater releases on aquatic resources in the Pit 3, 4, and 5 reaches. CDFG states, in its October 3, 2002, letter, that it did not support "intentional variation of flows beyond the magnitude, duration, frequency or season found in unimpaired systems," citing potential effects on invertebrate production and rearing behaviors for native amphibians and fish. Trout Unlimited and California Trout recommended "avoiding unseasonal flow fluctuations" in their October 11, 2002, letter. California Wild Trout Preservation Society (CWTPS), by letter dated October 23, 2002, urged that stable flow rates be maintained, and expressed concern that raising flows would disturb the balance of the ecosystem. In its October 8, 2002, letter, the Fly Fishers urged against providing out-of-season high flows, citing potential adverse effects on fishability and on the health of the river system including effects on frogs, invertebrates, and fish. The Anglers Committee Against Whitewater Flows, by letter dated October 7, 2002, urged that detailed boating and aquatic studies be conducted to determine effects on trout, invertebrates, and other fish and aquatic species. Interior recommended that PG&E examine the effects of recreational activities on fish and wildlife resources as part of a recreation management plan to be developed in consultation with the FWS, National Park Service (NPS), and other resource agencies.

The PRCT agreement calls for PG&E to develop, in consultation with SWRCB, CDFG, FWS, NPS, CDPR, the Tribe, AWA, and other parties who request involvement, a plan for providing annual recreational releases in the Pit 5 reach suitable for whitewater boating. The SWRCB would approve the plan prior to submitting the plan to the Commission for final approval. The overall plan would consist of baseline data collection (which would include: (1) identification of existing data and data to be developed; (2) a study plan and schedule for obtaining such data; and (3) a description of how the data would be used), establishment of a recreational release schedule, and environmental and boater-use monitoring.

Development of a baseline data study plan under the PRCT agreement would enable collection of baseline data necessary for the effective evaluation of possible ecological effects of recreational releases. In addition this plan would specify the timing relationship between data acquisition, initiation of recreation streamflow releases, and potential adjustments or releases in response to data gathered. This study plan would entail data collection for up to 5 years with a total cost cap.

The initial recreational release schedule under the PRCT agreement would entail a total of four releases per year; two consecutive weekend days in August with flows of 1,500 cfs from 10 AM to 4 PM at the Pit 5 dam and two consecutive weekend days in September with flows of 1,200 cfs from 10 AM to 4 PM at the Pit 5 dam. In years that spill does not occur at the Pit 3 dam, as specified in the minimum streamflow element of the PRCT agreement, all recreational flow releases would be 1,200 cfs. The initial recreational flow releases would occur for 3 consecutive years. Thereafter, the schedule may be modified based on the results of monitoring. PG&E would make a good faith effort to provide the specified recreational releases within the accuracy of the existing flow release facilities at the Pit 5 dam.

The monitoring element of the plan specified in the PRCT agreement would consist of environmental monitoring and boater use monitoring. The environmental monitoring would be designed to assess environmental effects of the recreational releases, including impacts on aquatic biota, other river users, other recreational users, special status species, and cultural sites and uses. Environmental monitoring would not exceed 3 years with a total cost cap. Boater-use monitoring would monitor actual boater use on each day during recreational releases for the first 3 years of recreational releases. After 3 years, boater-use monitoring would be performed in any year that the number of release days are altered and at least once every three years over the term of the license. Boater-use monitoring may be discontinued by mutual agreement with PG&E and SWRCB, with Commission concurrence, after consultation with AWA, FWS, and other interested members of the public.

The PRCT agreement specified plan would provide a basis to adjust the number of recreational release days after the initial 3 year monitoring period based on the monitoring results. Any adjustments would occur after consultation with resource agencies and other interested parties, approval by SWRCB, and notification of the Commission. The framework established by the PRCT agreement would entail the addition of one recreational release day for the next year if actual use exceeds 80 boater days for each recreational release day in a given month. One recreational release day would be subtracted for the next year if actual boater use is less than 25 boater days for each recreational release day in a given month. The number of recreational release days would not be less than 1 weekend day in August and 2 consecutive weekend days in September or more than 4 weekend days in August and 4 weekend days in September. If the maximum number of recreational release days is provided, and actual boater use exceeds 80 boater days on all days, one additional weekend day of release would be provided in October of the next year. In subsequent years, the October release days could be adjust upward to a maximum of 2 consecutive weekend days and downward to a minimum of no days. Because AWA (but not Shasta Paddlers and Chico Paddleheads), the FS, CDFG, Trout Unlimited, California Trout, and FWS signed the PRCT agreement, we presume this agreement supercedes the previous recommendations and concerns of these entities.

Our Analysis

The controlled flow tests conducted in the spring and summer of 2002 included a number of studies designed to evaluate the effects of high-flow releases on aquatic resources, including a fish stranding study, a mollusc study, a filamentous algae movement study, the 2002 sediment transport study, and a whitewater boating and fishability study.

Results from the fish stranding study, which we previously discussed, indicate that there may be a limited potential for stranding fish in the Pit 3, 4, and 5 bypassed reaches (Spring Rivers, 2003a). In addition, the potential for fish stranding may be further reduced by using an appropriate ramping rate to slow the rate at which flows recede. However, the report also concludes that the more often high flows are released and dropped, the greater impact stranding would have on fish populations in the Pit River drainage. Results from the filamentous algae study indicate that high-flow events could reduce the standing crop of algae, thus adversely affecting the forage base that is available to invertebrates and fish (Spring Rivers, 2003b).

PG&E's mollusc study was designed to assess the potential direct effects of high test flows on the abundance and distribution of mussels in an area located in the Pit 4 bypassed reach near Malinda Gulch (Spring Rivers, 2003c). This site had the highest density of mussels found in the project reaches and therefore the effects of high flows on mussels could be evaluated based on the responses of numerous individuals of several species. We expect the results at this location to be generally applicable to smaller mussel beds in all three bypassed reaches. Four species of mussels occur at this site: western pearlshell mussel, western ridgemussel, California floater (a FS sensitive species of concern), and Willamette floater. The study results indicate that the density of all species of mussels was not influenced by even the highest test flow releases (1,800 cfs). However, the authors of the study report point out that the study was not designed to address potential negative effects on mussel reproductive success or juvenile recruitment that could result from high flow events that occur at inappropriate times relative to the natural hydrograph.

High-flow events could also reduce populations of other invertebrates when high velocities occurring in the main stream channel dislodge the invertebrates and carry them downstream. Repeated high-flow events during the summer could adversely affect the standing crop of invertebrates at a time when the food requirements of trout and other fish are at a maximum due to relatively warm stream temperatures.

Provision of a single high-flow event early in the season, as originally recommended by the FS, would likely have much less of an adverse effect, and may provide beneficial effects, on aquatic resources. Timing the flow event during the spring months would allow flows to recede in time for algae to grow and for invertebrate populations to increase as water temperatures and fish feeding increases. It also would not influence recreational angling, because it would occur outside of the fishing season, which extends from the last Saturday in April through November 15.

Although we conclude that recreational releases during August and September, as now envisioned in the PRCT agreement, has the potential to adversely influence aquatic biota (as also indicated in the PRCT rationale statement for this measure), we agree that the collection of up to 5 years of baseline data at the Pit 5 bypassed reach would provide a reasonable basis to make a better informed decision about whether the recreational value of making out-of-season releases would outweigh the ecological consequences. The PRCT agreement allows for the potential adjustment of recreational releases in response to the baseline data gathered. We consider this to be a critical element of the proposed recreation streamflow release plan.

Spawning Gravel Management

The FS included, in its October 9, 2002, letter, a preliminary condition to develop a gravel supply management plan for the Pit 3 and Pit 4 bypassed reaches. The plan would include an initial study phase to quantify young-of-the-year fish production, spawning use, benthic invertebrate habitat and production, and wadeability in the Pit 3 bypassed reach. A second study phase would be designed to evaluate the physical and associated biological effects of augmenting the gravel supply through direct placement of clean, rounded, gravel-sized sediment in the Pit 3 bypassed reach. The second phase would continue until results are sufficient to determine the physical and biological benefits associated with gravel augmentation. Following completion of the study, the FS would determine continuing Section 4(e) conditions for gravel management.

Interior recommended, by letter dated October 9, 2002, that PG&E develop a plan for improving the passage of spawning-sized and larger gravels and cobbles past the Pit 3, 4, and 5 dams. Interior also recommended that the plan should include a program for gravel placement downstream of each of the dams and a follow-up monitoring program to evaluate the benefits of gravel placement to fish spawning and macroinvertebrate production. Trout Unlimited and California Trout made a similar recommendation in their October 11, 2002, letter stating that license conditions should provide for sufficient spawning gravel movement between and within reaches.

CDFG recommended that PG&E develop a spawning gravel management program, to include mapping of spawning areas at 3- to 5-year intervals to detect if there is any continued diminishment of spawning gravel. If continued loss of gravel is detected, CDFG recommended that PG&E implement a spawning gravel enhancement program in consultation with the FS, CDFG, and FWS.

In response to our draft EIS and the Section 10(j)/FS clarification meeting held on August 28, 2003, the FS issued its final 4(e) condition No. 21 pertaining to gravel management by letter to the Commission dated November 14, 2003. This 4(e) condition is very similar to the revised 4(e) condition submitted by the FS by letter to the Commission dated May 19, 2003. The final 4(e) condition calls for the development of a gravel management plan within 1 year of license issuance. The plan would include a 4-year pre-augmentation phase to establish baseline trout and invertebrate populations, trout reproduction and spawning, and substrate conditions in the Pit 3 and Pit 4 bypassed reaches near designated augmentation sites, followed by annual gravel placement at designated sites and post-implementation monitoring and reporting at 4-year intervals to evaluate and quantify program effects on aquatic resources. The final 4(e) condition calls for the annual placement of a total of 1,248 tons of gravel in the Pit 3 and Pit 4 bypassed reaches (624 tons per reach), with a $30,000 annual budget cap (adjusted annually for inflation at the consumer price index rate). The condition further specifies that the gravel should be clean and rounded, ranging in size from approximately 8 to 64 mm, with a median size of approximately 25 to 35 mm. The FS makes a similar Section 10(a) recommendation for the Pit 5 bypassed reach. CDFG, by letter to the Commission dated December 2, 2003, endorses the FS measures pertaining to gravel management.

Our Analysis

PG&E studies indicate that the project dams reduced the volume of gravel delivered to the Pit 3, 4, and 5 bypassed reaches by 89, 92, and 48 percent, respectively (Madsen and Beck, 2002). Most in-channel gravel occurs in patches behind boulders and other obstructions, and the elimination of upstream sediment supply has probably resulted in some depletion of these patches over time, especially in the Pit 3 reach upstream of Rock Creek and in the Pit 4 reach upstream of Canyon Creek (Madsen and Beck, 2001) (see our discussion of existing *Sediment Transport and Supply* in section 3.3.1.1, *Water Resources*).

We conclude that increasing the availability of gravel in the bypassed reaches could benefit aquatic resources by increasing the availability of trout spawning habitat and improving invertebrate production, and may also improve wading conditions. Although some trout from the Pit River probably move into tributaries to spawn, the relative scarcity of small trout collected in all three bypassed reaches during PG&E's 2002 fish sampling effort suggests that the scarcity of spawning habitat could limit recruitment. Increasing the amount of gravel deposits could also increase the amount of invertebrate habitat that is available within the stream substrate, and enhancing invertebrate production could increase the biomass of trout and non-game species that can be supported. Finally, increasing the amount of instream gravel deposits could improve wading conditions for anglers, especially in the upper portions of each bypassed reach. Wading conditions in these reaches are difficult because of the dominance of larger, irregular, and angular substrates that typically have a slick coating of algae.

In the draft EIS, we recommended that PG&E develop a gravel augmentation plan designed to enhance trout populations by increasing fry production in the upper portions of the Pit 3 and Pit 4 bypassed reaches. The plan was to be developed in consultation with the CDFG, the FS, FWS, and PRCT, and would include at least 4 years of monitoring of trout populations or spawning surveys prior to implementation and monitoring at 4-year intervals after implementation to evaluate and quantify benefits to trout reproduction, recruitment, and population size. Based on the scope of other gravel augmentation programs in California cited by the FS in its rationale for its preliminary 4(e) conditions,[14] we suggested that 2 to 5 tons of gravel be placed each year in the Pit 3 and Pit 4 bypassed reaches.

Comments on the draft EIS indicated that most agencies believed that trout populations would benefit from the placement of a much larger quantity of gravel, and CDFG indicated that it believed that regular mapping of gravel would provide valuable information for adjusting the gravel augmentation program.

The FS provided clarification of their revised 4(e) condition during a Section 10(j)/FS clarification meeting held on August 28, 2003 (see meeting summary issued by the Commission on September 22, 2003). The FS stated that the gravel would be placed at a single site downstream of each dam, that no new access roads would be constructed, and that the $30,000 cost cap would include all costs for materials, delivery, and placement of the gravel in both reaches. The FS also indicated that monitoring gravel abundance at selected monitoring sites would be acceptable, rather than more extensive gravel mapping throughout each bypassed reach where gravel was placed. FWS and CDFG indicated that the revised 4(e) condition would probably be acceptable to them, with the exception that they would want to see gravel augmentation extended to the Pit 5 reach. Although we indicated in the draft EIS that gravel appears to be less limiting to trout spawning in the Pit 5 bypassed reach, the agencies pointed out that gravel is still in short supply in the upper portion of the Pit 5 reach. FWS indicated that a similar quantity and a proportional cost cap ($45,000 for all three reaches) would probably be adequate to achieve their objectives.

We conclude that the primary potential benefit of gravel augmentation would be to increase the production of trout fry in the upper portions of each bypassed reach, where

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[14] On page 36 of enclosure 1 of its October 9, 2002 letter to the Commission, the FS stated: "Annual gravel additions on comparably sized rivers (e.g., Tuolumne, Stanislaus, Trinity, American, Feather Rivers) have ranged from one to ten tons/year with annual program costs ranging from $50,000 to $300,000."

little substrate suitable for trout spawning exists. If a gravel augmentation program is undertaken, we believe that it would be prudent to target the program toward achieving the objective of increased trout fry production.

Woody Debris Management

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop a large woody debris management plan for the Pit 3 and Pit 4 bypassed reaches. The recommended plan would, at a minimum, outline methods and criteria for simulating the transport of large woody debris through the project reservoirs by manually depositing all woody debris pieces removed from the Pit 3 and Pit 4 project reservoirs at approved channel bank sites in the Pit 3 and Pit 4 bypassed reaches. The plan would include a detailed description of proposed collection and deposition methods, diagrams of proposed "improvements" (presumably to accommodate collection or deposition), construction cost estimates, and a quantitatively supported rationale for deposition site, method selection, and cost minimization. Trout Unlimited and California Trout made a similar recommendation, in their October 11, 2002, letter, stating that license conditions should provide for sufficient woody debris movement between and within reaches.

Interior, by letter dated October 9, 2002, recommended that PG&E develop a woody debris and nutrient transport plan in consultation with the FS, FWS, CDFG, and SWRCB. The recommended plan would include: (1) an analysis of large woody debris transport and storage under various flows; (2) an analysis of how large woody debris can influence channel morphology; and (3) a plan for implementing placement of woody debris from Lake Britton to the Pit 3 bypassed reach. Interior noted that woody debris can provide important sources of nutrients to aquatic and riparian systems, large woody debris can provide habitat for aquatic and terrestrial organisms, and large woody debris can influence channel morphology.

CDFG, in its letter to the Commission dated October 3, 2002, recommended that PG&E develop a large woody debris management plan in consultation with the FS, CDFG, and FWS. CDFG noted that increasing the amount of woody debris in the low-flow channel would increase habitat complexity and structure for a variety of aquatic species including macroinvertebrates and spawning fish.

The FS, in its final 4(e) condition No. 21 submitted to the Commission by letter dated November 14, 2003, states that PG&E should develop and implement an operating procedure to facilitate the passage of woody debris over the Pit 3 spillway during spill events and provide documentation of the procedure for FS approval. The FS also makes a 10(a) recommendation that PG&E develop and implement an operating procedure to facilitate the passage of woody debris over the Pit 5 spillway during spill events. CDFG, by letter dated December 2, 2003, endorses the FS condition and recommendation pertaining to woody debris transport.

Our Analysis

PG&E documented the distribution and occurrence of large woody debris during the river corridor habitat mapping and biota surveys (Spring Rivers, 2001). It reported that woody debris was abundant throughout the river reaches, and there was continual recruitment of large wood from dead and dying trees along the mainstem channel margins. Wood deposits tended to be within the active channel, but above the low-flow channel. PG&E found a total of 375 woody debris occurrences (including individual pieces as well as debris jams) in the Pit 3 reach, of which 32 (8.6 percent) were in the low-flow channel. The Pit 4 reach had 456 woody debris occurrences, of which 26 (5.7 percent) were in the low-flow channel. The Pit 5 reach had 691 occurrences, of which 38 (5.5 percent) were in the low-flow channel. There were no apparent trends in the distribution or concentration of wood that would indicate primary sources of woody debris or restrictions to woody debris movement. Wood was not more abundant downstream of tributaries or less abundant downstream of dams. Providing a summary of PG&E's transport analysis in any woody debris transport plan that may be included in a license for this project, as specified in Interior's Section 10(j) recommendation, would provide useful perspective on the objectives of the plan.

In its June 21, 2002, response to our April 9, 2002, AIR, PG&E describes alternative methods that could be used to transport woody debris that accumulates on project trash racks into the bypassed reaches downstream of each project. At the Pit 3 development, PG&E states that debris removed from the trashrack could be placed outside of the log boom, where it would remain until it was carried over the dam when the gates were opened to pass spill flows. Two alternatives were described at the Pit 4 development: (1) transporting woody debris by truck around the dam and depositing it at the high water mark, which would require improving the access road and a dump area near the water; and (2) extending an existing debris conveyor so that material could be deposited on the back side of the dam. PG&E also describes two options at Pit 5: (1) extending a planned conveyor so that it could dump debris directly into the river; and (2) installing a dump site and hopper or chute on the right side of the dam.

Based on our review of the results of PG&E's habitat surveys, we conclude that passing woody debris over the project dams would not produce an appreciable increase in the incidence of large woody debris within the low-flow channel and, as a result, would provide very little benefit to aquatic resources. The results of the surveys indicate that a substantial amount of woody debris is recruited from tributaries and channel margins, but that little of this debris is deposited within the low-flow channel, and this would likely be the case for any debris that was transported around the dams. PG&E's also noted that the abundance of large substrate in the bypassed reaches provides habitat complexity despite the lack of woody debris in the low-flow channel. In its response to our AIR, PG&E also notes that the public may have a very negative opinion regarding disposing of debris removed from the trash racks in the river. In addition, debris that is passed over the dams could potentially create hazards for whitewater boaters.

Although the benefit to aquatic resources of passing woody debris over the project dams appears to be quite limited, we see little reason not to pass debris from Lake Britton over the spillway during spill events. The debris would be carried over and deposited primarily along the stream margin during high-flow events, and this passive approach would probably not elicit the negative reaction from the public that otherwise might result from other, more active or mechanical methods of transport and delivery. We are not aware of a procedural method that could be used to pass woody debris over the Pit 5 dam spillway, as the FS currently recommends (rather than a method that would entail construction or modification of existing facilities). However, if such a procedural technique can be developed, we would not be opposed to its implementation.

Hat Creek Barrier

The Hat Creek fish barrier was constructed in 1969 as part of the implementation of CDFG's *Wild Trout Management Program for Hat Creek*. The barrier was constructed and has been maintained by CDFG according to an easement granted by PG&E to CDFG, which has been extended to at least 2003.

CDFG expressed concern, by letter dated October 3, 2002, about the structural integrity of the barrier and recommended that PG&E be required to assume responsibility for maintaining the barrier, including conducting biannual inspections by a civil engineer. CDFG reports that formation of Lake Britton by the construction of Pit 3 dam caused the fish community in lower Hat Creek to shift from a typical coldwater fishery to one dominated by non-game species that take advantage of the warmwater habitat provided by Lake Britton. Trout Unlimited and California Trout, by letter dated October 11, 2002, also recommended that PG&E be responsible for future maintenance and management of the fish barrier.

Following extensive discussion of this issue at the August 28, 2003, Section 10(j)/FS clarification meeting, PG&E indicated that they had agreed to meet with CDFG to develop a new management agreement for the Hat Creek fish barrier (see summary of this meeting issued by the Commission on September 22, 2003).

The FS made a revised Section 10(a) recommendation, in a letter to the Commission dated November 14, 2003, that is consistent with a tentative agreement between PG&E and CDFG. The recommendation calls for PG&E to cooperate with CDFG in maintaining an effective fish barrier located on Hat Creek at the point where it enters Lake Britton for the term of any new license that may be issued for this project. PG&E would be responsible for the following: cost of materials; and archeological investigation, monitoring, and mitigation required for needed maintenance. CDFG would be responsible for the following: planning; permitting; and construction. In the event the it is necessary to replace the barrier dam, PG&E would, at a minimum, provide: materials; archaeological review and coordination; and some equipment. CDFG would provide: design; planning; environmental review; permitting; and personnel to complete the replacement.

CDFG, by letter to the Commission dated December 2, 2003, reiterates that they have reached a tentative agreement with PG&E regarding a cooperative effort to share in the future long-term maintenance of the Hat Creek fish barrier. CDFG notes that an important part of that agreement would be a specific license condition that establishes PG&E's responsibility for maintaining an effective fish barrier.

PG&E filed its proposed license measure pertaining to the Hat Creek fish barrier and the Hat Creek Wild Trout Management Area on December 29, 2003. In general, PG&E's proposed measure is consistent with the FS revised Section 10(a) recommendation, and sets a 50 percent cap on PG&E's contribution towards the annual maintenance costs for the fish barrier, as well as for PG&E's share of the replacement of the dam, should that become necessary. However, PG&E's proposed measure specifies that although it would cooperate with CDFG in maintaining an effective fish barrier, the barrier dam would not become a project feature. In addition to measures pertaining to the barrier dam, PG&E agrees to make available specified funding amounts for implementation of a Hat Creek Wild Trout Management Plan and to be an active member of the Hat Creek TAC that would develop and implement this management plan.

Our Analysis

PG&E provided a copy of the current easement that allows CDFG to operate and maintain the Hat Creek fish barrier (letter from J. Holeman, Sr., Project Manager, PG&E, San Francisco, CA, to the Commission, dated July 12, 2002). PG&E noted that CDFG has operated and maintained the fish barrier for 20 years according to the easement, and that CDFG has the obligation to remove the fish barrier and restore the site if it does not renew the easement when it expires in 2003.

Although the fish barrier was constructed in response to fish population changes that occurred after formation of Lake Britton, the future role of the barrier is primarily a fisheries management issue. We note that the Tribe, in its October 10, 2002, letter, states that it has proposed that removal of the fish barrier be considered in conjunction with the establishment of runs of non-anadromous salmon. Because of the potential effects on other fisheries resources in Hat Creek and in Lake Britton managed by CDFG, we consider both maintenance of the fish barrier, as well as the potential for stocking any fish species in Lake Britton, to be management decisions that are best left under the direct control of CDFG.

However, we acknowledge that the presence of Lake Britton has fostered population growth of native (Sacramento sucker, Sacramento pikeminnow, and hardhead) and non-native (centrarchids, including smallmouth bass) species that would not have been as abundant if the Pit 3 dam had not been constructed. Without the fish barrier, these fish would be able to move into the Hat Creek Wild Trout Management Area and diminish the quality of this important recreational fishery. If the barrier dam should fail due to lack of maintenance, reintroduction of these non-salmonid species into Hat Creek would be extremely difficult to reverse, because reclamation by chemical means (as was done following the initial construction of the barrier dam) is no longer an option according to CDFG (see summary of Section 10(j)/FS clarification meeting issued on September 22, 2003). We conclude that maintenance of the fish barrier is most appropriately addressed as a shared responsibility between PG&E and CDFG.

Fish Passage

In its October 9, 2002, letter, Interior indicates that it does not have sufficient information to support the filing of a prescription for fishways for the Pit 3, 4, 5 Project. Interior recommends that PG&E develop a plan to assess the potential restoration of volitional passage of anadromous fish between the Sacramento and Pit rivers. Interior further recommends that the plan be developed in consultation with the FS, FWS, NMFS, Reclamation, Tribe, CDFG, and SWRCB within 6 months of license issuance. Interior notes that Reclamation previously had developed a scope of work for completing a reconnaissance level investigation, but never completed the investigation. Reclamation's study would have evaluated the potential for an alternative fish passage corridor around Shasta dam instead of laddering or lifting fish over Shasta dam. The alternative corridor would start at the mouth of Cow Creek, just downstream of Anderson, continue northward up Little Cow Creek, then up Dry Creek to an unnamed seasonal drainage near the lowest elevation saddle between the Cow Creek Basin and the Shasta Lake Basin. The alternative corridor would pass through this saddle in an excavated ditch and then travel eastward around the perimeter of Shasta Lake in a new canal. Fish screens and flow control structures would be required at the intersections of the canal and the major tributaries to isolate anadromous fish from Shasta Lake while allowing the majority of the water to still flow into Shasta Lake.

The Tribe, in its October 10, 2002, letter, recommends that PG&E assess the feasibility of reintroducing anadromous fish or kokanee salmon to project waters, including assessing the feasibility of dam removal. The Tribe notes that the PG&E's dams were constructed prior to the formation of Shasta Lake, and that the Tribe's loss of salmon has never been addressed or mitigated. The Tribe also provides a list of ecological, economic, societal, and other dam removal-related issues that should be studied as part of the dam removal feasibility study.

In response to the Tribe's request to assess the feasibility of reintroducing anadromous fish to project waters, CDFG commented:

> Multiple dams on the Pit River as well Shasta Dam have blocked up and downstream migration of anadromous salmonids for decades. From both an engineering and a biological standpoint, the introduction of anadromous salmonids to the system is not feasible. Construction of ladders capable of moving fish over Keswick, Shasta, and all the Pit River diversions is not realistic. Successful downstream migration of young salmonids would fail even if functional fish ladders were installed on the dams of the Pit and Sacramento Rivers. Salmon and steelhead life history requirements include a roundtrip journey to the ocean which cannot be physically accomplished in this highly modified hydrology (memorandum to Annie Manji, Environmental Scientist, CDFG, from Steve Baumgartner, Northern California-North Coast Region, CDFG, dated August 21, 2002, as cited in CDFG's October 3, 2002, letter to the Commission).

Trout Unlimited and California Trout recommend, by letter dated October 11, 2002, that future license conditions promote fish access to tributaries for spawning purposes.

Our Analysis

Construction of PG&E's Pit River projects blocked anadromous fish runs from historical habitat. It is clear that the technology now exists for providing upstream and downstream fish passage at projects the size of the Pit River projects, if adequate passage survival could be achieved both to and from the projects. Providing adequate passage of anadromous fish through reservoirs the size of Shasta Lake, however, has not been achieved to date. Factors that may contribute to this challenge include a lack of attraction flows to guide migrating adult and juvenile salmon through the reservoir, water quality conditions in the reservoir at the time of migration, the establishment of populations of predatory fish in the reservoir, and the challenge of successfully collecting and bypassing juvenile salmon, which may require a facility capable of screening the entire volume of outflow during the spring months, encompassing the highest outflows of the year.

The alternative for bypassing fish around Shasta Lake, as described by Interior, involves enormous engineering challenges. Routing outmigrating smolts past Shasta Lake would require screening the entire flow of the Pit River during the spring months, when flows and debris loads are at their maximum so that smolts could be directed out of the Pit River and into the bypass canal. Likewise, facilities at tributary crossings along the canal route would need to be capable of directing fish along the canal under any flow condition. Maintaining conveyance flows across the connection between the Cow Creek and Pit River basins would be another major engineering challenge. Smolts that successfully emigrated from the Pit River via the bypass route would face additional, substantial obstacles as they outmigrated and returned as adults through the lower Sacramento River and San Francisco Bay.

Implementing a passage route either through or around Shasta Lake would involve the construction and maintenance of extensive facilities located on lands that are not under the ownership or control of PG&E. In addition, it does not appear to be reasonable to require PG&E to evaluate passage options to overcome obstacles that are attributable to dams downstream of its projects and that were constructed and are owned and operated by other entities. If migration problems in the lower river can be successfully overcome at some point in the future, the technology to provide passage at PG&E's projects on the Pit River is readily available, and a Section 18 prescription at these projects could be implemented with a reasonable expectation that passage could be provided with relatively high rates of fish survival through PG&E's Pit River projects.

Regarding the Tribe's recommendation to study the feasibility of establishing a population of kokanee in Lake Britton, we note that CDFG has unsuccessfully attempted to establish a kokanee population in Lake Britton. CDFG planted 387,000 kokanee fingerlings in Lake Britton in 1970, but no adult kokanee were found in 1971, when CDFG surveyed Lake Britton tributaries (memorandum to Annie Manji, Environmental Scientist, CDFG, from Steve Baumgartner, Northern California-North Coast Region, CDFG, dated August 21, 2002, as cited in CDFG's October 3, 2002, letter to the Commission). CDFG further notes that: "Currently, it is Department policy not to plant salmonids into Lake Britton because of their poor survival as well as the occurrence of a fish disease caused by the protozoan *Ceratomyxa shasta*, which is fatal to non-native salmonids." The Pit River strain of rainbow trout, which is able to maintain healthy populations in the Pit River, is resistant to the disease. We agree with CDFG's assessment regarding the potential for planting salmonids in Lake Britton.

We are in agreement with Trout Unlimited and California Trout's recommendation to promote fish access into tributaries for spawning, to the extent that any obstructions are project-related. However, we are not aware of any problems relating to access to Pit River tributaries, and surveys conducted by PG&E have documented spawning in most of the major tributaries in the Pit 3, 4, and 5 bypassed reaches.

Spring Reservoir Levels

As part of the peaking mode of operation, the level of Lake Britton fluctuates with power demand on a daily and weekly basis. Often, this involves a drawdown of 3 to 7 feet from Monday through Friday, with refilling on weekends. Reservoir fluctuations can adversely affect fish populations because fluctuations inhibit aquatic vegetation and invertebrate production and destabilize littoral zones, which provide critical habitat for many species of fish. Fluctuations that occur during the spring may influence nest-building species by causing spawning adults to abandon nests, and loss of eggs to dessication or increased wave action. Of the fish species that occur in Lake Britton, largemouth bass and black crappie are likely to be the most affected, because they construct their nests in shallow water.

In its October 3, 2002, letter, CDFG recommended that the elevation of Lake Britton be held to within 3 feet of the maximum normal water surface elevation (i.e., between elevations 2,737.5 and 2,734.5 feet NGVD) from March 1 through May 31. CDFG stated that this measure would help to achieve its objective of protecting the warmwater fishery (as well as recreation use) during the spring without requiring a loss of operational flexibility during the hot weather period, when peak electrical demand typically occurs.

The PRCT agreement establishes operating protocols for all three developments associated with this project, including Lake Britton, the Pit 3 dam, and the Pit 3 powerhouse. The year-round minimum water surface elevation at Lake Britton would be set at 2,731.5 feet (NGVD). From December 1 through at least April 20 of each year, Lake Britton elevations would be maintained within a 2 foot range between elevation 2,731.5 and 2,733.5 feet (NGVD) to the greatest extent practicable by regulating flow through the Pit 3 powerhouse, with at least one of the Pit 3 spillway bladder gates deflated. The maximum allowable Lake Britton water surface elevation would increase to 2,735.5 feet (NGVD) from April 21 to the Saturday preceding Memorial Day weekend. On the Saturday preceding Memorial Day weekend, or once there is not streamflow passing the Pit 3 dam in excess of the required minimum flow for the Pit 3 bypassed reach, whichever is later, the maximum normal water surface elevation would increase to 2,737.5 feet (NGVD). CDFG is a signatory party to the PRCT agreement, and therefore we conclude that the agreement supplants its original recommendation.

Our Analysis

Several of the warmwater species that occur in Lake Britton use shallow-water habitats for spawning, and recruitment of these species could be adversely affected by the range of water level fluctuations that occur during load following operations. Surveys of Lake Britton have found that the majority of largemouth bass spawn in depths between 0.15 and 1.5 meters (BioSystems Analysis, Inc. and University of California, Davis, 1985). Other species that occur in Lake Britton and that typically construct nests in water less than 1 meter deep include black crappie, white crappie, bluegill, and green sunfish. Smallmouth bass would likely be less affected by water level fluctuations, because they generally construct their nests in deeper waters (between 0.5 and 5 meters).

PG&E reports that largemouth bass, bluegill, black crappie, and green sunfish reproduction has improved since 1988, when inflatable gates were installed and spring drawdowns to install flashboards were discontinued. However, based on our review of the license application, we note that the abundance of some nesting species has remained low (only three white crappie were collected from 1988 through 2000) or has been quite variable between years (green sunfish collected from 1988 through 2000, respectively, were as follows: 8, 38, 15, 72, 134, 97, 115, 82, 30, 50, 8, 54, and 11). Recruitment of these species could improve or become more consistent if water level fluctuations were reduced in the spring. Typically there is spill at the Pit 3 dam during much of the late winter to May period, so the originally recommended spring drawdown restriction often would not be problematic.

By deflating one of the bladder gates at the Pit 3 dam during early spring until spill in excess of the designated minimum flow stops, and restricting water surface fluctuations to a 2 foot band (as proposed in the PRCT agreement), any nest building by centrarchids during periods of spill and at a minimum through April 20, would be confined to depths below elevation 2,733.5 feet (NGVD). Increases in the maximum water surface elevation after April 20 would not be likely to influence these nests. The maximum operating band between April 21 and the Saturday preceding Memorial Day weekend, which would encompass most of the centrarchid spawning season, would be 4 feet. Nest construction in the upper portion of this band could be initiated but would likely be abandoned if the nest became dewatered by allowable drawdowns of Lake Britton. Although imposing a 3 foot spring drawdown limitation, as originally recommended by CDFG, would facilitate successful centrarchid nest building, we recognize that the primary purpose of the Pit 3 development operating protocol, as stated in the PRCT rationale statement, is to increase the frequency of spills at the Pit 3 dam and enable associated flows to increase and decrease at a more natural rate. This protocol would benefit native aquatic biota in the Pit 3 bypassed reach with a minimal cost to the introduced species of centrarchids that would benefit by more stable Lake Britton water levels during the spawning season. The proposed operating protocol would reduce the maximum controllable Lake Britton water level fluctuation from 7 feet to 6 feet, which would represent a slight improvement in aquatic habitat over current conditions. We also discuss Lake Britton water level fluctuations in section 3.3.6.2, *Recreational Resources*.

Fish Population Monitoring

PG&E indirectly suggested that it would conduct fish and aquatic invertebrate monitoring in table H-3 of Exhibit H of its license application, which lists costs for all measures that it proposes to implement during the term of the new license. However, PG&E presented no information regarding its proposed fish and invertebrate monitoring in Exhibit E, and remained silent regarding this measure in its October 11 and November 25, 2002, letters that include references to measures that it proposes to implement.

CDFG, by letter dated October 3, 2002, recommended a fish monitoring program in the bypassed reaches in conjunction with PG&E's existing monitoring program on Lake Britton. It recommended that the fisheries assessment performed in July 2002, in response to our April 9, 2002, AIR, serve as the baseline, and that it should be repeated and refined every 3 to 5 years. CDFG recommended that two sites be sampled in each reach, with at least 100 trout collected at each site, and the data analyzed for length frequency, condition factor, and species composition. CDFG recommended that the 2002 protocol be modified to eliminate sampling efforts in pools deeper than 8 feet, as the methods employed appeared to be ineffective in these areas. CDFG also recommended that creel surveys be performed to assess attainment of CDFG objectives for the Pit 3 reach (one trout per hour, average size of 12 inches, and average catch of four trout per angler).

In its letter dated October 9, 2002, Interior provided several recommendations relating to fish population monitoring. Interior recommends that PG&E develop a fish population monitoring plan in consultation with the FS, FWS, CDFG, and SWRCB, providing a draft to these agencies for comment 30 days prior to filing the plan with the Commission. The recommended plan would include methods to conduct annual fish monitoring studies for the first 4 years and then in years 8, 12, 16, 20, and 24 using both snorkel/scuba and backpack/boat electrofishing surveys in the Pit 3, 4, and 5 bypassed reaches. Interior also recommends that the plan include methods to conduct annual angler surveys extending for the full length of each trout season from the last weekend in April through November 15. Components to be evaluated would include age and size (length and weight) distribution, biomass, and angler catch rates.

Interior also recommends that PG&E file a revised BCMP, that incorporates the elements of the BCMP that were required under the previous license, as well as the stream surveys. As part of the BCMP, fish populations in the Pit 3, 4, and 5 reservoirs and bypassed reaches would be sampled annually for the first 8 years and then in years 12, 16, 20, and 24 using both snorkel/scuba and backpack/boat electrofishing surveys. Sampling in the three bypassed reaches would occur in riffles, runs, and pools. Numbers of all species of fish would be recorded, and all crayfish collected would be identified and enumerated.

The FS recommended a preliminary Section 4(e) condition in its October 9, 2002, letter that PG&E should develop a plan to monitor fish population and condition trends in the Pit 3 and 4 reaches and reservoirs, and quantitative entrainment monitoring in the Pit 3 and 4 tailraces. Sampling would occur at least once every 3 years during first 10 years and at least once every 5 years thereafter.

The Tribe recommends, by letter dated October 10, 2002, that monitoring be conducted to determine fish species abundance and habitat use and preference for all age classes. In their letter dated October 11, 2002, Trout Unlimited and California Trout recommend that PG&E establish management plans for non-native fish species within project reservoirs.

In its June 19, 2003, letter to the Commission commenting on our recommendations in the draft EIS, PG&E stated that it supported our recommendation to develop a fish and invertebrate monitoring plan with provisions to monitor fish populations in the project reservoirs and bypassed reaches, and conduct angler surveys in the bypassed reaches, in years 1 through 4 and in years 8, 12, 16, 20, and 24. PG&E suggests that the monitoring use methods used in relicensing studies and the current BCMP. PG&E's proposed monitoring would include angler surveys, reservoir fish surveys, river reach fish surveys, macroinvertebrate surveys, and aquatic mollusc surveys.

The FS final 4(e) condition No. 23 is similar to its preliminary condition, with fish sampling occurring once every 3 years during the first 10 years after license issuance followed by sampling at least once every 4 years thereafter, unless an alternative sampling frequency is agreed upon by the Technical Review Group (TRG) (discussed in a following subsection). The FS indicates that a statistically meaningful entrainment study may need to be conducted if the results of fish population trend monitoring indicates either directly or indirectly that ongoing entrainment is a significant contributing factor toward a substantive down trend in the affected species' populations.

The PRCT agreement also calls for the collection of up to 5 years of ecological data, which would include monitoring fish populations, at the Pit 5 reach to establish baseline conditions prior to implementing recreational boating releases (discussed previously in the subsection *Whitewater Boating Flow Releases*).

Our Analysis

It is likely that a new license would include a number of measures that would alter conditions for aquatic resources in the bypassed reaches and reservoirs. Monitoring fish populations would provide a basis to evaluate whether intended objectives are being achieved and to allow measures to be adjusted as needed. For monitoring fish populations in project impoundments and bypassed reaches and angler success in the bypassed reaches, annual monitoring for the first 4 years would be appropriate to determine the biological response to any changes in flow regime that are implemented in the new license and to establish a new baseline for detecting biological responses to any measures, such as gravel augmentation, that would be implemented at a later date. During the first 4 years from license issuance, it is likely that several different water year types would occur and assessment of length frequency distribution would provide an indication of year class success during each of the years sampled. After the first 4 years, reducing the frequency of monitoring to every fourth year would enable evaluation of long-term responses to measures implemented in the new license and any subsequent modifications that are made through adaptive management. A 4 year interval between monitoring events would allow at least one complete reproductive cycle for most fish that occur in project waters to occur during the period following the previous monitoring event. For example, hardhead and largemouth bass typically mature by their second year, rainbow trout mature by their third year, and Sacramento pikeminnow and smallmouth bass mature by their fourth year (Calhoun, 1966; Wang, 1996). Year class strength during any given year may be influenced by natural events (climate), non-project related events, or project related events. After 4 years, the population trends associated with all variables would likely be evident. This sampling frequency would be consistent with Interior's Section 10(j) recommendation regarding fish monitoring (number 13 in its October 9, 2002, letter to the Commission) but not consistent with Interior's original fish monitoring recommendation pertaining to the BCMP.

During the August 28, 2003, Section 10(j)/FS clarification meeting, FWS indicated that they are in agreement that annual monitoring during the first 4 years from license issuance followed by sampling at 4 year intervals represents a sufficient frequency. This sampling frequency also varies from the FS final 4(e) condition to monitor fish populations every 3 years for the first 10 years from license issuance. Monitoring every 3 years for the first 10 years from license issuance, as specified in the FS final 4(e) condition, would make it difficult to separate the fish population effects that may be the result of the new flow regime that is specified in a new license, from natural variability of population size that could be associated with different water year types, other varying climatic conditions, such as temperature, or other non-project related factors. At the end of the initial 10 year period, it would be difficult to assess the success of the new flow regime, and whether it would be appropriate to consider adaptive changes to project operations.

In the draft EIS, we did not recommend that entrainment monitoring be included in the monitoring plan. Interpreting data from entrainment studies conducted using nets that filter part of the flow emanating from a powerhouse is often confounded by uncertainty about whether the fish collected in the net represent fish that were entrained through the powerhouse or fish that were residents of the tailrace environment (FERC, 1995). Larger-scale studies using nets that filter the entire flow exiting from one or more turbines reduce the potential for collecting fish from the tailrace, but the studies are very costly to conduct and the results are still subject to controversy relating to the effects of entrainment on fish populations.

Regarding Trout Unlimited and California Trout's recommendation that PG&E develop management plans for non-native fish species within project reservoirs, we conclude that developing such plans would most appropriately be done by CDFG, the agency with management authority over the fisheries in Lake Britton and its tributaries.

Benthic Invertebrate Monitoring

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop a plan to conduct trend monitoring of benthic macroinvertebrate populations in the Pit 3 and Pit 4 bypassed reaches. Parameters to be monitored would include population robustness, feeding group, and pollution tolerance of the invertebrate community. Sampling would occur at least once every 3 years during the first 10 years and at least once every 5 years thereafter.

Interior included a preliminary recommendation that PG&E develop a macroinvertebrate monitoring and assessment plan in consultation with the FS, FWS, CDFG, and SWRCB within 6 months of license issuance. Interior recommended that the plan include assessments of the relationship between macroinvertebrate assemblages and watershed management, including changes to flow and temperature. The recommended plan would also assess the existing condition of native mollusc populations within reservoir and stream reaches and their relationship to the flow regime. Known locations of molluscs would be mapped and monitored to determine trends in abundance. Interior recommended that annual surveys be conducted in the first 4 years and then in years 8, 12, 16, 20, and 24. Interior also recommended that reports of each survey should be provided to the consulted agencies for 30 days for review and comment prior to filing with the Commission.

The FS final 4(e) condition regarding benthic macroinvertebrate sampling is similar to its preliminary 4(e) condition except that, as with its fish monitoring frequency, the sampling frequency would be once every 3 years for the first 10 years and after that, at 4 year intervals, unless an alternative sampling frequency is agreed upon by the TRG.

As noted in the discussion of fish monitoring, PG&E, by letter to the Commission dated June 19, 2003, agreed to conduct macroinvertebrate and aquatic mollusc surveys in the project bypassed reaches.

Our Analysis

It is likely that the new license would include a number of measures that would alter conditions in the bypassed reaches and reservoirs for aquatic macroinvertebrates. Because of the importance of macroinvertebrates as food sources for trout and native non-game species of fish, and the presence of several sensitive species of aquatic molluscs, we concur that it is appropriate to conduct monitoring studies to evaluate whether intended objectives are being achieved and to allow measures to be adjusted if necessary. For monitoring macroinvertebrates in the bypassed reaches, we conclude that annual monitoring for the first 4 years would be appropriate to determine the biological response to any changes in flow regime that are implemented in the new license and to establish a new baseline for detecting biological responses to any measures, such as gravel augmentation, that would be implemented at a later date. After the first 4 years, the frequency of surveys could be reduced to every 4 years to evaluate long-term responses to measures implemented in the new license and any subsequent modifications that are made through adaptive management. With a 4 year monitoring interval, most benthic invertebrates would complete several life cycles and, for similar reasons previously discussed for fish monitoring, would be representative of general benthic invertebrate population trends. In addition, benthic invertebrates serve as an important food source for many fish that inhabit project waters. Sampling invertebrates at the same time as fish would better enable linkages between the two to be assessed.

Adaptive Management

Interior, in its October 9, 2002, letter, provided several recommendations intended to facilitate adaptive management of environmental measures over the term of the license. First, it recommends that PG&E develop a comprehensive BCMP to ensure that PM&E measures accomplish their intended goals. Second, Interior recommended that PG&E develop an adaptive management program to implement PM&E measures included in the license. Third, Interior recommended that PG&E establish an Environmental Resource Committee to assist in implementation of PM&E measures and adaptive management decisions. Finally, Interior recommended that PG&E establish an adaptive management fund to be used for PM&E implementation.

The FS, in its final 4(e) condition No. 23, stipulates that PG&E should within 3 months of issuance of a new license establish a biological resources program TRG for the purpose of: (1) consulting with PG&E on the design of management and monitoring plans;

(2) review and evaluation of data; and (3) developing adaptive management or other recommendations that may arise during implementation of natural and recreational resource monitoring. The membership of the TRG would be open to all stakeholders and meetings would be open to the public. PG&E would maintain and make public, records of consultation with the TRG and forward those records with any recommendations to appropriate agencies and the Commission. The TRG would establish communication protocols which would allow for open participation, peer review, and communication between all parties.

Our Analysis

Some of the measures that may be implemented in the next license term could affect many different resources. For example, changes in the flow regime in any of the bypassed reaches could affect water temperatures, rainbow trout, aquatic insects, sensitive molluscs and fish species, non-game fish species important as forage for eagles, eagle foraging habitat, fishability and wading conditions, whitewater opportunities, and cultural resources. Although the response of individual resources would be monitored in a number of resource-specific plans, it would be beneficial to have a broader plan developed by a TRG to guide the interpretation of monitoring results and consideration of potential effects on all resources, if any measures are adjusted via adaptive management.

We present the estimated cost of all measures that pertain to aquatic resources in chapter 4.0, *Developmental Analysis*, and make our final recommendations regarding these measures in section 5.2, *Comprehensive Development and Recommended Alternative*.

Project Decommissioning

Removal of the Pit 3, 4, 5 Project dams would not allow for anadromous fish to be restored to the project area unless downstream dams, especially Shasta dam, were also removed or passage is provided. Because of the engineering challenges described previously in *Fish Passage*, a dam removal study, such as the one recommended by the Tribe, would probably need to include evaluation of the trade-offs involved in the removal of Shasta dam, because we consider the implementation of successful passage through or around Shasta Lake to be unlikely. Removal of the Pit 3, 4, 5 Project dams would eliminate the warmwater recreational fishery and reduce the production of native species important as forage for bald eagles. Short-term effects, which could extend for a decade or more, would include erosion and suspension of sediments that have been deposited in the project reservoirs. After habitat conditions stabilized, the reservoir habitat would be replaced by riverine habitat that would most likely support trout fisheries similar to those that currently exist in the Pit 3, 4, and 5 bypassed reaches. Average flows in the bypassed reaches would be increased by approximately an order of magnitude, which would limit angler access by preventing anglers from crossing the stream via wading.

3.3.2.3 Cumulative effects on rainbow trout: Construction of the Pit 3, 4, 5 Project reservoirs and downstream reservoirs (Pit 6, Pit 7, and Shasta) has reduced the amount of riverine habitat in the Pit River between Hat Creek and the McCloud River from about 70 miles to about 23 miles, divided among the Pit 3, 4, and 5 bypassed reaches. Although some of these reservoirs provide suitable rearing habitat, the fish communities in impounded areas have generally shifted toward warmwater species. Within the Pit 3, 4, 5 Project area, this is especially true in Lake Britton, and has resulted in a similar shift toward warmwater species in the lower section Hat Creek (Deinstadt and Berry, 1999). Diversion of water for hydroelectric generation has substantially reduced flow volumes and altered temperature regimes in the bypassed reaches, but trout fisheries remain in good condition, especially in the Pit 3, 4, and 5 reaches. Trout habitat in the Pit River upstream of the Pit 1 project is also affected by agricultural withdrawals.

Several of the measures proposed by PG&E, and reflected in the PRCT agreement, are expected to provide benefits to rainbow trout in the Pit 3, 4, and 5 bypassed reaches. These include increased minimum flows in the Pit 3, 4, and 5 reaches, which would increase the amount of physical habitat that is available and improve summer water temperatures in the upper portion of the bypassed reaches, and finalizing a plan for ramping spill flows to avoid rapid onset and termination of spill flows that may flush aquatic biota downstream, if sufficient opportunity to seek cover from high velocities is not provided, or strand trout and invertebrates. PG&E's proposed minimum flows of 350 to 450 cfs to the Pit 5 bypassed reaches would create near optimal conditions for rainbow trout adults, although fry habitat, based on mapping of shallow habitat with low velocity water, would decrease slightly compared to existing conditions with PG&E's proposed flow (see table 30). Consequently, there would not be much of an increase in production of the number of rainbow trout in the Pit 5 bypassed reach, but because of the near optimal flow conditions, and slight decrease in the prevailing water temperature in this reach, the growth and condition of the rainbow trout would be expected to improve. This could result in anglers catching larger trout from the Pit 5 reach downstream to the Pit 6 dam. Providing a limited gravel augmentation program to improve spawning habitat for trout in the Pit 3, Pit 4, and Pit 5 reaches and monitoring fish and macroinvertebrate populations would enable determinations of trout responses to new project operations and evaluation of the need to implement adaptive management measures. Providing scheduled weekend whitewater flows, if implemented, could adversely affect trout populations by scouring algae and invertebrates from the stream channel, but ecological monitoring during any such events would enable identification of substantial effects and provide a basis for taking corrective actions.

CDFG currently maintains the Hat Creek fish barrier dam in accordance with an easement granted by PG&E. According to the terms of the easement, CDFG has the obligation to remove the fish barrier and restore the site if it does not renew the easement when it expires in 2003. CDFG would like PG&E to assume dam inspection and maintenance responsibilities under the terms of a new license. The original primary purpose of the barrier dam was to prevent such native fish as hardhead, Sacramento pikeminnow, and Sacramento sucker from entering the Hat Creek Wild Trout Management Area. Now the dam also prevents such introduced species as smallmouth bass from moving upstream into the management area. CDFG's current management objective for Lake Britton is to manage for the introduced centrarchids to enhance the warmwater fishery. The dam eliminates competition by these fish with the rainbow trout upstream of the barrier dam, thus enhancing the trout fishery. The Tribe recommends that the barrier dam be eliminated, thus allowing the other native fish that previously inhabited Hat Creek to move upstream as far at the Joerger diversion dam, which is in the Hat Creek 2 bypassed reach. We conclude that the purpose of the dam and whether it should remain or be breached is a fisheries management decision that should be made by the local resource agency, in this case CDFG. However, we agree that the presence of Lake Britton has created habitat that is more suited to introduced species (centrarchids) and rough fish (Sacramento sucker, Sacramento pikeminnow, and hardhead) than would exist if the Pit River was not impounded. If the dam should fail because of lack of maintenance, or be breached it would allow other native, as well as non-native, species to enter the Wild Trout Management Area. This would result in an adverse effect on the wild rainbow trout that currently reside in this portion of Hat Creek.

The current management strategy for Lake Britton favors introduced warmwater species. This may lead to an overall decline in the number of rainbow trout in Lake Britton. Rainbow trout concentrate near the confluence of tributaries, which provide cool water refugia. However, as the population of centrarchids increases, they may increasingly prey on trout fry that may reside in the tributaries, and in the main stem of the Pit River up to Pit Falls. This would represent an adverse effect on rainbow trout from Lake Britton up to Pit Falls. We conclude that the cause of this cumulative effect is a combination of project operations, the illegal introduction of centrarchids, and the current CDFG management strategy.

3.3.2.4 Unavoidable adverse effects: Unavoidable adverse effects of the Pit 3, 4, 5 Project include the continued replacement of riverine with reservoir habitat, blockage of fish migrations, losses of fish from entrainment and turbine passage, and interruption of sediment transport processes. The Pit 3, 4, and 5 reservoirs would continue to inundate approximately 50 percent of the riverine habitat that existed between Hat Creek and the current location of the Pit 6 reservoir. The dams would continue to block upstream fish passage, and some mortality of fish passing downstream through the turbines at each powerhouse would continue to occur. Each of the reservoirs would also continue to interrupt the transport of larger sediments including gravel, most likely reducing the availability of substrates suitable for trout spawning in the upper portion of each bypassed reach.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment:

Vegetation

The project area is situated within the Cascade Range geographic subdivision of the California Floristic Province (Hickman, 1993). The eastern portion of the project area lies between the Cascade Range and Modoc Plateau geographic subdivisions. This transitional zone supports flora that is also characteristic of the Great Basin, such as Great Basin sagebrush and Great Basin wildrye.

As shown in table 31, PG&E identified and mapped 13 upland cover types and 6 riparian vegetation series within the project boundary (PG&E, 2001, 2002). Upland vegetation in the project area can be characterized as mixed conifer forest and oak woodland. Mixed conifer forest is most often found on north-facing slopes. The most common species in these stands are Douglas fir, ponderosa pine, incense cedar, bigleaf maple, and Oregon white oak. Common shrubs include several species of ceanothus and manzanita, vine maple, and California greenbriar.

Oak woodlands occur primarily on south-facing slopes in the project area. Canyon live oak, Oregon white oak, and black oak occur in varying proportions in these stands. Understory species in oak woodlands include deerbrush, skunkbrush, and poison oak.

A narrow band of riparian vegetation grows along the Pit River; for the most part, the transition from riverine habitat to upland habitat is abrupt. Along the riverbanks, common species include torrent sedge, Indian rhubarb, and water hemlock. The most common tree species in riparian zones are white alder, bigleaf maple, Oregon ash, and willow. Both Fremont cottonwood and black cottonwood are also present, but not abundant.

A few emergent wetlands have developed on the margins of Lake Britton, Pit 4 reservoir, Pit 5 reservoir, and the Tunnel Reservoir but are not mapped because of their small size. Sedges, rushes, bulrushes, and spikerushes are present in these areas. The project area supports very few wetlands outside the riparian zone along the river, but during the riparian habitat mapping task, biologists identified and mapped 105 springs and spring/seep systems. Common plants at these sites include ferns, mosses, horsetail, stinging nettle, and mint.

In addition to vegetation cover types shown in table 31, PG&E also mapped approximately 38.7 acres of basalt cliff, 18 acres of mines and 88.2 acres of transmission line corridor. PG&E also mapped 1,429.2 acres of project reservoir area and 4.8 acres of seeps.

Table 31. Vegetation series mapped within the FERC project boundary. (Source: PG&E, 2003a)

Vegetation series	Acres	Dominant species and general description
Upland series		
Annual or non-native grassland	35.5	Annual, non-native grasses to about 3 feet in height with some perennial forbs and grasses; ripgut brome, Idaho fescue, California poppy
Bracken fern or dry herb sites	1.4	Primarily in t-line corridors; bracken fern, poison oak, creeping snowberry, California goldenrod
Ruderal	171.4	Disturbed areas along access roads, trails, and around project facilities; cheatgrass, black mustard, yellow starthistle, Klamathweed
Wedgeleaf ceanothus or ceanothus chaparral	32.6	Dense chaparral to about 6 feet in height; wedgeleaf ceanothus, chamise, greenleaf manzanita, yerba santa
Greenleaf manzanita or montane chaparral	17.0	Dense chaparral to about 15 feet in height; greenleaf manzanita, whiteleaf manzanita, bush chinquapin, mountain whitethorn
Rubber rabbitbrush	0.6	Shrubs and grasses to about 3 feet in height; rubber rabbitbrush, cheatgrass, blue wildrye, hairy willowherb
Canyon live oak	85.2	Open canopy with diverse shrub and herbaceous layers, including introduced annuals; canyon live oak, wedgeleaf ceanothus, greenleaf manzanita, deerbrush, blue wildrye
Oregon white oak	196.8	Open savanna; Oregon white oak, wedgeleaf ceanothus, skunkbush
Douglas fir or Sierran mixed conifer, Douglas fir dominated	1,436.4	Douglas fir, ponderosa pine, sugar pine, incense cedar, California greenbriar, white-stemmed blackberry, brackenfern

Vegetation series	Acres	Dominant species and general description
Ponderosa pine or Sierran mixed conifer, ponderosa pine dominated	31.8	Ponderosa pine, Douglas fir, incense cedar, deerbrush, greenleaf manzanita, whiteleaf manzanita, mountain misery
Jeffrey pine	347.3	Open to moderately closed canopy of tall, mature trees; Jeffrey pine, skunkbush, deerbrush, common yarrow, annual grasses
Jeffrey pine-Oregon white oak	80.2	Partially open forest with mixed shrub understory; Jeffrey pine, Oregon white oak, greenleaf manzanita, wedgeleaf ceanothus, mountain whitethorn, mahala mat
Eastside ponderosa pine	117.1	Open forest; ponderosa pine, Jeffrey pine, incense cedar, Spanish lotus, self-heal, Brewer's lupine, common yarrow
Black oak (upland)	57.6	Moderately dense woodland; black oak, mountain mahogany, deerbrush, hedgehog dogtail, blue wildrye
Riparian cover types		
Torrent sedge or wet herb	0.7	Perennial herbaceous species along shorelines; northern torrent sedge, willows, perennial herbs
California brickellbush or dry herb	1.4	Riparian scrub and sparse herbaceous cover on gravel and cobble bars; California brickellbush, sandbar willow, disturbed-site annuals
Willow shrub (arroyo willow, sandbar willow, Pacific willow)	11.1	Open to dense streamside thickets; arroyo willow, sandbar willow, Pacific willow; Himalayan blackberry on disturbed sites
White alder (immature and mature)	26.2	Dense shrubby or more open mature stands; white alder
Black cottonwood (immature and mature)	0.03	Very open shrub stands (immature) to fairly dense mixed riparian forest (mature); black cottonwood, Oregon ash

Vegetation series	Acres	Dominant species and general description
Oregon ash (immature and mature)	1.9	Open sapling stands to medium height deciduous forest on high, stable terraces; Oregon ash, black cottonwood
Black oak (riparian)	1.0	Open to dense woodland growing on fluvial surfaces; black oak, canyon live oak, Douglas fir, Oregon ash, Himalayan blackberry, western redbud, bigleaf maple
Total Acreage	2,652.3	

Special-status plant species

PG&E's review of information published by the FS, FWS, CDFG, and California Native Plant Society (CNPS) indicated that 82 special-status species could occur in the project area. Based on their range and habitat requirements, 29 of these species are known to occur in the project vicinity or are documented within the project area (table 32). Two of these sensitive plant species, slender Orcutt grass and Greene's tuctoria, are federally listed threatened and endangered species and therefore are discussed in section 3.3.4, *Threatened and Endangered Species*. PG&E conducted field surveys for rare plants during the spring and summer of 2000. Surveyors documented the occurrence of seven rare plants, including one new taxon and four species designated as sensitive in FS Region 5.

PG&E conducted surveys during 2002 for Pacific fuzzwort (*Ptilidium californicum*), a moss that is designated as an FS SM species under the Northwest Forest Plan (FS and BLM, 1994). Pacific fuzzwort is thought to be strongly associated with Douglas fir and white fir stands in late-successional and old-growth forests. However, recent sightings indicate it may also occur in younger stands and on incense cedar logs within mixed forest (FS, 2002). PG&E found no Pacific fuzzwort during its surveys, although 44 other species of bryophytes were found (GANDA, 2002b). PG&E concluded, based on a recognized bryophyte expert's field reconnaissance, that the potential for occurrence of this species in the project area was slight.

Table 32. Special-status plant species that are known to occur in the vicinity or documented within the project area. (Source: PG&E, 2001)

Species	Status[a]	Habitat
Susanville milkvetch (*Astragalus inversus*)	CNPS 4	Documented during PG&E's surveys; basaltic, dry soils in sagebrush or pine forest from 4,000 to 6,000 feet NGVD; six occurrences documented in Lake Britton area.
Geyer's sedge (*Carex geyeri*)	CNPS 4	Documented during PG&E's surveys; open mixed conifer forest; documented within 1 mile of Pit 4 powerhouse along access road.
Long-haired star tulip (*Calochortus longebarbatus* var. *longebarbatus*)	FSC, FSS, CNPS 1B	Wet meadow, openings in ponderosa pine forest on boggy or sandy soils; closest known occurrence west of Burney Valley.
Starry clarkia (*Clarkia stellata*)	FSS	Documented during PG&E's surveys; road embankments or open areas; documented in Jeffrey pine forest near Hat Creek picnic area and Sierran mixed conifer forest in Burney Falls State Park and near Pit 4 powerhouse.
Mountain lady's slipper (*Cypripedium montanum*)	FSS, CNPS 4	Documented during PG&E's surveys; lower elevation mixed conifer forest; documented on south shore of Lake Britton, west branch of Salmon Springs, and Rim-of-the-Lake Spring.
Bidwell's knotweed (*Polygonum bidwelliae*)	FSI, CNPS 4	Documented during PG&E's surveys; volcanic outcrops in foothill woodlands; documented on shore of Lake Britton, including one population near the North Shore Campground.
Ishi jewel-flower (*Streptanthus sp. nov*)	--[b]	Documented during PG&E's surveys; oak woodlands and lower conifer forests; documented on access road between Pit 4 powerhouse and Deer Creek Campground.

Species	Status[a]	Habitat
Silvery false lupine (*Thermopsis californica* var. *argentata*)	FSI, CNPS 4	Documented during PG&E's surveys; open ridges in lower elevation conifer forest and pinyon/juniper woodlands at 1,800–4,500 feet NGVD; documented at 30 sites in Jeffrey pine forest, with most along lower river reaches from Highway 299 bridge to the Pit 3 dam.
Butte County morning-glory (*Calystegia atriplicifolia ssp. buttensis*)	FSC, FSS, CNPS 1B	Dry, rocky places in open forest of chaparral, 1,800 to 3,500 feet NGVD.
Northern clarkia (*Clarkia borealis ssp. borealis*)	CNPS 1B	Openings in cismontane woodland and low-elevation conifer forest; known from Pit River watershed.
Baker's cypress (*Cupressus bakeri*)	FSI, CNPS 4	Chaparral or lower conifer forest on serpentine or volcanic-derived soils; elevations from 1,100 to 2,000 feet NGVD; known from Burney Mountain.
Mariposa lily (*Calochortus syntrophus sp. nov*)	FSI, CNPS 3	Endemic to northeastern Shasta County; cismontane woodland on Kilare sedimentary soils near Montgomery Creek.
English sundew (*Drosera anglica*)	CNPS 2	Cold bogs and swamps in ponderosa pine forest at 4,300 to 6,000 feet NGVD; known from Goose Valley, northwest of Burney.
Bogg's Lake hedge-hyssop (*Gratiola heterosepala*)	SE, FSS, CNPS 1B	Vernal pools and margins of vernal lakes and artificial ponds, 25 to 8,000 feet NGVD.
Baker's globe mallow (*Iliamna bakeri*)	FSS, CNPS 1B	Volcanic or rocky soils under chaparral or pinyon/juniper woodland.
Red bluff dwarf rush (*Juncus leiospermus var. leiospermus*)	CNPS 1B	Vernally wet areas, pools and swales, running water; known east of Redding, and between Goose Valley and Burney Valley.
Bellinger's meadowfoam (*Limnanthes floccosa ssp. bellingeriana*)	FSS, CNPS 1B	Vernal pools; known from 4.5 miles southwest of Ingot.

Species	Status[a]	Habitat
Woolly meadowfoam (*Limnanthes floccosa ssp. floccosa*)	CNPS 2	Vernally wet pools, ditches and ponds in chaparral and cismontane woodlands; known from vicinity of Lake Britton.
Egg Lake monkeyflower (*Mimulus pygnaeus*)	FSS, CNPS 1B	Vernally mesic meadows in Great Basin scrub and lower coniferous forest; known from Burney Falls vicinity.
Shasta snow-wreath (*Neviusia cliftonii*)	FSS, CNPS 1B	Shaded, north-facing limestone slopes in riparian areas; known from about 7 miles west of Round Mountain.
Slender Orcutt grass (*Orcuttia tenuis*)	FT, SE, CNPS 1B	Vernal pools, moist roadside, creek floodplain; known from Burney Valley.
Engelmann spruce (*Picea engelmannii*)	CNPS 2	Cool, moist subalpine mixed-conifer forest; moist slopes and canyons from 4,500 to 4,700 feet NGVD.
Profuse-flowered pogogyne (*Pogogyne floribunda*)	CNPS 1B	Vernal pools with heavy clay soils in pine/juniper woodland or sagebrush scrub; known from east of Long Valley, 2 miles north of Johnson Park.
Eel-grass pondweed (*Potamogeton zosteriformis*)	CNPS 2	Still or slow water in ponds, lakes, and streams below 5,000 feet NGVD; historical occurrence (1949) in project area.
Sidalcea (*Sidalcea sp. nov*)	FSI	Seeps, streams, edges of wet meadows, and shaded banks in middle-upper conifer forests, 2,100 to 5,400 feet NGVD; known from Pit 3 t-line in Goose Valley.
Western campion (*Silene occidentalis ssp. longistipitata*)	FSS, CNPS 1B	Chaparral or conifer forest at 3,000 to 6,000 feet NGVD.
English Peak greenbriar (*Smilax jamesii*)	FSS, CNPS 1B	Shady streambanks, lake margins in montane conifer forest.
Long-leaved starwort (*Stellaria longifolia*)	CNPS 2	Wet meadows, seeps, riparian woodland; historical occurrence in Goose Valley.

Species	Status[a]	Habitat
Greene's tuctoria (*Tuctoria greenei*)	FE, FSS, SR, CNPS 1B	Large, deep vernal pools.

[a] FE = federally endangered
FT = federally threatened
FSC = federal species of concern
FSS = FS sensitive species
FSI = FS special interest
SE = state endangered
SR = state rare
CNPS 1B = rare or endangered in California and elsewhere
CNPS 2 = rare or endangered in California, but more common elsewhere
CNPS 3 = plants for which more information is needed
CNPS 4 = plants of limited distribution

[b] The Ishi jewel-flower is a recently described new species, which has not yet been designated in terms of special status.

Noxious weeds

The California Department of Food and Agriculture (CDFA) lists 135 plants as noxious weeds in California (CDFA, 2002). Based on literature review and information obtained from the CDFA, California Exotic Pest Plant Council (CalEPPC) and the FS, PG&E determined that 28 of these could occur in the project area. PG&E conducted surveys for noxious weeds in the project area together with surveys for rare plants in 2000. Surveyors identified and mapped 195 occurrences of nine noxious weed species (table 33). A tenth species, Himalayan blackberry, was not mapped because it was found to be so widespread in the project area.

Most weed populations were observed along project access roads, around the powerhouses, and at recreational facilities, where vehicle and foot traffic serve as vectors for the spread of weed seed. However, weed infestations were also documented at remote sites along the Pit River below Lake Britton, suggesting that plant fragments and seed are also spread by high flows.

Table 33. Noxious weeds documented in the project area. (Source: PG&E, 2001)

Species	Status[a]	Documented occurrences
Barbed oatgrass (*Aegilops triuncialis*)	CDFA B	River floodplain approx. 3 miles downstream of Pit 4 dam.
Cheatgrass (*Bromus tectorum*)	CalEPPC A-1, CDFA C	Common throughout project area, particularly on access roads and near facilities.

Species	Status[a]	Documented occurrences
Hairy whitetop (*Cardaria pubescens*)	CDFA B	Near gasline crossing of Pit River upstream of Lake Britton.
Spotted knapweed (*Centaurea maculosa*)	CalEPPC Red Alert, CDFA A	Pit 3 powerhouse and 15 sites between Big Bend Hot Springs and James B. Black powerhouse.
Yellow starthistle (*Centaurea soltitialis*)	CalEPPC A-1, CDFA C	Common throughout project area along roads, with sporadic occurrences on floodplain.
Klamathweed (*Hypericum perforatum*)	CalEPPC B, CDFA C	Most common noxious weed in the project area, found on access roads, around facilities, and in remote areas along the river corridor.
Povertyweed (*Iva axillaris*)	CDFA C	East and west sides of the river upstream of Lake Britton on disturbed areas of floodplain.
Himalayan blackberry (*Rubus discolor*)	CalEPPC A-1	Intermittent band from Lake Britton dam to Pit 5 powerhouse and scattered around Lake Britton.
Bouncing-bet (*Saponaria officinalis*)	CalEPPC A-2, CDFA C	Scattered in riparian habitats on the river or near the active scour zone, below Lake Britton.
Medusahead (*Taeniatherum caput-medusae*)	Cal EPPC A-1, CDFA C	Common in grazed annual grasslands on the river floodplain upstream of Lake Britton.

[a] CalEPPC List Designations:
A-1 = most invasive wildland pest, widespread
A-2 = most invasive wildland pest, regional
B = wildland pest plants of lesser invasiveness
Red Alert = pest plants with the potential to spread explosively

CDFA List:
A = targeted for eradication or containment
B = more widespread, counties determine control efforts
C = very widespread, control efforts typically targeted only in nurseries or seed lots

Wildlife

The project area provides habitat for a variety of wildlife species that use the mixed conifer forests of varying stand ages, oak woodlands, riparian areas along the Pit River and its tributaries, and project reservoirs. Riparian communities are of particular importance, because they support a greater density and diversity of wildlife than any other terrestrial habitat in California (Small, 1974).

PG&E documented 59 bird species in riparian habitats during point count surveys.[15] The most common waterfowl species observed during the point counts were mallards, common mergansers, and Canada geese. Based on species/habitat relationships documented in the Wildlife Habitat Relationship (WHR) database, at least 21 other waterfowl species are also likely to be present on project reservoirs. Many of these species have been documented during the bald eagle studies PG&E has conducted since 1983, including coots, wood ducks, and American wigeon. Great blue heron, osprey, and belted kingfisher are often observed near the project reservoirs and along the Pit River.

During PG&E's riparian biota surveys, biologists also observed several aquatic furbearers, including river otter, beaver, mink, and muskrat. The most commonly observed amphibians during the riparian biota surveys were rough-skinned newts; ensatinas; Pacific tree frogs; and bullfrogs, an introduced species. The most commonly observed reptiles during the surveys were western fence lizards and sagebrush lizards. California red-sided garter snakes and western aquatic garter snakes were also common.

In addition to point count surveys for birds and more general riparian biota surveys, PG&E conducted specific surveys for bats in the project area. Using a variety of methods, biologists documented the presence of 15 different species of bats (Pierson et al., 2001). Bats were documented to be using 9 of the 17 project structures.

The most important game species in the project vicinity is the deer, including black-tailed deer and Rocky Mountain mule deer, and hybrids of these two subspecies. The Pit 3, 4, 5 Project area is adjacent to habitat mapped as deer winter range for the Lake Britton deer herd. The Lake Britton deer herd likely intermingles with several other local herds on higher elevation summer range.

PG&E's search of the WHR database indicates that several upland game bird species are likely present. These include native species, such as California quail, mountain quail,

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[15] A point count survey is a systematic and repeatable technique for counting birds by enumerating audio or visual detections within a circle of a specific radius.

blue grouse, band-tailed pigeon, mourning dove, and introduced species, such as turkey and pheasant.

Special-status wildlife

PG&E's consultation with the FS, FWS, and CDFG indicated that 53 species with special status could occur in the project area. Three additional species (the VELB, bald eagle, and northern spotted owl) are federally listed as threatened, and are discussed in section 3.3.4, *Threatened and Endangered Species*. The amphibians, reptiles, birds, and mammals shown in table 34 include federal species of concern; sensitive species in FS Region 5; and state-listed threatened, endangered, or species of concern. We evaluated the likelihood of occurrence of these species in the project area based on their historical range, known occurrences, habitat associations documented in the literature, and the results of PG&E's field surveys. The current status of each species was identified after reviewing CDFG's current list of special animals (CDFG, 2002) and information provided by the FS in appendices B-2 and B-4, attached to the FS letter to the Commission containing comments on the draft EIS, dated May 19, 2003.

Table 34. Special-status species that could occur or are documented to occur in the project area. (Source: PG&E, 2001; Spring Rivers, 2001a; letter from the FS to the Commission dated May 19, 2003)

Species	Status[a]	Occurrence and habitat
Amphibians and reptiles		
Tailed frog (*Ascaphus truei*)	FSC, CSC	Likely; known from tributary to Kosk Creek in Pit 5 reach. Associated with cold, fast, well-shaded perennial streams.
Cascades frog (*Rana cascadae*)	FSC, CSC, FSS	Possible; known from upper Rock Creek and near Pit 1 powerhouse. Breeds in ponds or bogs at elevations above 3,000 feet NGVD; associated with wet meadows, moist forests, along forested small streams or pond edges in summer.
Foothill yellow-legged frog (*Rana boylii*)	FSC, FSS	Documented in Pit 4 reach downstream of Canyon Creek and in upper mile of Pit 5 reach below Pit 5 dam at sites along river with high width-to-depth ratio, close to tributaries, with cobble/boulder substrate and exposed rock for sunning.

Species	Status[a]	Occurrence and habitat
Northern leopard frog *(Rana pipiens)*	CSC, FSS	Possible; upper and middle reaches of Pit River are within historical range, but no current records in vicinity.
Shasta salamander *(Hydromantes shastae)*	FSM, ST	Possible, but not documented during PG&E's surveys in 2000 or 2001. Restricted to forested canyons of tributaries to Shasta Lake, south of Mt. Shasta, between about 1,000 and 3,000 feet NGVD, including lower to middle portion of Pit River drainage. Strongly associated with caves and limestone bedrock walls.
Northwestern pond turtle *(Clemmys marmorata marmorata)*	FSC, CSC, FSS	Documented during PG&E's surveys; common in Lake Britton, 1 observation in Pit 3 reach, 8 observations in Pit 4 reach. Typically found in still or slow-moving water of ponds, marshes, streams, rivers, and reservoirs.
Birds		
American peregrine falcon *(Falco peregrinus anatum)*	FSC, FSS, SE	Documented during PG&E's surveys; 1 eyrie confirmed near Pit 4 powerhouse, and another suspected in the Pit 3 reach. Uncommon breeding resident and migrant in northern California. Nests in protected cliffs and ledges near water, preys primarily on birds in flight.
American white pelican *(Pelecanus erythrorhynchos)*	CSC	Possible; occasionally observed at Baum and Crystal lakes, about 10 miles southeast of the project area, but nearest known breeding populations are in Klamath Basin refuges along Oregon border.
Bank swallow *(Riparia riparia)*	FSC, ST	Documented during PG&E surveys; 8 active colonies in project area; considered uncommon and local summer resident in riparian, lacustrine, and coastal areas with vertical banks and cliffs with fine-textured or sandy soils.

Species	Status[a]	Occurrence and habitat
Barrow's goldeneye (*Bucephala islandica*)	CSC	Not likely; rare, local resident in winter on lakes and rivers; formerly nested in south Cascades and Sierra Nevada mountain ranges, but no longer thought to breed in California.
Black-capped chickadee (*Parus atricapillus*)	CSC	Possible; uncommon, local resident in riparian woodland in northwestern California; restricted to pockets of montane riparian habitat, but more widely distributed in winter.
Black swift *(Cypseloides niger)*	FSC, CSC	Known from cliffs at Burney Falls; nests throughout western Sierra Nevada on moist cliffs, especially near waterfalls.
Burrowing owl (*Athene cunicularia*)	FSC, CSC	Not likely; no current records from Shasta County. Strongly associated with open, dry grassland and desert habitats at low elevations, but also occurs in open pinyon-juniper and ponderosa pine and has been observed as high as 5,300 feet in Lassen County.
California gull (*Larus californicus*)	CSC	Not likely; nearest known nest colonies located on islands in northeast plateau and Klamath Basin, winters along the coast and interior lowlands.
California spotted owl *(Strix occidentalis occidentalis)*	FSC, FSS, CSC	Subspecies in the project area is considered to be northern spotted owl (*S. o. caurina*). See section 3.3.4, *Threatened and Endangered Species*.
Common loon *(Gavia immer)*	FSC, CSC	Documented at Lake Britton. No breeding known in project vicinity, but may nest on high-elevation lakes in Shasta County. Winters along coast.
Cooper's hawk *(Accipiter cooperii)*	CSC	Likely; breeding resident throughout most wooded habitat in state, primarily in dense stands of like oak, riparian deciduous, or other forest habitats near water.
Double-crested cormorant *(Phalacrocorax auritus)*	CSC	Documented at Lake Britton, but no nesting colonies known; forages for fish in inland lakes and roosts in trees along the shorelines, but primarily found year-round along coast.

Species	Status[a]	Occurrence and habitat
Ferruginous hawk (*Buteo regalis*)	FSC, CSC	Not likely; uncommon winter resident and migrant at lower elevations and open grasslands in Modoc Plateau, Central Valley, and Coast Range; winters in southwestern California; occasional in summer in northeastern California in open grasslands, sagebrush, desert scrub, low foothills.
Golden eagle *(Aquila chrysaetos)*	CSC	Likely; uncommon permanent resident and migrant throughout most of California in foothills, mountains, sagebrush-juniper flats, and desert; nesting territory in cliff habitat in Hat Creek drainage approximately 1 mile from Hat Creek 2 powerhouse.
Great gray owl (*Strix nebulosa*)	FSS, FSM	Not likely to occur; nests on platforms in large trees or broken-topped snags in older forest, hunts from low, exposed perches on meadow edges, but project area is outside the range of primary prey (red tree voles) and provides no open-meadow foraging habitat.
Greater sandhill crane *(Grus canadensis tabida)*	FSS, ST	Possible occurrence as transient, but project area provides no suitable nesting or wintering habitat. Occasionally observed at Baum and Crystal Lakes, about 10 miles southeast of project area. Historical breeding in Shasta County and 1 pair documented in 1988; nests in wet meadows interspersed with emergent wetlands. Irrigated pastures are important for resting during migration and through the winter.
Harlequin duck (*Histrionicus histrionicus*)	FSC, CSC	Not likely; formerly nested on swift, shallow, turbulent Sierra Nevada rivers from Madera to Tuolumne Counties; rare to uncommon in winter along coast.
Least bittern (*Ixobrychus exilis*)	FSC, CSC	Not likely; may nest on northeast plateau, but more common summer resident in Central Valley wetlands and southern California; some birds resident during winter; others winter in Mexico.

Species	Status[a]	Occurrence and habitat
Long-eared owl (*Asio otus*)	CSC	Possible; uncommon resident or winter visitor throughout most of northern California at low to middle elevations. Requires riparian habitat, also uses live oak thickets and other dense forest stands.
Long-billed curlew (*Numenius americanus*)	FSC, CSC	Not likely; uncommon to fairly common breeder in wet meadows in northeastern California; winters primarily along coast and in Central Valley.
Mountain plover (*Charadius montanus*)	FPT, CSC	Not likely; winter resident from Central Valley south, and foothill valleys west of San Joaquin Valley, Imperial Valley.
Northern goshawk (*Accipiter gentilis*)	FSC, FSS, CSC	Documented; occasionally observed within project area, but no nesting observed during PG&E's surveys. Scarce to uncommon resident; breeds through Cascade, Klamath, Sierra Nevada mountains at middle and higher elevations in mature, dense conifer forest.
Northern harrier (*Circus cyaneus*)	CSC	Likely; occurs throughout Sierra Nevada; nests and forages in grasslands. Observed in Hat Creek watershed southeast of project area.
Osprey (*Pandion haliaetus*)	CSC	Documented; three active territories on Lake Britton, one in Pit 4 bypassed reach. Three inactive territories also known. Also known from upper Pit River and Hat Creek drainages. Arrives in northern California in late March or early April, nests in snags or dead-topped conifers near large bodies of water.
Prairie falcon (*Falco mexicanus*)	CSC	Not likely; uncommon permanent resident and migrant; associated primarily with perennial grasslands, savannahs, desert scrub.
Purple martin (*Progne subis*)	CSC	Possible; uncommon to rare local summer resident; breeds in a variety of habitats including forests, woodlands and riparian areas; uses open areas, especially near water, during migration.

Species	Status[a]	Occurrence and habitat
Sharp-shinned hawk *(Accipiter striatus)*	CSC	Possible; very few breeding records for Cascades/Sierra Nevada; considered uncommon permanent resident in mid-elevation habitats, including ponderosa pine, black oak, mixed conifer, Jeffrey pine, and riparian forest; fairly common winter migrant throughout California.
Short-eared owl (*Asio flammeus*)	CSC	Possible; occasional breeding in northern California; usually found in grasslands, prairies, meadows, open wetlands; winter migrant in western Sierra Nevada foothills.
Swainson's hawk *(Buteo swainsonii)*	FSC, FSS, ST	Not likely; primarily associated with low-elevation open habitats (e.g., juniper-sage flats, riparian areas, oak savannah, grasslands, agricultural fields).
Tri-colored blackbird (*Agelaius tricolor*)	FSC, CSC	Not likely; summer resident in northeastern California, breeds in emergent and scrub-shrub wetlands, forages in grassland and cropland.
White-faced ibis (*Plegadis chihi*)	FSC, CSC	Not likely; recent nesting in Klamath Basin, but no longer known to breed at other sites in California. Widespread during migration. Forages in emergent wetlands, shallow lakes, wet meadows and pastures; nests in large emergent wetlands.
Willow flycatcher (*Empidonax traillii*)	FSS, SE	Documented during PG&E's surveys. Rare to locally uncommon summer resident in the Sierra Nevada; strongly associated with large, wet meadow complexes at elevations between about 2,000 and 8,000 feet NGVD.
Yellow-breasted chat (*Icteria virens*)	FSC, ST	Documented during PG&E's surveys; common spring migrant and summer resident in Sierra Nevada foothills primarily at elevations below 1,000 feet NGVD.

Species	Status[a]	Occurrence and habitat
Yellow warbler (*Dendroica petechia brewsteri*)	CSC	Documented during PG&E's surveys; common spring and summer resident in northern California; breeds in riparian shrub in woodlands or open ponderosa pine and mixed conifer habitats up to 8,000 feet NGVD in Sierra Nevada.
Mammals		
American marten (*Martes americana*)	FSS	Not likely to occur; elevations may be too low, and none observed during 3 years of survey in Chalk Mountain Late Successional Reserve.
California wolverine (*Gulo gulo luteus)*	FSC, FSS, ST	Possible; but scarce resident in northern California; typically associated with conifer forests at elevations between 4,300 to 7,300 feet NGVD.
Pacific fisher (*Martes pennanti pacifica*)	FSC, FSS, CSC	Possible; but more often associated with mature conifer forest at elevations between 3,300 to 6,000 feet NGVD.
Sierra Nevada red fox (*Vulpes vulpes necator*)	FSC, FSS, ST	Not likely; range extends from California Cascades east to Sierra Nevada in northern California, but most sightings reported between 5,000 and 7,000 feet NGVD.
Snowshoe hare (*Lepus americanus*)	CSC	Not likely; but known from vicinity of Mt. Shasta; uses riparian areas with thickets of alder, willow, and young conifer.
White-tailed hare (*Lepus townsendii*)	CSC	Not likely; uncommon to rare resident of crest and eastern slope of Sierra Nevada in sagebrush, subalpine conifer, juniper, alpine dwarf-shrub, perennial grassland and low sagebrush, wet meadow, and early successional conifer stands.
Fringed myotis (*Myotis thysanodes*)	FSC, FPB	Documented during PG&E's surveys with one acoustic detection and capture of one lactating female. Uses open habitats, early successional stages near streams, lakes, and ponds for foraging; roosts in caves, mines, buildings or crevices.

Species	Status[a]	Occurrence and habitat
Long-eared myotis (*Myotis evotis*)	FSC, FPB	Documented during PG&E's surveys; 125 acoustic records from 44 sites, primarily from forested and riparian areas. Capture of one post-lactating female indicates local reproduction.
Long-legged myotis (*Myotis volans*)	FSC, FPB	Documented during PG&E's surveys; four observations at two night roost sites; capture of a lactating and post-lactating female indicates local reproduction.
Pallid bat (*Antrozous pallidus*)	FSS, FSM, CSC	Documented during PG&E's surveys; uses caves, tunnels, abandoned mine shafts, and sometimes buildings.
Silver-haired bat (*Lasionycteris noctivagans*)	FPB	Documented during PG&E's surveys; uses trees, snags, rock crevices and caves for roosting; solitary or forms nursery colonies in dense foliage or hollow trees.
Small-footed myotis (*Myotis ciliolabrum*)	FSC	Possible; occurs in a wide variety of habitats, primarily in dry, wooded and brushy uplands near water, from sea level to at least 8,900 feet NGVD.
Spotted bat (*Euderma maculatum*)	FSC, CSC	Documented during PG&E's surveys; 11 acoustic detections at 4 sites, primarily in the vicinity of the Pit 4 powerhouse, reservoir and dam. Known from grasslands through mixed conifer forest. Roosts in rock crevices, forages over water and near the ground.
Townsend's big-eared bat [b] (*Corynorhinus townsendii pallescens*)	FSC, FSS, CSC	Documented during PG&E's surveys; typically found in caves, mines, tunnels, attics and other man-made structures.
Western red bat (*Lasiurus blossevillii*)	FSS, CSC	Documented during PG&E's surveys; strongly associated with riparian forest, uses tree foliage for day roosting.

Species	Status[a]	Occurrence and habitat
Yuma myotis (*Myotis yumanensis*)	FSC	Documented during PG&E's surveys; associated with open forests and woodlands; forages over ponds, lakes and reservoirs; typically roosts in buildings, mines, caves or crevices.

[a] FSC = federal species of concern
FSS = FS sensitive species, Region 5
FSM = FS Survey and Manage species
SE = state endangered
ST = state threatened
CSC = state species of concern

[b] The subspecies *C. townsendii townsendii* and *C. townsendii pallescens* overlap in the project area.

Several of the wildlife species shown in table 34 as having special FS or state status are also considered FS MIS. MIS do not necessarily have special status, but are important in representing certain habitats and other species or guilds associated with such habitats. The FS uses MIS to evaluate the effects of various management actions on wildlife populations. For their analysis of the impacts of relicensing the Pit 3,4 and 5 project, the FS selected seven wildlife MIS: mallard, osprey, pileated woodpecker, hairy woodpecker, deer, black bear and gray squirrel (FS comments on the draft EIS dated May 19, 2003, Appendix B-4).

Special-status amphibians and reptiles documented in the project area

The foothill yellow-legged frog and the northwestern pond turtle, both designated as an FS sensitive species in Region 5, are of special interest in the project area, because project operations, such as reservoir levels and flow releases, could affect the quantity and quality of habitat for these species. Below, we provide additional information about occurrences of foothill yellow-legged frog and northwestern pond turtle in the project area.

Foothill yellow-legged frog (*Rana boylii*)—The known range of the foothill yellow-legged frog extends across the southern Cascades and the western slopes of the Sierra Nevada mountain range as far south as Kern County, but, currently, populations are found only in scattered locations. PG&E's search of the California Natural Diversity Database (CNDDB) indicated no historical records from the project area.

The foothill yellow-legged frog typically occurs in small, low-gradient rocky streams with exposed boulders that provide sunning spots for adults. The foothill yellow-legged frog uses wide, shallow reaches near the mouths of tributaries for breeding, attaching egg masses to cobbles and boulders in shallow, slow-moving backwaters.

During surveys for foothill yellow-legged frogs in 1999, 2000, and 2001, PG&E documented the presence of adults at 17 sites in the Pit 4 and Pit 5 reaches. Most occurrences were observed in the Pit 4 reach and in Deep Creek, a tributary to this reach. Biologists observed 51 adults, 5 subadults, and 9 tadpoles. PG&E and the FS continued to survey at Deep Creek during the spring of 2002 and identified foothill yellow-legged frog adults, juveniles, tadpoles, and egg masses. Egg masses were found at only three locations, all in the vicinity of Deep Creek (Spring Rivers, 2003d). In May of 2003, egg masses were found at 12 locations, including ten previously unknown breeding sites in the Pit 4 reach (Spring Rivers, 2003e).

Only a few foothill yellow-legged frogs were observed in the Pit 5 reach during the 1999 surveys; none were observed in 2000 or 2001. Conversely, bullfrogs were common throughout the Pit 5 reach. Biologists documented the occurrence of over 200 adult bullfrogs and several hundred bullfrog tadpoles. Bullfrogs were observed only in the Pit 5 reach and in Lake Britton.

Northwestern pond turtle (*Clemmys marmorata marmorata*)—The northwestern pond turtle occurs throughout the western Sierra Nevada at elevations as high as 6,700 feet, but is typically found at lower elevations (i.e., below 4,500 feet) (Lovich, 1995). The northwestern pond turtle occurs in rivers, streams, lakes, ponds, and seasonal wetlands where still or slow-moving water is present; this species is uncommon in high-gradient streams. Females excavate nests up to 0.25 mile from water, usually on south to southwest-facing slopes.

During PG&E's surveys in 1999, 2000, and 2001, biologists observed 40 northwestern pond turtles in the project area. One northwestern pond turtle was observed in the Pit 3 reach. Eight were observed in the Pit 4 reach, and seven (including two unconfirmed identifications and one dead northwestern pond turtle) were observed in the Pit 5 reach. All other observations were from the reservoirs, and most of these were from Lake Britton.

Special-Status Bird Species Documented to Occur in the Project Area

The FS has identified several special-status bird species as being of particular interest in the project area. These include the American peregrine falcon, northern goshawk, and three neotropical migrants, including the bank swallow, yellow warbler, and willow flycatcher. Below, we provide additional information about these species.

American peregrine falcon (*Falco peregrinus anatum*)—The American peregrine falcon was removed from the federal list of threatened and endangered species in 1999, due to the success of recovery efforts throughout its range (64 FR 46,541-46,558). However, the peregrine will continue to be protected under the Migratory Bird Treaty Act, and is considered sensitive in FS Region 5. The Land and Resource Management Plan (LRMP) objectives are to manage for 3 active pairs on the Lassen National Forests lands and 9 pairs on the Shasta National Forests lands (FS, 1992; FS, 1995).

Peregrine falcons nest on steep and inaccessible cliffs that offer protection from predators. They prey almost exclusively on birds captured in flight. Cliffs in the Pit 3 and Pit 4 reaches provide suitable nesting habitat for peregrine falcons. One pair has nested above the Pit 4 powerhouse since 1979. Although nesting has not been confirmed at the Pit 3 site, observations of a juvenile in 2000 and adults in 2002 suggest the presence of a nest in the cliffs above the warning siren near Pit 4 powerhouse. A third pair may be nesting near the Pit 4 dam, based on several observations of two adults in April, 2003.

Northern goshawk (*Accipiter gentilis*)—The project area provides suitable habitat for the northern goshawk. The northern goshawk typically nests in mature or older mixed conifer stands, but uses a variety of stand ages during foraging.

PG&E conducted northern goshawk surveys in 2000 according to the FS survey protocol. Surveyors walked or drove to over 100 monitoring stations, and played taped recordings of territorial calls in an attempt to elicit responses from adults. During the post-fledging period in mid-June through early July, surveyors visited the monitoring stations again and played taped calls of begging juveniles. Surveyors detected no responses during the surveys, but observed goshawks in the project area at other times. Based on the FS surveys, the nearest confirmed northern goshawk nesting areas are located in the Rock Creek drainage about 3 miles north of the Pit River, and on Bird Flat just west of Rock Creek, about 2 miles north of the Pit River. The FS suspects nesting at Iron Canyon reservoir, about 4 miles northwest of the Pit 5 reach.

Bank swallow (*Riparia riparia*)—The bank swallow is likely extirpated from southern California, where it was once common, and is now considered a locally common to uncommon summer resident in northern California. In northern California, nesting birds typically arrive from wintering areas in late April or early May, and vacate nesting colonies by late July. The bank swallow winters in South America.

The bank swallow breeds at elevations from sea level to over 6,000 feet, but most colonies are known from valleys and coastal areas (RHJV, 2000). Vegetation associated with breeding habitat is variable, because it depends to such a great extent on bank suitability; the bank swallow uses vertical riverbanks or bluffs near water where fine-textured or sandy soils allow for nest burrow excavation. Banks and bluffs selected for nesting are typically at least 3 feet high, affording some protection from predators. In reservoirs such as Lake Britton, boat wakes and fluctuating water levels may erode existing habitat, but also have the potential to create new nesting substrate as banks erode. Bank swallows may dig new burrows each year if the bank face used the previous year has collapsed (RHJV, 2000).

During surveys in 1999 and 2000, PG&E documented eight active nesting colony complexes along the shoreline of Lake Britton, where several deposits of diatomaceous earth, inter-layered with ash and fluvial sediments, are located. These substrates are exposed and easily erodible. Colonies ranged in size from 30 to more than 2,000 burrows. No activity was observed in either of the survey years at a historical colony near the mouth of Cayton Creek.

During surveys in 1999 and 2000, PG&E documented eight active nesting colony complexes along the shoreline of Lake Britton. Colonies ranged in size from 30 to more than 2,000 burrows. No activity was observed in either of the survey years at an historical colony near the mouth of Cayton Creek.

Yellow warbler (*Dendroica petechia brewsteri*)—PG&E reported 77 yellow warbler detections during point count surveys. The historical breeding range for the yellow warbler included much of California, but analysis of annual breeding bird surveys indicates a substantial state-wide population decline between 1980 and 1996 (RHJV, 2000). Like the yellow-breasted chat, the yellow warbler is considered common in Shasta County during spring and summer (Wintu Audubon, Shasta County Bird List Committee, 1992). Breeding birds begin to arrive in April and May, and depart for wintering areas in Mexico and South America in August and September, although some birds are resident in southern California during the winter. Yellow warblers breed in riparian shrub habitats, and appear to be most abundant in shrub communities having a large percentage of willows.

Willow flycatcher (*Empidonax traillii*)—The willow flycatcher breeds in California from Tulare County north, along the western side of the Sierra Nevada and Cascades and along the northern coast. This species is strongly associated with large wet meadow complexes that support willow or willow/alder thickets at elevations between about 2,000 to 8,000 feet, but breeding habitat may be extremely variable (RHJV, 2000). Birds arrive on the breeding grounds in May and June, and migrate southward in mid-September to wintering areas in Mexico and Central America.

PG&E documented willow flycatchers on three occasions during point count surveys in 2000. PG&E also conducted surveys for willow flycatcher in 43 riparian shrub habitat patches in the project area, and located one potential breeding area near the confluence of the Pit River with Lake Britton. A male willow flycatcher responded to taped calls with several territorial songs, but no female was observed.

Special-Status Forest Carnivores That May Occur in the Project Area

Although the California wolverine and Pacific fisher have not been documented in the project area, suitable habitat is present in the vicinity, and the FS has indicated that these species are of special interest. We describe these species below.

California wolverine (*Gulo gulo luteus*)—The California wolverine occurs in mixed conifer, red fir, and lodgepole forests at elevations between about 4,300 to 7,300 feet, but may also use lower elevations in areas where it is undisturbed by development and human activity (Banci, 1994). The California wolverine uses caves, hollows in cliffs or rock outcrops or ground burrows in dense forest stands for den sites, but forages in more open areas.

The current range of the California wolverine extends from Del Norte and Trinity Counties through Shasta County, and south through the Sierra Nevada to Tulare County. However, no wolverines were detected during a 4-year study of forest carnivores in California (Zielinski et al., 2000). CNDDB has one historical sighting from near the Pit 1 Project, north of Hat Creek (PG&E, 1998), but there are no known occurrences in the project area. The presence of roads, facilities, residential development, and recreation may limit habitat potential for the California wolverine.

Pacific fisher (*Martes pennanti pacifica*)—The Pacific fisher is typically found in late-successional conifer forests and riparian areas, and avoids open, hardwood-dominated stands (Powell and Zielinski, 1994). Stand attributes that appear to be important for the Pacific fisher include a diversity of tree sizes and shapes, openings that allow for the growth of understory vegetation, abundant dead and down material, and limbs close to the ground (Powell and Zielinski, 1994). Very few dens have been found in the western United States, but fishers typically den high in cavities in large-diameter live trees or snags. In California, fishers prey on small- to medium-sized mammals, including mice, voles, shrews, moles, squirrels, birds, snowshoe hare, and porcupines, and fisher foraging habitat coincides with forested and riparian habitats where these species are abundant (Powell and Zielinski, 1994).

At one time, the range of this species extended from British Columbia to Central California, but populations declined dramatically around the turn of the last century, due to trapping and logging (Zielinski et al., 1995). During a 4-year study of forest carnivores in California, fishers were detected at about 37 percent and 44 percent of sample units in the Klamath and southern Sierra Nevada, respectively, and at only about 11 percent of the sample units in the south Cascades, including sites in the vicinity of Mt. Shasta (Zielinski et al., 2000).

In the south-central Sierra Nevada, the Pacific fisher is reported from habitats between about 3,300 to 6,600 feet above mean sea level; the Southern Sierra Fisher Conservation Area encompasses the known occupied range in the Sierra Nevada, which is considered to be an elevational band from 4,500 to 8,000 feet (FS, 2001; Golightly, 1997). However, in the Klamath Province, Pacific fishers have been documented to use elevations from less than 100 feet up to about 3,300 feet, and it is possible that the species could occur in the project area. The FS indicates that suitable habitat is present along the Pit River within the Chalk Mountain Late Successional Reserve (LSR), but no fishers were detected during remote-camera studies in 1994, 1995, and 1996 (FS, 1996).

Special-Status Bats Documented in the Project Area

As mentioned above, PG&E documented the presence of 15 bat species during surveys in the project area, including seven special-status species. These species may be of particular interest in the project area because of their potential use of project facilities. Below, we provide additional information about these seven species. General information about their range, distribution in California, foraging or roosting patterns is based on species accounts presented in *California's Wildlife, Volume III: Mammals* (Zeiner, et al., 1990), with updates from CDFG's Wildlife and Habitat Data Analysis Branch website (www.dfg.ca.gov/whdab/html/cawildlife.html). Site-specific information was obtained through field studies conducted in the project vicinity in 2000 by Pierson et al. (2001).

Long-eared myotis (*Myotis evotis*)—This species is widespread in California, with the exception of the Central Valley and deserts, but it is not common. The long-eared myotis occurs in a variety of habitats. It is most strongly associated with conifer forests from sea level to about 9,000 feet. The long-eared myotis feeds on insects in flight or gleans from foliage or the ground, flying low over water, trees, and shrubs. This species roosts in buildings and crevices, under bark, and in snags, often in small groups or alone. During PG&E's surveys, biologists documented 125 acoustic records at 44 sampling sites. Most of these records were in forested and riparian habitats. One post-lactating female was captured, indicating that reproduction occurs in the vicinity.

Long-legged myotis (*Myotis volans*)—The long-legged myotis is a common species in California, but is absent from the Central Valley and Colorado and Mojave deserts. The long-legged myotis is primarily associated with woodland and forest habitats above 4,000 feet. This species forages at low heights over water and in openings in forests. The long-legged myotis roosts in rock crevices, caves, mines, and buildings; under tree bark; and in snags. Trees are most important for day-roosting, while caves, mines, and similar structures are used for night-roosting. In the project area, biologists documented the long-legged myotis at the tunnel crossing over Rock Creek. Breeding is likely to occur in the area, based on the capture of one post-lactating female.

Pallid bat (*Antrozous pallidus*)—The pallid bat occurs throughout California. In central California, the pallid bat occurs in a variety of habitats, including oak woodland, ponderosa pine, and mixed conifer forest at elevations below 6,000 feet. The pallid bat uses rock outcrops, caves, tree hollows, and human-made structures as day-roosts. Night roosts may be located under bridges or in caves or mines, where temperatures do not exceed 40 degrees C (104 degrees F). During the 2000 surveys, biologists made 9 detections of pallid bats at 8 of the 142 sample stations. Most detections occurred in mixed oak conifer and at the base of cliffs (Pierson et al., 2001). No pallid bats were detected using project facilities or other man-made structures.

Silver-haired bat (*Lasionycteris noctivagans*)—Silver-haired bats are common, but their abundance is highly variable. Summer distribution is thought to be limited to coastal and montane forests below 9,000 feet, while the species occurs throughout California during the winter. The silver-haired bat feeds primarily on moths and insects, flying low above the ground over streams, ponds, and other openings. The silver-haired bat may be found foraging with a number of other species. Females may remain solitary during the breeding season, or may form nursery colonies in dense foliage or in tree cavities. Males and females are strongly associated with forested habitat. In the project area, a total of 14 silver-haired bats were captured from locations below the Pit 4 dam, near Bush Bar, and at Kosk Creek, and a total of 118 audio detections were recorded (Pierson et al., 2001).

Spotted bat (*Euderma maculatum*)—In California, the spotted bat is most common in the southern portion of the state, in deserts, grasslands, foothills, and montane conifer forests. The spotted bat often roosts in rock crevices in cliffs, and occasionally in caves and buildings. This species forages over water, feeding primarily on moths. In the project area, biologists obtained 11 acoustic records of spotted bats at 4 sites in the vicinity of the Pit 4 powerhouse, reservoir, and dam.

Townsend's big-eared bat (*Corynorhinus townsendii*)—Townsend's big-eared bat occurs throughout California, from low desert to mid-elevation forests. It relies on caves, mines, tunnels, or attics, where it roosts in clusters on open surfaces. While this species occasionally uses man-made structures that resemble caves, none of the powerhouses, dams, or associated project features provide suitable day roosting habitat (Pierson et al., 2001). It is most readily detected by surveying potential roost sites, but is not easily captured or acoustically recorded. In the Pit 3, 4, 5 Project area, one acoustic detection of this species was made along Kosk Creek near Hunt Hot Spring, and guano that likely indicated roosting by one Townsend's big-eared bat was observed in a cave-like space under the Pit 3 flow line crossing of Rock Creek.

<u>Western red bat (*Lasiurus blossevillii*)</u>—The western red bat is found throughout California at low elevations. Most occurrences of breeding females are from low elevations along major drainages in the Central Valley, but males and non-reproductive females may use elevations up to about 8,000 feet. The western red bat uses tree foliage for day-roosting and is strongly associated with riparian forest. During PG&E's surveys in the Pit 3, 4, 5 Project area, biologists obtained 24 acoustic records of red bats. Detections were scattered throughout the project area. The majority of the detections were obtained during September, indicating that red bats may migrate through the project area down the Pit River to wintering sites in southern California or along the coast (Pierson et al., 2001).

<u>Yuma myotis (*Myotis yumanensis*)</u>—The Yuma myotis is common and widespread throughout most of California, from sea level to about 8,000 feet. This species is most often found in open forests and woodlands near waterbodies that provide foraging habitat. The Yuma myotis usually roosts in buildings, mines, caves, or crevices. PG&E's surveys indicate that about 200 Yuma myotis use chambers in the open archway on the deck of the Pit 3 dam seasonally as a night roost. Over 1,000 Yuma myotis use the roof area of the Pit 4 powerhouse as a day-roost and nursery colony. Yuma myotis also use the Pit 5 transformer pad, the Pit 5 gaging station intake, and small chambers in the abutment of the tunnel crossing at Rock Creek.

<u>Survey and Manage Terrestrial Molluscs Documented in the Project Area</u>

The FS designated 11 terrestrial mollusc species that may occur in the project area as SM species under the Northwest Forest Plan (FS and BLM, 1994), but recently determined that survey and manage guidelines were not necessary to protect two of these; the papillose taildropper and Church's sideband snail (FS letter to the Commission dated May 19, 2003). Of the nine molluscs still considered SM, the FS indicated that special management requirements would apply to the Oregon shoulderband, Klamath shoulderband, and Shasta hesperian snail. These species typically occur in shady, moist sites with decaying wood, deciduous trees, and mossy talus or rock substrate. The FS notes that the Oregon shoulderband and Klamath shoulderband are not necessarily restricted to streamside habitats, as long as permanent ground cover, moisture, and food are available, but the Shasta hesperian has a high affinity for water (FS letter to the Commission dated May 19, 2003).

PG&E mapped potential habitat in areas that project operations could affect, selecting 29 representative survey sites along the three mainstem river reaches and around the reservoirs. PG&E also selected sites along the lower reaches of tributaries to the Pit River and around project facilities, where these provided potential habitat.

To meet the requirements of the FS survey protocol for SM terrestrial molluscs, surveys must be conducted twice at each survey site, under specific temperature and moisture conditions. PG&E conducted surveys during the fall of 1999 and spring and fall of 2000 (Spring Rivers, 2001a; PG&E, 2000) and completed the second set of surveys at the Lake Britton and upper Pit River sites in November 2001 (Spring Rivers, 2001b). During these field efforts, surveyors documented the occurrence of 19 terrestrial mollusc species. The species composition was generally consistent among all three of the river reaches. Molluscs were most often found near springs, seeps, and along perennial tributary channels.

Three SM species were observed, including the Shasta hesperian snail, Klamath shoulderband snail, and a species that was tentatively identified as either Shasta sideband snail or Wintu sideband snail. Both the Shasta sideband snail and Wintu sideband snail are SM species, as well as being federal species of concern.

The three SM species documented in the surveys were found in all three of the river reaches, except for the Klamath shoulderband snail, which was found only in the Pit 5 reach and at the lower end of the Pit 4 reach. The Klamath shoulderband snail was most often found in relatively dry sites, including talus slopes, rockslides, and terraces. The Shasta hesperian snail was very common and was usually associated with springs, seeps, and tributaries. Only one of the SM species (Shasta hesperian snail) was observed on the reservoir margins at Lake Britton, Pit 4 and Pit 5 reservoirs.

3.3.3.2 Environmental effects:

Vegetation Management

Vegetation management at project facilities, including recreational sites, transmission line corridors, and access roads, has the potential to positively or adversely affect native plant communities, rare plants, ethnobotanical resources, and wildlife habitat. Vegetation management also may create conditions that decrease or increase the risk of establishment and spread of non-native plants and noxious weeds.

Recreational activities may adversely affect vegetation in the project area, as well. ORV traffic may cause erosion, soil compaction, and loss of vegetative cover. Vehicles, anglers, hikers, and even domestic pets can serve as vectors for the spread of weeds at both formal and dispersed recreational sites.

To address these concerns, PG&E proposes to develop two vegetation management plans. One would be directed toward controlling noxious weeds in the vicinity of project powerhouses and recreational facilities, and at vegetation clearing sites along project rights-of-way. A separate plan would be developed to manage understory and overstory vegetation at PG&E's recreational areas.

FS preliminary 4(e) condition No. 32 would require PG&E to develop a vegetation management plan that would identify and prioritize areas for revegetation, and would address vegetation management on transmission and distribution line rights-of-way that cross FS lands. PG&E would also be required to fund prescribed fire treatment of up to 920 acres around Lake Britton to reduce fuel-loading and improve forage values for deer. The FS would also require PG&E to conduct surveys for the federally listed VELB where suitable vegetative habitat could be affected by project-related activities. Final 4(e) condition No. 23 is similar to the FS preliminary 4(e) condition and would include the vegetation management plan as a component of a biological resources management plan. However, the final 4(e) condition does not specify that PG&E should be responsible for funding prescribed fire treatment.

FS final 4(e) condition No. 23 would require PG&E to develop a plan to manage noxious weeds and submit it to the Commission for approval, as part of the vegetation management plan. The plan would include inventory, mapping and monitoring; development of prevention strategies; treatment of new and established infestations; and education of project personnel. The FS also indicates it may request PG&E to develop a plan for management of aquatic noxious weeds.

FS final 4(e) condition No. 15 would require PG&E to prepare a biological evaluation (BE) to assess the potential effects on FS special status species of any actions to construct (including, but not limited to, proposed recreational developments), operate or maintain project facilities, and submit it to the FS for approval. This requirement would apply to plants, fish, and wildlife, and their habitats.

Interior makes a 10(j) recommendation that PG&E consult with the agencies and the Tribe to develop a vegetation management plan that would focus on the use of manual, mechanical, and biological control of noxious weeds. As a 10(a) recommendation that would be included in the vegetation management plan, Interior recommends prohibiting the use of herbicides to control noxious weeds for a minimum of 10 years. As part of the vegetation management plan, Interior recommends PG&E consider the use of vegetative management for reducing excess fuels within the project area, especially near facilities and developed recreational areas, to minimize the risk of wildfire. In addition, Interior recommends planning project-related maintenance in a manner that avoids sensitive plant species, and employee awareness training for those conducting work in sensitive areas.

The Tribe submitted two recommendations regarding vegetation management. The Tribe recommends PG&E consult with the Tribe and resource management agencies to develop a program to eradicate noxious weeds, using no herbicides within the first 10 years of program implementation. The Tribe also recommends consulting with the Tribe to identify native plants of cultural importance, and selecting these for use in revegetation projects.

Our Analysis

Vegetation management encompasses a wide variety of activities, such as roadside mowing, removal of hazard trees, revegetation of eroding soils, and fire suppression. Vegetation management can have adverse or beneficial effects, or both, on natural resources, cultural values, recreation, aesthetics, health and safety, and socioeconomics. For this reason, consultation with the FS, FWS, CDFG, CDPR, and the Tribe to develop and implement a project-level land and habitat management plan (LHMP) would serve as a mechanism to integrate a number of separate, resource-specific programs. We address this plan in section 3.3.6, *Land Use and Aesthetic Resources*. In the following section, we address development of a Vegetation Management Plan, and focus on four aspects of vegetation management having to do with terrestrial resources: protection of special status plants, control of noxious weeds, improvement of wildlife habitat, and enhancement of ethnobotanical resources. Vegetation management at recreational sites is addressed in section 3.3.6, *Land Use and Aesthetic Resources*.

<u>Protection of special status plants</u>: During field surveys in spring and summer of 2000, biologists documented the occurrence of seven special status plants along project transmission line and access road rights-of-way and in the vicinity of recreational sites (GANDA, 2001). In its comments on the draft EIS dated May 19, 2003, the FS identified protection of two of these - Lake Almanor fairyfan and mountain lady's slipper - as being of particular concern. Since these are sites that could be affected by spread of noxious weeds or a variety of vegetation management activities (e.g., brushing, mowing, herbicide application, fuel reduction projects, replanting projects), recreation-related activities (e.g., camping, wood-cutting, ORV use), and other ground disturbances, we conclude that consultation with the FS, FWS, and CNPS to identify any measures that may be needed to protect these species should ensure that relicensing the project should not adversely affect special status plants.

<u>Control of noxious weeds</u>: Noxious weeds are a growing threat to California's environment, because of their potential to degrade native plant communities, outcompete rare species, and reduce wildlife habitat values. Both federal and state law require landowners to manage noxious weeds within their ownerships. Currently, the species of greatest concern are spotted knapweed, identified as a CalEPPC "red alert" species and designated as a Class A weed by CDFA; and yellow starthistle, identified as a CalEPPC Class A-1 species and designated as a Class B weed by CDFA.

Successful weed control requires a cooperative effort by all landowners and land managers in the vicinity, since untreated weeds on adjacent lands provide a ready seed source for infestation by new species and re-infestation after treatment of existing problem weeds. We conclude that consultation with the FS, FWS, CDFG, the Tribe, NPS, CDFA, Shasta County Weed Management Area, and local landowners, to develop an integrated weed management plan as part of the vegetation management plan would facilitate a unified approach to control effects, and is appropriate. We encourage PG&E to implement weed control measures on its adjacent non-project lands to help reduce the risk of spread of weed infestations.

We agree that weed management on lands affected by project operations, including high priority erosion sites along Pit River downstream of Lake Britton, such as the Pit 4D and Miners Creek spoil piles, is necessary to control the spread of invasive plants. We conclude that participants in the development of an integrated weed management plan should identify realistic weed control intensities for each species of noxious weed. Eradication may be attainable for species that are currently limited in distribution, but attempts to eradicate species that are already well-established and widespread would not be likely to succeed, except at unacceptably high cost to other resource values.

Noxious weed monitoring could also be included as an element within other plans that could entail monitoring for erosion, such as the erosion and sedimentation control plan and the spoil pile management plan (both discussed in section 3.3.1.2, *Water Resources*), the recreation management plan (discussed in section 3.3.5.2, *Recreational Resources*), the road and facilities management plan (discussed in section 3.3.6.2, *Land Use and Aesthetic Resources*), and the HPMP (discussed in section 3.3.7.2, *Cultural Resources*).

We do not concur that a blanket 10-year prohibition on the use of herbicides, as recommended by Interior and the Tribe, is appropriate. Herbicides should not be the automatic first choice for weed control, because of the potential health and environmental risks associated with their use, especially near surface water. However, many herbicides have a lower risk of unintended adverse effects than other kinds of controls, and the risks of any control method must be weighed against the adverse effects of the weed infestation itself (Tu et al., 2001). Limiting available control techniques for 10 years throughout the project area could enable some populations of noxious weeds to become established to the point where future control potential is unlikely (William et al., 2001). For this reason, we conclude that a blanket, project-wide 10-year prohibition on the use of herbicides is not appropriate. However, any integrated weed management plan should emphasize non-herbicide techniques, and allow for herbicide use, if any, only at specific sites.

<u>Improvement of wildlife habitat</u>: Years of fire suppression have allowed the accumulation of fuels over large portions of California's forest and range habitat, on both

public and private lands. Accumulation of fuels increases the risk of devastating wildfire. In some stands, fire suppression results in a dense understory that prevents sunlight from reaching the forest floor, reducing the abundance of annual herbaceous cover that would provide forage for deer and other wildlife species. On shrub-dominated sites, old shrubs may become woody, less palatable and less nutritious as browse.

The deer population in the project vicinity, which is located within the Cascade-North Sierra Nevada Deer Assessment Unit (DAU), declined precipitously from a peak of over 70,000 individuals in 1991 to less than 30,000 animals in 1992. Deer numbers increased again to almost 50,000 in 1993 and remained at similar levels through 1996, but the population is considered to be trending slightly downward (CDFG et al., 1998). CDFG identifies forestry practices, lack of habitat disturbance that would provide a continuous supply of early-successional stage vegetation, and localized overgrazing by livestock as important influences on deer populations in the Cascade-North Sierra Nevada DAU.

Prescribed fire, as originally recommended by the FS, could contribute to increased soil fertility, promote plant vigor by removing old shoots and foliage, and enhance herbivorous wildlife food sources by increasing the palatability and protein content of resprouting shrubs. A controlled fire component of a vegetation management plan for land within the project boundary could reduce the danger of wild fires and improve the quality of the deer winter range. However, such benefits would need to be weighed against potential adverse affects on other resources. We encourage PG&E to consider similar actions on its adjacent non-project lands. Implementation of prescribed fire may benefit several FS MIS associated with forested stands, including deer and black bear, that use young forest stand ages. It would also help to protect habitat over the long term for several MIS, including pileated woodpecker, hairy woodpecker, and gray squirrel, by reducing the risk of catastrophic wildfire.

<u>Enhancement of ethnobotanical resources</u>: The Tribe has identified a number of plants that grow in the project area, such as redbud and hazel, as being of special importance for medicine, art, basketry, and cultural use. PG&E and the Tribe entered into a Memorandum of Understanding regarding ethnobotanical studies in June 2003. The studies entail compilation of a list of important plants and their existing locations, identification of areas where these species could be re-established for the purpose of gathering, and development of a plan for protecting and managing gathering sites.

We discuss protection of ethnobotanical resources and management of existing and proposed plant gathering sites in section 3.3.7, *Cultural Resources*. We anticipate that a number of plants of ethnobotanical importance could be incorporated into revegetation projects that would be implemented during the new license period, such as stabilization of spoil piles, road improvements, and vegetative screening at recreational sites, provided

PG&E schedules time to investigate sources of native plant materials and the possibility of contract growing well in advance of the dates the plants are needed.

Effects of Flow Releases on Riparian Habitat

Riparian habitat in the project area occurs in small patches and narrow bands along the shorelines of project reservoirs and waterways. Under the current flow regime, riparian vegetation is encroaching into the active stream channel along each of the bypassed reaches. Higher stem densities may reduce water velocities, allowing increased sediment deposition and further encroachment of vegetation. This process is especially evident in low-gradient segments of the Pit River, where torrent sedge has established on sediments trapped in debris and among the roots of willow and alder that also are growing within the active channel.

The primary objectives of the PRCT agreement regarding flows are to improve habitat for native fish species and to more closely mimic the unimpaired hydrograph. The agreement is also intended to improve riparian habitat by providing flows that would remove vegetation that has encroached into the active channel, while promoting the establishment of cottonwood on gravel bars, floodplains and terraces. To accomplish these objectives, the PRCT agreement calls for increasing minimum instream flows and shaping them seasonally; releasing freshet flows in late winter or early spring; restricting ramping rates; and controlling out-of-season spills. The PRCT's proposed flow regime is described in detail in section 3.3.2.2, *Aquatic Resources*. Basically, minimum flows would vary from 280 to 350 cfs in the Pit 3 reach, and from 350 to 450 cfs in the Pit 4 and Pit 5 reaches (see table 27), with carefully controlled ramping rates following higher-volume winter spills.

According to the PRCT rationale statement, a purpose of the operating protocols, out-of-season spill control, and ramping rate control specified in the PRCT agreement is to assure that spill flows increase and recede naturally, out-of-season project-related spill events are minimized, and sudden increases in streamflow due to the initiation of spills or a sudden reduction of spill flows due to increasing flow through a generation unit or exercising reservoir storage capacity are avoided. Avoiding sudden increases in flow would avoid displacement of organisms, including aquatic reptiles, amphibians, birds, and mammals, by a sudden increase in streamflow. The PRCT believes that a more naturally receding streamflow would benefit the riparian community by facilitating seed dispersal and germination.

The FS identified several specific objectives of its recommended flow regime, as well, in its comments on the draft EIS dated May 19, 2003. These include: (1) maintaining or improving habitat for FS special status aquatic species, including foothill yellow-legged frogs; (2) improving the hyporheic zone, to the extent feasible; (3) maintaining or improving habitat for species of interest or where directed by LRMPs (i.e., coldwater fishery); (4) increasing the diversity of aquatic habitats by increasing inundation of side channels, backwaters; (5) maintaining or restoring the species composition and structural diversity of plant communities in riparian areas; and (6) other aquatic conservation strategy objectives.

Interior recommends development of a riparian monitoring plan to enable PG&E to determine the discharge regime needed to maintain an appropriate distribution and diversity of riparian vegetation in the project-affected reaches. The plan would be designed to evaluate the range, timing, and duration of flows necessary to remove (through inundation and scouring) torrent sedge, willow, and alder.

CDFG also recommends PG&E develop a riparian management plan in conjunction with increasing the minimum flow releases. The plan would include a regular program of monitoring riparian community composition and distribution.

Our Analysis

The 2002 habitat mapping study results indicated that test flows began to inundate sedges at about 250 cfs, but inundation did not become marked until flows reached about 400 cfs. Flows began to inundate willow shrub between 200 and 300 cfs, and alder shrub between 300 and 400 cfs (R2, 2003). PG&E's October 1, 2002, response to AIR No. 5 indicated that increases to 600 cfs in each of the bypassed reaches would reduce the amount of riparian vegetation by about 50 acres. Most losses would occur in the torrent sedge series, as shown in table 35. The area occupied by torrent sedge would be reduced by about 45 percent at 600 cfs flow releases. Much smaller reductions would occur in the acreage of narrowleaf willow habitat in the Pit 3 reach, white alder series in the Pit 3 and 4 reaches, and arroyo willow in the Pit 5 Reach.

Table 35. Estimated riparian vegetation acreage at existing and experimental flows. (Source: PG&E, response to AIR No. 5, dated October 1, 2002)

	Pit 3 Reach (cfs)			**Pit 4 Reach (cfs)**			**Pit 5 Reach (cfs)**		
Riparian Vegetation Series	**150**	**600**	**1,200**	**150**	**600**	**1,200**	**100**	**600**	**1,200**
Torrent sedge	22.79	9.32	1.41	4.55	3.20	0.91	13.93	10.25	6.46
California brickellbush	0.35	0.34	0.18	11.71	11.50	10.65	51.60	49.87	48.31

Riparian Vegetation Series	Pit 3 Reach (cfs)			Pit 4 Reach (cfs)			Pit 5 Reach (cfs)		
	150	600	1,200	150	600	1,200	100	600	1,200
Arroyo willow	3.16	2.83	1.93	6.54	5.58	3.90	109.58	103.14	92.51
Narrowleaf willow	11.27	9.88	6.80	12.55	11.59	9.70	16.11	14.79	13.78
White alder, immature	6.76	5.76	4.77	19.06	17.18	14.21	20.45	19.45	18.75
White alder, mature	33.56	27.34	23.21	39.12	33.52	30.14	7.96	7.09	6.79
Black cottonwood, immature	0.34	0.34	0.34	0.00	0.00	0.00	0.00	0.00	0.00
Black cottonwood, mature	0.00	0.00	0.00	0.19	0.19	0.19	0.65	0.50	0.45
Oregon ash, immature	6.71	6.32	4.35	1.15	1.15	1.15	5.28	5.14	4.97
Oregon ash, mature	4.04	3.29	3.21	0.18	0.15	0.15	0.70	0.70	0.70
Black oak	1.10	1.09	1.09	3.94	3.87	3.86	66.74	66.60	66.45
Pacific willow	0.00	0.00	0.00	0.00	0.00	0.00	1.67	1.64	1.61
Bare ground	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.31	0.19
Total	90.08	66.51	47.29	98.99	87.93	74.86	295.02	279.48	260.97

Torrent sedge, willow, and alder would be likely to re-establish along the new ordinary high water mark in a relatively short period of time (e.g., within 5 to 10 years) after implementation of the proposed flow regime, because they can adapt to a wide range of moisture conditions and can tolerate relatively long periods of inundation during the winter and early spring. The amount of vegetation that would re-establish would likely vary from site to site along the affected stream reaches, depending on factors such as aspect, slope, width of the floodplain, substrate, stream gradient, and existing plant community, in addition to flow volumes. The 2002 habitat mapping studies suggest that minimum flows would have to reach the historic summer base flow of 1,800 cfs to prevent recurrence of encroachment of vegetation into the channel. At that point, topographic, hydrologic, and soil conditions would continue to support upland plant communities.

We conclude that higher minimum instream flows would have both positive and negative effects on riparian habitat. We agree that flows recommended by the PRCT, that more closely mimic the natural hydrograph, would promote more active riverine processes in terms of surface water and groundwater interactions, instream habitat complexity, and primary productivity. We also note that existing riparian vegetation supports unique plant communities and provides important habitat for wildlife. Riparian vegetation occupies a very small proportion of the landscape, and the loss of up to 50 acres of this habitat type as a result of increased flows in the Pit 3, 4, and 5 reaches could adversely affect amphibians, reptiles, songbirds, small mammals, and aquatic furbearers that depend on riparian plant communities for forage, hiding, nesting, or denning. Loss of riparian vegetation could also reduce bank stability and increase the risk of establishment and spread of noxious weed populations on exposed soils. In considering these positive and negative effects, we conclude that long-term benefits of higher instream flows would outweigh the adverse effects of short-term habitat loss and alteration.

Based on information PG&E provided in responding to AIR No. 5 (letter to the Commission dated October 1, 2002), the Pit 3, 4, and 5 reaches currently support a total of 1.18 acres of cottonwood. Appendix E.3.3-1 of the license application indicates very little cottonwood was present in the project area at the time the project was constructed, and a comparison of the 1944 air photos with photos taken in 2000 shows no substantial change in cottonwood cover. Extensive cottonwood forests are more typical of broad floodplains along alluvial rivers than in confined systems such as the Pit River; cottonwood may never have represented a large proportion of riparian cover in the project vicinity. We conclude that implementation of flows recommended by the PRCT agreement would be unlikely to achieve their objectives for increasing cottonwood recruitment or expanding the acreage of this cover type.

In addition to increasing minimum instream flows to improve aquatic and riparian habitat, the PRCT agreement calls for PG&E to release freshet flows into the three project reaches as needed to ensure that such flows occur at least every second year. PG&E would release the flows starting between March 1 and March 7 each year, if adequate spill (i.e., as defined in the PRCT agreement, this would mean spill occurring between December 1 and

May 31 of the previous year, having a cumulative volume of at least 25,000 acre-feet, a duration of at least 21 days, and at least two average daily flows exceeding 1,500 cfs) has not occurred in a reach. PG&E would taper the flow to the wintertime minimum requirement for the reach in five steps of approximately equal magnitude and duration over the remaining days of the freshet period. The PRCT anticipates that freshet flows would prevent the accumulation of fine sediments and organic materials, recharge riparian groundwater, reduce vegetation encroachment, and increase germination and recruitment of riparian vegetation.

As described in section 3.3.2.2, *Aquatic Resources*, our review of USGS gage data indicates that freshet flows of over 1,500 cfs occur in the bypassed reaches in approximately 8 out of 10 years under existing conditions. We agree that freshets of about 1,500 cfs likely help to mobilize fine sediments and reduce accumulations of substrate that could be colonized by torrent sedge and other herbaceous species, but do not reduce woody cover. Freshet flows may also provide seasonal hydrologic connections with side channels and the limited amount of gravel bar and floodplain habitat that is present. For these reasons, we concur with implementation of the PRCT's recommended freshet flow plan.

Monitoring the response of riparian vegetation to increased minimum flows, freshet flows, peak flow management, and reduced ramping rates would provide information that could be used to modify flows in the future, if necessary. For this reason, we concur with Interior and CDFG that PG&E should develop a plan to monitor riparian vegetation.

Effects of Flows on Special-Status Amphibians and Reptiles

Declines in several native frog populations have been observed in California (Jennings, 1996). Reasons for decline may include habitat loss or alteration, disease, climate change, or a combination of these factors, and several studies indicate that predation by bullfrogs and non-native fish can dramatically affect populations of native frogs (Moyle, 1973; Kupferberg, 1996; Kupferberg, 1997; Kiesecker and Blaustein, 1997; Kiesecker and Blaustein, 1998; Reaser, 2000). Declines have been notable for the foothill yellow-legged frog, especially in the west slope drainages of the Sierra Nevada (Jennings, 1996).

Populations of western pond turtles have also declined throughout their range (Holland, 1994). Turtles are highly susceptible to environmental disturbance, due to the longevity of individuals, their delayed maturity, and low and variable annual reproductive success (Lovich, 1995). Loss of habitat and reduced genetic diversity due to habitat fragmentation are also threats to the western pond turtle (Reese and Welsh, 1998). In addition to aquatic habitat considerations, the fact that the western pond turtle may move overland as much as 3 miles from water exposes it to another set of environmental disturbance on land, e.g., predation, residential and recreational development, road traffic, and ORV use (Holland, 1994).

Changes in the flow regime in the project reaches (including increases in minimum flows, implementation of freshet flows, restricted ramping rates, controlled out-of-season spills, and whitewater boating releases) may affect aquatic and riparian habitat that currently supports populations of foothill yellow-legged frog in the Pit 4 reach, and scattered occurrences of western pond turtles in the Pit 3, Pit 4 and Pit 5 reaches. The FS concludes in its revised BE submitted to the Commission by letter dated November 20, 2003, that the flow regime outlined in the PRCT agreement and implementation of the FS final 4(e) conditions may adversely affect individual foothill yellow-legged frogs and western pond turtles, but is not likely to result in a trend toward federal listing or loss of species viability.[16]

To evaluate project effects on these special-status species, the FS recommends, under final 4(e) condition No. 23.c, that PG&E consult with the FS, Interior, and CDFG to develop an amphibian monitoring plan that would be approved by the FS and filed with the Commission. The plan would provide for monitoring changes in foothill yellow-legged frog use of the Pit 4 and Pit 5 reaches, the distribution of bullfrogs in the Pit 5 reach, and the distribution of foothill yellow-legged frogs and Cascades frogs in the Pit 3 reach. PG&E would also collect data to evaluate the effects of flows, signal crayfish predation, and water temperatures on foothill yellow-legged frogs. Monitoring would be conducted each spring and summer for a minimum of 4 years following license issuance. After completion of the initial monitoring period, PG&E would monitor at 4-year intervals, unless the TRG develops a different schedule.

The FS, under final 4(e) condition No. 23.d, would also require PG&E to develop and implement a population monitoring plan for the western pond turtle. The plan would rely on assessing the size class distribution of the existing population.

Interior recommends PG&E develop a plan for annual surveys of foothill yellow-legged frog through the term of the new license. Interior indicates the plan should include breeding and tadpole surveys and management measures directed at controlling or reducing the populations of non-indigenous predators, such as bullfrogs. Interior also recommends temperature monitoring, in coordination with the BCMP.

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16 The complete FS revised BE can be viewed by going to the Commission's web page (www.ferc.gov), clicking on the eLibrary link, specifying the docket number for the Pit 3, 4, 5 Project (p-233), and the date of the filing, when asked for the range of dates to be searched (11/20/03 to 11/20/03); the BE is filed under subdocket 081).

Our Analysis

In riverine environments, breeding habitat for the foothill yellow-legged frog typically consists of low-velocity, shallow water and rocky substrates, near sparsely vegetated gravel and cobble bars (Lind et al., 1996). A study conducted on the Trinity River in northern California indicated that reduced flows allowed riparian vegetation to encroach into the channel, which decreased habitat complexity and reduced the area of suitable breeding habitat for foothill yellow-legged frogs by as much as 94 percent (Lind et al., 1996). Habitat enhancement projects on the Trinity River were designed to remove berms (bank feathering) that had developed over time along the mainstem as a result of severely reduced flows in an alluvial system with large sediment inputs (USBR, 2000). Although removing the berms and recontouring the banks (which required removing riparian vegetation) was intended to improve rearing habitat for juvenile Chinook salmon, Lind et al. (1996) found that foothill yellow-legged frogs rapidly colonized several of the feathering project sites.

The Pit 4 reach is generally steeper than the Trinity River mainstem, is not constrained by berms and fossilized bars, and carries a lower sediment load. However, observations of the amount of foothill yellow-legged frog breeding habitat at various test flows in the summer of 2002 suggest that conditions in the Pit River may be somewhat comparable to those in the Trinity River. Table 36 shows the estimated area of potential breeding habitat at occupied and unoccupied sites in the Pit 4 reach by vegetation category. The estimates indicate that the total area of Canopy 1, or existing suitable habitat, would be substantially reduced from current conditions at flows of 250 cfs, 400 cfs, and 600 cfs. Canopy 2 habitat (now densely vegetated with sedges and willow/alder shrub) may become available at flows of 600 cfs, as vegetation is inundated and dies out. The addition of Canopy 2 habitat (together with smaller amounts of more shaded habitat in Canopy 3) would roughly double the amount of existing breeding habitat.

The flow regime outlined for the Pit 4 reach in the PRCT agreement would likely benefit foothill yellow-legged frogs by slightly increasing habitat complexity and continuity, and slightly reducing vegetation encroachment into the channel. However, since recent findings (Spring Rivers, 2003d; Kupferberg, 2003) suggest that the area of available breeding habitat under current conditions is not limiting to populations in the Pit 4 reach, the more important effect may be to reduce the magnitude of change between minimum base flows and spring flood flows during the breeding season. Large changes in flow during the breeding season (such as those that occur under existing conditions) may result in scouring, desiccation of egg masses, and increased exposure to predation. The PRCT rationale statement indicates that the timing of proposed freshet flows is designed to avoid interrupting foothill yellow-legged frog breeding and egg deposition.

Table 36. Area of potential foothill yellow-legged frog breeding habitat in the Pit 4 reach at various test flows. (Source: Spring Rivers, 2003d, modified by staff).

	Potential Breeding Habitat in Square Meters			
Test Flows (cfs)	Canopy 1[a]	Canopy 2[b]	Canopy 3[c]	Canopy 1 + 2 + 3
150	406	0	36	442
250	279	0	24	303
400	172	68	151	391
600	245	414	166	825

[a] Canopy 1 habitat is open and sparsely vegetated, and is considered suitable in its current condition for FYLF breeding.
[b] Canopy 2 habitat is vegetated with dense, low-growing sedge and shrub species. Although it provides hiding cover for juveniles and adults, vegetation would have to be removed (mechanically or via inundation) to provide conditions suitable for breeding.
[c] Canopy 3 habitat has a relatively open understory, but is shaded by mature alder that would not likely be removed by inundation. Due to shading it is considered less suitable for FYLF breeding than Canopy 1 habitat.

One predator, the signal crayfish, was noted to be abundant at Deep Creek in 2002. Sacramento pikeminnow, another known predator of amphibians, was commonly observed (Spring Rivers, 2003d). Bullfrogs are also a well-documented predator on amphibians. At the present time, bullfrogs are known to occur only in the Pit 5 reach, but one objective of the spring freshet flows is to help control bullfrog populations and prevent a possible spread into the Pit 4 reach. The FS believes studies conducted in the Eel River in northern California demonstrate that the annual release of spring freshet flows would be effective in preventing bullfrog movement into the Pit 4 reach. Bullfrog tadpoles may mature during their first season under ideal conditions (warm temperatures, abundant food resources), but generally require over a year for metamorphosis (Graves and Anderson, 1987). Foothill yellow-legged frogs mature during their first season and would not be at risk of flushing through the system as a result of 1,500-cfs spring freshet flows during late winter or early spring, while bullfrog tadpoles could be swept from side channel pools, shallows and backwaters by such flows. We agree this sequence of events may occur at some sites in the Pit 5 reach; however, we note that bullfrogs have persisted there, despite flooding of over 40,000 cfs in 1997 and an extended period of spills in the spring of 1998. In our view, the existing array of temperatures in the Pit 4 and Pit 5 reaches may be more effective in segregating bullfrogs and foothill yellow-legged frogs. Bullfrogs are warm-adapted, and maintaining cold temperatures where they currently exist as a result of spring and tributary contributions could help to limit habitat suitability for this species. Section 3.3.2.2, *Aquatic Resources*, provides more detailed information about the effects of various flow regimes on temperatures in each reach.

We concur with the ramping rate plan outlined in the PRCT agreement, which is designed to moderate the rate of flow change on the receding limb of the hydrograph and establish means of reestablishing minimum flows after either planned or unplanned spills. Reducing rapid flow fluctuations would benefit the foothill yellow-legged frog, since abrupt changes in water velocity and water surface elevation have the potential to reduce the abundance of the aquatic invertebrate prey base, dislodge or desiccate egg masses, and impair the development of eggs and juveniles through changes in water temperature.

We anticipate that minimum flows outlined in the PRCT agreement would be adequate to maintain and possibly improve habitat for the foothill yellow-legged frog, but conclude it would be reasonable to evaluate the effects of changes in the flow regime, including effects of minimum flows, spring freshet flows, ramping rates, and whitewater boating flows. The FS final 4(e) condition would require PG&E to conduct an initial 4-year study following implementation of a new flow regime and then to conduct monitoring at 4-year intervals, unless otherwise determined by the TRG. Initial surveys would be used to evaluate foothill yellow-legged frog population abundance, distribution, and use of habitat, and collect the data needed to evaluate any correlations between foothill yellow-legged frog populations and the hydrologic regime, water temperatures, and predation by bullfrogs. Since the signal crayfish has been identified as possibly a more important predator than bullfrogs (Spring Rivers, 2003d; Kupferberg, 2003), it is necessary to include this species in the study plan as an element to be monitored. We do not recommend the consideration of direct control measures for bullfrogs or crayfish until the end of the initial 4-year study period, when PG&E, in consultation with the FS, FWS, and CDFG, has had an opportunity to evaluate the preliminary results of changes in the flow regime on foothill yellow-legged frog populations. Killing predators is often expensive and rarely effective, unless there is a significant change in the environment. Increasing minimum flows may represent such a change, and predator control may become less of a concern in the future.

We have no information that Cascades frogs occur in the project area or that there is a need to monitor their populations. We note that PG&E did not observe any Cascades frogs during the riparian biota surveys in 1999 or 2000 (Spring Rivers, 2001a) or during follow-up surveys for Shasta salamander and terrestrial molluscs in 2001 (Spring Rivers, 2001b). However, it would be reasonable for PG&E to include documentation of any wildlife species that are observed during the amphibian surveys as a routine component of the survey protocol.

The western pond turtle is a weak swimmer, and is almost always found in still or slow-moving water. Changes in minimum flows as proposed in the PRCT agreement would increase velocities in some stream reaches and microhabitats that are currently used by turtles. Although neither the habitat mapping study (R2, 2003) nor the 2-D hydraulic modeling study (Hardin-Davis, Inc., 2003) can be used to directly quantify changes in turtle habitat, the results can be used as rough indicators of potential effects.

The habitat mapping study indicates that proposed flows would either slightly increase or slightly decrease the area of shallow, slow-moving water (shallow/slow habitat) at four of the five analysis sites, and decrease the area of deep, slow-moving water (deep/slow habitat) at all five sites. The amount of shallow/slow habitat would increase substantially at one site, located at Deep Creek.

Based on the 2-D hydraulic modeling study, there would be very little change in the amount of habitat between existing flows and flows up to 1,200 cfs in the Pit 3 reach. In the Pit 4 reach, habitat area would begin to decrease somewhat at 500 cfs or more, and in the Pit 5 reach, would begin to decrease rapidly at flows over 250 cfs.

New habitat that may become available in reconnected side channels, backwaters, and bank undercuts would help to offset projected losses of existing habitat. In addition, higher minimum flows would help to maintain small pools through the summer and provide habitat where none may currently exist, due to dewatering.

We concur with the FS that PG&E should conduct surveys of western pond turtle populations to evaluate the response of this species to changes in the flow regime. Although PG&E has already conducted surveys of presence/absence, the collection of baseline data on age distribution, with monitoring at 5-year intervals through the license period to evaluate changes in population abundance, distribution, age structure, and habitat use has not yet been conducted and we conclude that it is warranted. Since there is some evidence of year-to-year site fidelity (Holland, 1994), information about turtle locations over time may be useful in managing upland habitat along riverine shorelines that turtles may use for nesting or over-wintering.

Effects of Whitewater Flows on Special-Status Amphibians and Reptiles

The PRCT agreement calls for PG&E to consult with FWS, NPS, CDFG, CDPR, the Tribe, SWRCB, AWA and other interested parties to develop a recreation streamflow release plan for the Pit 5 reach. The FS revised 10(a) recommendation No. 9 (whitewater boating in the Pit 5 reach), filed with the Commission by letter dated November 14, 2003, is consistent with the PRCT agreement. Baseline environmental data would be collected for a maximum of 5 years prior to implementing the flow releases. Initially, releases would be scheduled for 1 weekend in August with flows of 1,500 cfs; and 1 weekend in September with flows of 1,200 cfs. This schedule would be maintained for 3 years, with monitoring of environmental parameters and boater use. At the end of 3 years, the program would be re-evaluated.

Prior to completion of the PRCT agreement, AWA, Shasta Paddlers, and Chico Paddleheads had recommended PG&E schedule flow releases on 1 weekend in June and on two weekends in July, August and September each year to provide whitewater recreational opportunities. Flows would be about 900 cfs in the Pit 3 reach during the June release. In the Pit 4 and 5 reaches, flows would be 1,800 cfs in June, 1,700 cfs in July, 1,500 cfs in August, and 1,250 cfs in September. In their June 18, 2003, letter commenting on the draft EIS, these entities modified their original recommendation to eliminate recreational boating releases to the Pit 3 reach, but retained their originally recommended release to the Pit 4 and Pit 5 reaches. AWA is a signatory to the PRCT agreement (although Shasta Paddlers and Chico Paddleheads are not) suggesting that AWA concurs with the PRCT agreement and no longer recommends recreational boating releases to the Pit 3 and Pit 4 bypassed reaches. However, since Shasta Paddlers and Chico Paddleheads did not sign the PRCT agreement, we still consider their recommended flow releases to the Pit 4 and Pit 5 reaches to be operative.

Our Analysis

The effects of whitewater flow releases on foothill yellow-legged frogs and western pond turtles would depend on the volume, timing, frequency and duration of flows. Releases during times of the year when base flows are typically low (June through September) could directly affect these species through scouring, reductions in the forage base, or reductions in water temperature.

High-volume flows in June or early July could dislodge foothill yellow-legged frog egg-masses in years when egg-laying is initiated late in the spring. Surveys of the Pit 4 reach in 2003 documented the presence of tadpoles at various stages of development as early as June and as late as September (Spring Rivers, 2003e). High flows during this period could sweep tadpoles from backwaters and side channels, causing stranding, dessication, and exposure to predators. The PRCT rationale statement indicates that scheduled recreational releases to the Pit 4 bypassed reach "might adversely impact the population of foothill yellow-legged frog located in the Pit 4 reach" and therefore restricted its recreational release measure to the Pit 5 reach.

Results of the 2002 controlled flow studies indicate that high flows events during the summer effectively reduce the standing crop of algae. Reductions in the amount of algae or aquatic macrophytes in the Pit 4 reach could affect the forage base for foothill yellow-legged frog tadpoles, which feed on algae they scrape from plants and rocks (Jennings and Hayes, 1994). Large-volume flows would also be likely to affect foothill yellow-legged frogs through their effects on temperature. Colder and more variable temperatures at intervals during the summer could delay tadpole development and reduce survival. We anticipate that adult frogs would be affected to a much lesser degree, because they are more mobile, and because terrestrial invertebrates (e.g., flies, moths, beetles, grasshoppers) appear to make up more of their diet than aquatic invertebrates (Nussbaum et al., 1983).

For these reasons, we conclude that implementation of scheduled recreation flows would have a high likelihood of adversely affecting the foothill yellow-legged frog in the Pit 4 reach. The risk of releasing recreation flows in the Pit 5 reach is lower, since foothill yellow-legged frog populations appear to be centered in the Pit 4 reach under current conditions. However, species presence was documented in the Pit 5 reach in 1999 (Spring Rivers, 2003d), and habitat conditions may improve over time as a result of implementing the streamflow regime outlined in the PRCT agreement. We, therefore, concur with the PRCT agreement and the FS 10(a) recommendation that would require baseline data collection under the flow regime specified in any new license that may be issued for this project. Such data would enable effective evaluation of possible ecological effects (including foothill yellow-legged frog) of potential recreational releases on the Pit 5 bypassed reach ecosystem. The collection of these baseline data would enable the stakeholders and the Commission to make informed decisions about whether or not to implement recreational flow releases and avoid any adverse effects that these flows may have on amphibians.

Implementation of whitewater flow releases during the summer would likely affect the western pond turtle, since both hatchlings and adults rely on aquatic insect larvae, crustaceans, and annelids that could be flushed out of the system during high summer flows. Turtles also may rely on plant and animal detritus that is abundant in filamentous algae, to supplement their diet when other prey is scarce (Bury, 1986).

The growth rate of the western pond turtle is regulated, in part, by temperature, and this species could also be affected by intervals of cold temperatures resulting from whitewater flow releases during the summer. Hatchlings, in particular, use areas with slow, shallow, warm water. Although pond turtles spend a considerable portion of their time on land, they show a high degree of fidelity to aquatic sites, and appear unable to eat except in water (Ashton et al., 1997).

We conclude that the provision of high-volume recreation flows during the summer in any of the project reaches would have the potential to adversely affect the western pond turtle, because species occurrence has been documented in each of the project reaches. Restricting the recreation flows to 2 days in August and 2 days in September and implementing the releases only in the Pit 5 reach, as described in the PRCT agreement, would likely have less impact than AWA, Shasta Paddlers, and Chico Paddlehead's original proposal to release flows in June, July, August, and September in all three of the bypassed reaches.

Project Effects on Special-Status Birds and Mammals

Existing project facilities and on-going project operations have the potential to affect some special status birds and mammals. Proposed changes (such as construction of new recreational facilities, increases in minimum flows, vegetation management measures, and development of a whitewater boating program) could also affect special status birds and mammals. In its revised BE (filed with the Commission by letter dated November 20, 2003), the FS determined that implementation of the PRCT agreement and the FS final 4(e) conditions could adversely affect individual peregrine falcons, willow flycatchers, northern goshawks, Pacific fishers, wolverines, pallid bats, Townsend's big-eared bats, and western red bats and their habitat. However, the FS concluded that the project would not contribute to a trend toward federal listing, or a loss of viability to populations or species.

The FS concluded in its May 19, 2003, letter to the Commission that relicensing the project as proposed would maintain habitat at current levels or close to current levels for all selected wildlife MIS. These include mallard, osprey, pileated woodpecker, hairy woodpecker, deer, black bear, and gray squirrel.

The FS final 4(e) condition No. 23.f would require PG&E to develop a Terrestrial Wildlife Mitigation and Monitoring Plan. The plan would require PG&E to conduct surveys of bank swallow colonies at 5-year intervals; annually monitor peregrine falcon nest territories until the TRG determines that monitoring is no longer necessary; periodic monitoring of project facilities to see if they are used by Townsend's big-eared bats or other special-status bats; construct a gate to protect bats using the tunnel below the Pit 4 reservoir; and continue boating speed restrictions in upper Lake Britton. The FS would also require PG&E to limit operating periods around active peregrine falcon and northern goshawk nest sites from February 1 through August 15, or until the young have fledged.

Interior recommends PG&E consult with the agencies and the Tribe to develop a Wildlife Resource Management Plan. The plan would include descriptions of baseline conditions, identify protection measures, and provide for wildlife surveys to be conducted every 5 years to evaluate the status and trends of occurrence, distribution and populations through the new license period. In addition to this general recommendation, Interior also recommends PG&E annually monitor known peregrine falcon eyries and suitable nesting habitat in the project area.

Our Analysis

We agree that implementation of the FS recommendations for special-status species that may occur in the project area and that could be affected by the project is necessary for species protection. We also agree with the FS conclusions that relicensing the project as proposed would not adversely affect MIS that do not have special status; the project area would continue to provide habitat for mallard, osprey, deer, black bear, pileated woodpecker, hairy woodpecker, and gray squirrel.

We do not concur with Interior's recommendation for development of a wildlife management plan, as written. Hundreds of wildlife species may occur in the project area, but other than recommending special emphasis on special status species, Interior does not identify which populations it believes PG&E should monitor or explain why monitoring is needed. Our analysis of the need for PG&E to provide mitigation and monitoring for wildlife specified by the resource agencies follows.

Protection of special-status species—Although the Commission's standard license re-opener should provide adequate protection for federally listed species through any new license term, we conclude that it would be appropriate for PG&E to develop a mechanism for consultation with the FS to address potential effects on FS sensitive species, consistent with the FS final 4(e) conditions.

Bank swallow—We concur with the FS recommendation that PG&E monitor bank swallow colonies at 5-year intervals through the new license period. PG&E's geomorphology studies suggest that the amount of steep cliff area with relatively soft, friable soils that provide potential nesting habitat for bank swallows is about the same under current conditions as it was prior to filling of Lake Britton, but reservoir fluctuations at Lake Britton may affect the stability of banks where swallow colonies are located. Erosion may cause the loss of existing habitat while at the same time creating new habitat. Regular monitoring of existing bank swallow colonies would provide a basis to evaluate the potential effects of changes in reservoir operation on bank swallows.

Peregrine falcon—We agree that PG&E should monitor peregrine falcon nesting territories in the project area, because some project-related facilities (e.g., the warning siren near Pit No. 4 powerhouse, maintenance activities at Pit No. 4 powerhouse, road improvements, trail construction in the vicinity) have the potential to disturb peregrines during the breeding season. Noise and human activity may cause a variety of adverse effects on raptors, including failure to breed, trampling of eggs or young in the nest, and temporary or permanent nest abandonment (Richardson and Miller, 1997). Temporary abandonment may cause overheating or cooling of eggs, premature fledging of the hatchlings, and increased exposure to predators. The responses of individual pairs of birds may be quite variable, however, and some pairs appear to be quite tolerant or to become de-sensitized to human activity over time (Richardson and Miller, 1997).

In our view, PG&E could contribute to region-wide assessment of peregrine recovery by taking a monitoring approach consistent with the strategy FWS has outlined in its Monitoring Plan for the American Peregrine Falcon (FWS, 2003). The plan calls for two visits to known nesting territories during each survey year to determine occupancy and nest success. Surveys are to be conducted at 3-year intervals for a total of 5 surveys over 15 years.

Neotropical migrants—Changes in the flow regime could affect habitat quantity and quality for neotropical migrant bird species that are closely linked with riparian habitat, including yellow warbler, and willow flycatcher. We anticipate that implementation of the flows outlined in the PRCT agreement would reduce the cover of willow shrub along the existing riverbanks, but this vegetation would quickly re-establish at slightly higher elevations along the new shoreline, and there would be no substantial loss over the long-term. The one documented willow flycatcher nest site located upstream of Lake Britton would not be affected by changes in the instream flow regime.

Northern goshawk—Several project-related activities could affect special-status species that are associated with forest interior habitats, such as the northern goshawk. Construction activity could cause short-term noise disturbance, while development of new campgrounds and trails in areas that are currently inaccessible could cause long-term disturbance and reduce habitat quality for this species. Vegetation management activities, including prescribed fire treatment or understory removal, could also affect the northern goshawk.

Pacific fisher and California wolverine—If present, the effects of project-related recreational facilities and vegetation management on Pacific fisher and wolverine would be similar to those described above for the northern goshawk. However, no Pacific fishers were observed during three years of field surveys in the Chalk Mountain LSR (FS, 1996), and the nearest known occurrences are from the vicinity of Mt. Shasta, approximately 50 miles from the project area. No wolverines were detected during 4 years of survey in California (Zielinski et al., 2000). For these reasons, we make no specific recommendations regarding protection or management for Pacific fisher or wolverine at this time.

Bats—Changes in the flow regime could affect habitat quantity and quality for the western red bat, a species that forages and roosts in riparian habitats. Torrent sedge and willow/alder shrub cover types likely provide an abundance of prey species. Since sedge and shrub cover types would be expected to quickly (i.e., within 5 to 10 years) re-establish along the new shoreline under any flow scenario that may be implemented, loss of foraging habitat would be temporary. We do not anticipate adverse impacts on roosting habitat, due to the young age of trees that would be affected by higher flows. In Merced County, western red bats were sometimes observed emerging from riparian shrub in the evening, but were most often observed roosting in mature cottonwood/sycamore forest, where they hang under large leaves in the canopy (Pierson and Raney, 2002 in Vollmar, 2002).

We concur with the FS final 4(e) condition No. 23.f to install a gate at the Pit 4 tunnel that would continue to allow access by bats, but prevent access by humans. Installation would require little alteration of oak conifer forest and no alteration of rock outcrops/cliffs that provide suitable, naturally-occurring habitat. We also support implementation of measures identified in the report on PG&E's bat surveys in 2000 as being needed to reduce the risk of conflict between humans and bats, which could cause injury or mortality to bats and represent a human health issue from bat droppings (Pierson et al., 2001). The bat surveys indicated that two special status bat species (Yuma myotis and long-legged myotis) use an upper story enclosed room at the Pit 5 dam, gaining access to the area via an open staircase. Yuma myotis also access the control room at the Pit 5 gaging station intake via slots in a wooden cabinet. Periodic monitoring of any structures that are installed to minimize bat/human interactions would ensure that the structures are operating as planned (i.e., they have not been vandalized). Periodic monitoring of project facilities that are not already protected by structures, for special status bats, would help identify whether protective measures are needed should new bat colonies be found in project facilities. Although the FS final 4(e) condition No. 23.f specifies periodic monitoring of project facilities to determine whether Townsend's bats are using them, we conclude that concerns about potential project impacts would be adequately addressed by a condition for consultation on special-status species, coupled with other project-related monitoring.

Project Effects on Survey and Manage Terrestrial Molluscs

As mentioned in the affected environment section, SM terrestrial molluscs were most often observed near springs, seeps, and along perennial tributary channels. These species were less often observed along the margins of the Pit River, and few were noted around the margins of Lake Britton.

Threats to SM terrestrial molluscs center around the loss of favorable microclimates when riparian vegetation is removed, either as a result of intentional clearing or flood scour; disruption of occupied sites by vehicles or equipment; and invasion by non-native plants and animals (Applegarth, 1999). Fire, herbicide use, recreational development, road-building and maintenance are also identified as threats (Weasma, 1999; Weasma, undated).

The FS, as part of its final 4(e) condition No. 23.f, specifies that PG&E should implement measures to protect known sites of survey and manage molluscs (which would include both aquatic and terrestrial species). In addition, the FS states that PG&E should conduct pre-construction surveys for FS special status species (including terrestrial molluscs) using approved protocols. The results of the surveys would help define appropriate protective measures.

Our Analysis

SM terrestrial molluscs require a cool, moist microclimate. Management recommendations for these species generally rely on maintaining riparian forest and shrub canopy, retaining large woody debris and herbaceous vegetation, protection of the stream, seep or spring hydrology that supports the microclimate, and protection from wildfire.

We agree that ground-disturbing actions proposed for implementation on NFS lands where SM terrestrial molluscs may occur could adversely affect these species. We concur with the FS' recommendation that PG&E consult with the FS to conduct surveys where needed on NFS lands for ground-disturbing actions that are part of the new license. We also conclude that maintaining a project GIS database would allow for tracking of the status of occupied sites.

Higher minimum flows recommended under the PRCT agreement could affect up to 50 acres of riparian vegetation and inundate occupied sites, depending on their proximity to the margin of the Pit River, but most SM terrestrial molluscs were observed at higher elevation springs and seeps and upper reaches of tributaries that would not be affected by any changes proposed at this time. Over the long-term, new habitat would be expected to develop along the new ordinary high water mark in low-gradient segments, and higher flows could benefit SM terrestrial molluscs through effects on surface water/groundwater interactions that would increase the area of moist substrate. We conclude that adverse effects of any of the proposed changes in the flow regime on SM terrestrial molluscs would be minor and temporary.

Freshet flows in the winter or spring would be similar to events that occur under existing conditions and would not be likely to adversely affect SM terrestrial molluscs. Unseasonal, high-volume flow releases for whitewater boating at intervals in June, July, August or September would not be likely to adversely affect SM terrestrial molluscs if ramping rates are restricted as proposed in the PRCT agreement.

Project Decommissioning

Project decommissioning would affect riparian habitat throughout the project area, from Lake Britton to the Pit 5 powerhouse. Riparian vegetation would likely re-establish along the banks of the new river channel in the reservoir reaches, while most of the area exposed by drawdown of each of the project reservoirs would be colonized by a mix of upland vegetation series, similar to those that are currently present. Assuming an average riparian corridor width of 100 feet along the 8-mile length of Lake Britton, the 1.9-mile length of the Pit 4 reservoir, and the 1.5-mile Pit 5 reservoir, we estimate that decommissioning would add about 138 acres of riparian vegetation and about 1,200 acres of upland vegetation to the land base, as well as about 70 acres of riverine habitat in the areas now occupied by reservoirs.

The benefits that new riparian and upland areas might have as wildlife habitat would depend to a great extent on how they were restored and managed. If managed primarily for wildlife, the reservoirs could provide habitat for a variety of small mammals and songbirds, hunting opportunities for raptors, and high-quality winter range for deer.

The loss of a total of about 1,451 reservoir acres would reduce the area of resting habitat for migrant waterfowl. The loss of open water habitat would also reduce foraging opportunities for osprey, bald eagle, and other piscivorous birds, and for several species of bats. Nesting habitat for waterfowl, which is very limited under current conditions, would also be reduced with the conversion of the Pit 4, Pit 5 and Tunnel reservoirs to riverine or upland environments.

In the Pit 3, 4, and 5 riverine reaches, a return to unimpaired flows would increase the average annual flow and the magnitude and frequency of floods. Adverse impacts would be likely to occur within the first 5 to 10 years following project decommissioning, as a result of erosion, bank failure, development of debris jams and gravel bars, scour, deposition, and changes in side channel connections. However, riparian systems are characteristically resilient, and over time, riparian plant and wildlife communities along the Pit River would likely equilibrate to changes in seasonal flows and changes caused by those flows.

3.3.3.3 Unavoidable adverse effects: None.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected environment: FWS and Interior identified four federally listed species of wildlife that could occur in the project area (letter from D.A. Pierce, Acting Field Supervisor, FWS, Sacramento, CA, to the Commission, dated December 18, 2001; letter from Interior to the Commission, dated October 9, 2002). The VELB (*Desmocerus* *californicus dimorphus*), bald eagle (*Haliaeetus leucocephalus*), and northern spotted owl (*Strix occidentalis caurina*) are listed as threatened, while the Shasta crayfish (*Pacifastacus fortis*) is listed as endangered. Our draft EIS served as our biological assessment for these federally listed species for the purposes of consultation under Section 7 of the ESA.

In addition to species identified by FWS, PG&E's review of applicable databases and our review of an updated (as of September 16, 2002) endangered and threatened species listing for Shasta County (submitted by Interior to the Commission by letter dated October 9, 2002) indicate that the threatened slender Orcutt grass (*Orcuttia tenuis*), the endangered Greene's tuctoria (*Tuctoria greenei*), the threatened California red-legged frog (*Rana aurora draytoni*), the endangered vernal pool tadpole shrimp (*Lepidurus packardi*), and the endangered vernal pool fairy shrimp (*Branchinecta lynchi*) could also occur in the project area. We reviewed the known ranges and habitat requirements of these species and conclude that relicensing of the Pit 3, 4, 5 Project would not affect these species. The project area provides no habitat for slender Orcutt grass, Greene's tuctoria, vernal pool tadpole shrimp, or vernal pool fairy shrimp, all of which occur only in vernal pools (67 FR 59,884–59,932; 62 FR 14,338–14,352; 59 FR 48,136–48,153). The project area is outside the historical ranges of the California red-legged frog, and there are no current records of their presence anywhere in Shasta County (FWS, 2002).

Valley Elderberry Longhorn Beetle

The VELB was listed as a threatened species in 1980 (45 FR 52,803). The beetle relies entirely on its host plant, the elderberry (*Sambucus* species). Elderberry shrubs are a common component of riparian forests in the Central Valley, and optimal habitat is usually considered to be moist valley oak woodlands or hardwood stands with a large component of species, such as cottonwood, sycamore, Oregon ash, or willow. PG&E's search of the California Natural Diversity Database indicated that to date, all recent occurrences of VELB in Shasta County have been from riparian habitat below 500 feet in elevation (PG&E, Response to AIR No. 7, filed with the Commission on August 9, 2002). However, suitable habitat may also be found in uplands of the Sierra Nevada and Cascades ranges, up to 3,000 feet in elevation.

VELB is a wood-boring insect and lays its eggs in the stems of elderberry shrubs that are at least 1 inch in diameter at ground level. Frequently, there is no sign of VELB occurrence except for the exit holes that the larvae create as they emerge just prior to the pupal stage. For this reason, surveys for VELB focus on searching for elderberry shrubs.

Surveyors did not observe any elderberry shrubs during PG&E's riparian habitat mapping study or botanical resource studies. In response to our April 9, 2002, AIR, PG&E

conducted specific surveys for elderberry shrubs in May and June of 2002, focusing on areas that existing or proposed project facilities or operations could affect. During this field effort, surveyors found 26 elderberry shrubs at four sites in disturbed areas along project roadways or near project facilities (PG&E, 2002). Three of the observations were in ponderosa pine forest. The fourth site, described as grazed floodplain along Highway 299 a few hundred feet from the bridge over the Pit River, contained 4 plants with 32 stems larger than 1 inch in diameter at ground height. Surveyors observed nine exit holes in one dead stem at this site.

Bald Eagle

In 1999, FWS proposed to remove the bald eagle from the list of threatened and endangered species, due to the success of recovery efforts throughout the United States (64 FR 36,453–36,464). Overall recovery goals for the bald eagle in the Pacific Region (which includes California) were met in 1990 and have been reached or exceeded in every year since. Goals for nest productivity and wintering population stability in the region have also been met or exceeded. Although the recovery goal of 800 breeding pairs has not yet been reached in California, the number of breeding pairs has increased dramatically. About 30 pairs were documented in 1977, while surveys in 1999 indicated the number had increased to over 150 (CDFG, 2002a). In addition to increasing in numbers, bald eagles are recolonizing their range in California. In 1977, bald eagles were known to nest in eight of the 58 counties in the state, and as of 1999, bald eagle nests were documented in 28 counties.

The Pit River system is one of the most important bald eagle nesting areas in California. There are currently 10 active nest territories in the Pit 3, 4, 5 Project area, plus an 11th territory in the vicinity of the Pit 6 development (table 37). Between 1993 and 2002, PG&E's reports show the number of young per occupied territory has averaged 1.22, and the occupied territories that were successful each year has averaged about 71 percent (PG&E, 2001; PG&E, 2003b).

The bald eagle populations in California comprise both resident and migrant birds. Resident bald eagles typically remain in the vicinity of their nesting areas year-round, except under severe winter conditions. This appears to be the case in the project area, where the number of adult bald eagles remains fairly stable year-round. The number of non-breeding eagles (including immature, subadult and near-adult birds) increases slightly from December through February (PG&E, 1993).

Table 37. Reproduction in 11 Bald Eagle Nesting Territories in the Pit 3, 4, 5 Project Vicinity, 1993-2002. (Source: PG&E, 2001; PG&E, 2003)

	Number of Young Fledged										
Nesting Territory Location	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**1993-2002**
Dry Lakes	2	2	ONS[a]	ONS	ONS	2	2	2	ONS	2	12
Two Knobs	ONS	ONS	1	1	ONS	2	2	2	1	1	10
Dusty	3	3	3	3	2	3	2	3	3	ONS	25
South Shore	1	2	1	2	2	2	ONS	3	1	2	16
Cayton Creek	2	2	2	2	1	ONS	ONS	2	2	2	15
North Shore	ONS	2	1	2	1	ONS	2	2	2	1	13
Camp Britton								ONS	ONS	2	2
Pit 3 Powerhouse	1	1	2	1	1	1	2	1	2	ONS	12
Pit Rim	1	2	1	ONS	ONS	ONS	ONS	ONS	1	1	6
Hagen Flat	ONS	2	1	1	1	1	ONS	1	1	2	10
Pit 6	ONS	1	ONS	ONS	ONS	ONS	ONS	NO[b]	NO	NO	1
Occupied territories	10	10	10	10	10	10	10	10	10	10	100
Total young produced	10	17	12	12	8	11	10	16	13	13	122
Young per occupied territory	1.00	1.70	1.2	1.2	0.8	1.1	1.0	1.6	1.3	1.3	1.22
Successful territories	6	9	8	7	6	6	5	8	8	8	71
% of occupied territories successful	60	90	80	70	60	60	50	80	80	80	71

[a] ONS: occupied, not successful
[b] NO: not occupied

In California, bald eagles forage primarily on fish (Jackman et al., 1999). Studies in the project area showed that at Lake Britton, bald eagles preyed mainly on seven taxa of fish: Sacramento sucker, hardhead, Sacramento pikeminnow, tui chub, ictalurids (e.g., catfish, bullheads), and crappie (table 38). Sacramento sucker accounted for 69 percent of the prey biomass for eagles in upper Lake Britton, while at the lower end of the lake, sucker made up 39 percent of the prey biomass. Hardhead accounted for 7 percent of the prey biomass of eagles foraging in upper Lake Britton, and provided 14 percent of the prey biomass in lower Lake Britton.

Sacramento sucker was also the most important prey item in the river reaches. Hardhead were also taken, accounting for about 17 percent of the prey biomass, but no other fish taxa appeared to be as important as these two, as part of the forage base (BioSystems Analysis, Inc. and University of California, Davis, 1985).

The results of the foraging studies indicated that bald eagles foraging in the riverine reaches of the study area were most successful at locations where shallow pools without surface turbulence enabled them to see and capture prey (BioSystems Analysis, Inc. and University of California, Davis, 1985). The studies also pointed out the importance of suitable tree and boulder perches adjacent to these pools.

Table 38. Estimated percent of biomass of bald eagle prey identified from remains at six nests on Lake Britton, 1983-1991. (PG&E, 1993, modified by staff)

Species	**Percentage of Biomass of Fish Species Collected in Prey Remains at Lake Britton Bald Eagle Territories**		
	Total Lake Britton Territories (N = 6)	Upper Lake Britton Territories (N = 3)	Lower Lake Britton Territories (N = 3)
Sacramento sucker	59.5	69.2	38.8
Hardhead	9.5	7.2	14.4
Bullhead species	4.7	5.0	2.0
Tui chub	4.1	2.6	7.3
Sacramento pikeminnow	3.4	1.9	6.7
Carp	2.9	2.7	3.4
Cyprinids	1.8	0.8	3.9

Species	**Percentage of Biomass of Fish Species Collected in Prey Remains at Lake Britton Bald Eagle Territories**		
	Total Lake Britton Territories (N = 6)	Upper Lake Britton Territories (N = 3)	Lower Lake Britton Territories (N = 3)
Crappie species	1.0	0.3	2.5
Channel catfish	0.7	1.0	---
Unknown fish	0.4	0.4	0.3
Salmonids	0.3	0.2	0.5
Largemouth bass	0.2	0.1	0.4
Rainbow trout	0.1	---	0.3
Tule perch	0.1	---	0.2
Centrarchids	0.1	0.1	---
Micropterus spp.	0.1	---	0.2
Ictalurids	0.1	---	0.2

PG&E identified 21 bird species in eagle prey remains during the winter and early spring. Coots and mallards accounted for most of the biomass. The results of the prey studies indicated that waterfowl may supply from 25 to 33 percent of the yearly energy requirement of eagles foraging in the Lake Britton area, with most waterfowl being taken during the winter (BioSystems Analysis, Inc. and University of California, Davis, 1985). Results of more recent monitoring studies showed that waterfowl were relatively infrequent in prey samples during the bald eagle breeding season, but their importance varied geographically. Waterfowl accounted for about 6 percent of prey biomass at three upper lake nests, almost 13 percent at three lower lake nest sites, and almost 23 percent at nests near Pit 4 and Pit 5 reservoirs (PG&E, 1993).

The importance of mammalian prey also appears to vary by season; most mammalian prey remains were observed during the winter (PG&E, 1993). The mammals most often observed in prey remains were squirrels, muskrats, and lagomorphs (e.g., rabbits and hares). Biologists noted a very slight geographical difference; mammals accounted for about 5 percent of the biomass of prey remains at bald eagle nests on Lake Britton and about 7 percent at nests near the downstream reservoirs.

Northern Spotted Owl

The FS considers the Pit River to be the geographic line separating the California spotted owl (*Strix occidentalis occidentalis*) from the northern spotted owl (*S. o. caurina*). The FWS considers the dividing line to be Highway 299. Because there is very little difference in the general contact zone, PG&E considered all spotted owls in the Pit River Canyon of the project area to be northern spotted owls. The California spotted owl is a federal species of concern, an FS sensitive species, and species of concern in California. The northern spotted owl was listed as a threatened species throughout its range in 1990 (55 FR 26114–26194). A 1999 analysis of demographic studies indicated that a rangewide population decline of almost 4 percent per year occurred between 1985 and 1998 (65 FR 5,298–5,300). As of 2000, territorial pairs of spotted owls were detected in about 43 percent of the surveyed territories in the south Cascades demographic area (Lint, 2001). Nesting occurred in 82 percent of the occupied territories, and 62 young were fledged.

The northern spotted owl is strongly associated with old-growth or mature conifer forest. However, stand structure may be more important than stand age for nesting owls, and younger stands with old-growth characteristics also support nesting. Habitat for roosting, foraging, and dispersal of adults and juveniles to colonize new territories often consists of younger, denser stands. In the project area, suitable habitat for spotted owls is located primarily on the south side of the Pit River in the lower Pit 3 reach and along the Pit 4 reach (FS, 1996).

In the Pit 3 and Pit 4 reaches, the Pit River passes through the 36,560-acre Chalk Mountain LSR. The Shasta National Forest and Lassen National Forest share management of the LSR to protect and enhance habitat for species that depend on mature and old-growth forests, including the northern spotted owl (FS, 1996). As of 1996, the LSR contained five spotted owl protected activity centers (PACs). The boundaries of two PACs overlap the project boundaries in the Pit 3 and Pit 4 reaches. These PACs are located near the Pit 4 dam and in the Canyon Creek watershed. We define LSRs in section 3.3.6, *Land Use and Aesthetic Resources*.

PG&E used the FS protocols to conduct surveys for northern spotted owls in the project area in 1999 and 2000. Surveyors received responses from one owl on the south side of the Pit 4 reach near Bee Knoll, about 0.5 mile south of the Pit 4 powerhouse, in June 1999, but did not observe any owls or nests during a daylight follow-up survey.

Shasta Crayfish

The state of California listed the Shasta crayfish as an endangered species in 1988, and the Shasta crayfish was federally listed as an endangered species on September 30,

1988. The FWS published a *Recovery Plan for the Shasta Crayfish* on August 8, 1998. This species is known to occur in springs and tributaries upstream of Lake Britton including Sucker Springs Creek, the Pit River near Pit River Falls, Hat Creek, and Fall River. The Shasta crayfish is most common in cool, clear, spring-fed headwaters that are characterized by clean volcanic cobbles and boulders on top of gravel or sand (FWS, 1998).

Although the Pit 3, 4, 5 Project is outside the known range of the Shasta crayfish, there appears to be the potential for Shasta crayfish habitat in the Pit 3 reach due to its occurrence upstream of Lake Britton and the predominance of springs and lava substrate in the area. PG&E conducted specific surveys for Shasta crayfish, using snorkel techniques to survey a 2-kilometer length of stream both in the upper and lower segments of each of the three bypassed reaches. No Shasta crayfish were found, but signal crayfish were reported to be very abundant in all of the reaches. The signal crayfish is an invasive species that is a known competitor and predator of Shasta crayfish, and is considered the single largest threat to the continued existence of Shasta crayfish (FWS, 1998). The lack of documented occurrences of Shasta crayfish combined with the high abundance of signal crayfish lead us to conclude that is unlikely that any self-sustaining populations of Shasta crayfish occur within the project boundary.

3.3.4.2 Environmental effects:

Valley Elderberry Longhorn Beetle

PG&E originally proposed no specific measures for the protection of the VELB. In its June 19, 2003, response to our draft EIS, PG&E stated that it would accept our recommendation to develop and implement a protection plan for VELB and its habitat, including pre-construction site surveys where needed and training and education of maintenance crews. The FS addressed the VELB as part of its preliminary and revised 4(e) conditions, indicating that protection of elderberries that could represent potential habitat should be considered in the development of a vegetation management plan and that VELB be included in a protection of threatened, endangered, proposed for listing, and sensitive species plan (filed with the Commission by letters dated October 9, 2002, and May 19, 2003, respectively), but did not directly address the VELB in its final 4(e) conditions filed with the Commission by letter dated November 14, 2003.

Interior makes no specific management recommendations for the VELB in its October 9, 2002, letter to the Commission, but indicates that additional surveys might be required if ground-disturbing activities are proposed in potentially suitable habitat. The FWS, in its biological opinion filed with the Commission by letter dated October 15, 2003, pursuant to Section 7 of the ESA, states that all protective measures for the VELB described in our draft EIS should be fully implemented and enforced.

Our Analysis

PG&E biologists documented the occurrence of 26 elderberry shrubs during surveys of project lands below 3,000 feet where management activities could affect potential habitat for the VELB (PG&E, 2001; PG&E, 2002b). Only one of the four sites where these plants were observed was located in riparian or floodplain habitat, the environmental settings that most frequently support the VELB. At this site, near the Highway 299 bridge at the upper end of Lake Britton, surveyors observed nine holes in one dead stem that could indicate the presence, at one time, of the beetle.

We conclude that habitat for the VELB in the project area is extremely limited, and occurrences of this species are unlikely. However, we concur with the FS and Interior that evaluation of future actions by PG&E, including maintenance, construction, or other ground-disturbing activities, for their potential to affect elderberry shrubs at sites within the project area that may not have been previously surveyed (i.e., sites where agency preliminary terms and recommendations have identified that recreation facilities should be constructed) should occur and would be protective of the VELB. Examples of activities that could affect elderberry shrubs include: mowing, brushing, herbicide application, culvert replacement, and other road repairs; ground-clearing needed to improve or expand recreation sites; and thinning or burning for fuels management. FWS's *Guidelines for the Conservation of the Valley Elderberry Longhorn Beetle* (FWS, 1999) specify that complete avoidance is required to assume no adverse effects will occur. Complete avoidance is defined as protection of a 100-foot buffer (or wider) around elderberry plants containing stems measuring 1.0 inch or more in diameter at ground level. In addition to conducting pre-construction surveys, providing training and education for maintenance crews, so that incidental observations of potential habitat for the VELB can be reported and appropriate actions can be taken, would provide additional protection to the VELB. We conclude that development of a VELB protection plan, in consultation with FWS, which could be included as a component of a vegetation management plan, would ensure that protective measures are clearly defined and would be consistent with condition 2.F of the biological opinion.

Bald Eagle

Fish are the dietary mainstay of bald eagles nesting near the shoreline of Lake Britton and along the bypassed reaches (PG&E, 1993). Because of their strong reliance on fish, proposed changes in reservoir operation or the flow regime (including implementation of higher minimum flows, freshet flows, more restrictive ramping rates, improved control of out-of-season spills, and recreation releases) that affect fish populations or foraging conditions would have the potential to affect bald eagles. Bald eagles could also be affected by proposed construction projects or increases in recreational activities, because they are sensitive to disturbance.

To protect bald eagles, PG&E proposed to consult with the FS, FWS, and CDFG to revise the 1986 IBEMP currently in place (CDFG et al., 1986). PG&E proposed no other specific measures for bald eagle management, but indicated that one of the purposes of the proposed flow regime is to maintain or improve eagle foraging habitat. PG&E would continue to conduct annual surveys to monitor breeding, productivity, and wintering populations as part of a cooperative effort with CDFG. In its June 19, 2003, letter responding to our recommendations in the draft EIS, PG&E agreed to update the current BCMP to be consistent with any new monitoring requirements that may be specified in the updated IBEMP. PG&E noted that the updated BCMP should include provisions to allow discontinuing monitoring studies that have provided enough information to provide reasonable assurance that project effects could be determined. PG&E's proposal is consistent with the FS final 4(e) conditions.

The FS final 4(e) condition No. 23.e would require that the revised IBEMP include periodic monitoring of human use patterns to evaluate the potential for conflicts; annual monitoring of bald eagle reproduction; coordination of timber harvest or mining in the Lake Britton area or along the Pit 3, 4, and 5 reaches with other agencies; and coordination of wood-cutting activities on PG&E land. The FS would require PG&E to continue to implement boating speed restrictions on upper Lake Britton to minimize disturbances to nearby bald eagle nest sites.

Interior recommends PG&E consult with the agencies to update the IBEMP to reflect changes in nesting sites, new information about recreational use and levels, and to more adequately address management issues. Interior identifies concerns about the threshold of human disturbance that eagles can tolerate; the abundance and distribution of prey species; and the potential introduction of non-indigenous aquatic species that could adversely affect native fish species.

The biological opinion filed by FWS with the Commission on October 15, 2003, finds that relicensing the project is not likely to jeopardize the continued existence of the bald eagle, but concludes that proposed project activities may cause the incidental injury or death of one bald eagle at some time during the new license period, as a result of disturbance while foraging or perching in the area. The biological opinion states that PG&E shall begin revising the IBEMP within 6 months of license issuance, complete the plan within 2 years of license issuance, and update the plan at 5-year intervals. The biological opinion would also require PG&E to implement a water quality monitoring plan (discussed in more detail in section 3.3.1.2, *Water Resources*); file a fire management and response plan, including measures for fuel treatments, prevention, and emergency response procedures as they pertain to the bald eagle (discussed in more detail in section 3.3.6.2, *Land Use and Aesthetic Resources)*; provide for consultation with the FWS should future Commission actions have the potential to affect listed species; require buyers of any lands sold by PG&E in the project area to abide by the same terms and conditions as the licensee; and report compliance on a quarterly or annual basis.

The biological opinion also contains two conservation recommendations. These state that PG&E should assist FWS in recovery efforts for the bald eagle and preserve habitat by ensuring that any project lands divested by PG&E revert to public ownership.

CDFG also recommends PG&E update the IBEMP, incorporating data that have been collected over the past 16 years.

Our Analysis

Reservoir operations: Under current project operations, reservoir levels in Lake Britton fluctuate on a daily and weekly basis. Fluctuations that occur in the spring may adversely affect the populations of fish that spawn in the reservoir's littoral zones. As discussed in section 3.3.2.2 (*Aquatic Resources*), the PRCT agreement would reduce fluctuations and could improve recruitment of species such as largemouth bass, black crappie, white crappie, bluegill, and green sunfish. However, implementation of seasonal restrictions on fluctuation would not be likely to affect bald eagles, since the BEFS indicated that the fish species that would benefit from the measure are not among those that contribute substantially to the bald eagle diet. Compilation of prey data from 1983 to 1991 showed that largemouth bass and other centrarchids accounted for less than 1 percent of the prey biomass of all pairs of bald eagles at Lake Britton (PG&E, 1993). By contrast, Sacramento sucker dominated the diets of all pairs and accounted for almost 60 percent of the prey biomass.

It is important to point out that the data collected in the Pit River project area showed no significant correlation between the abundance of various fish species that were captured during the electrofishing surveys and the abundance of these fish species in prey remains found at bald eagle nests (PG&E, 1993). For this reason, the changes in abundance of largemouth bass and other centrarchids in Lake Britton that have occurred since 1983 (as noted in PG&E's BCMP 2002 Annual Report) would not necessarily indicate any change in the level of exploitation of these species by bald eagles.

Minimum streamflows: PG&E's 1985 BEFS (Biosystems Analysis, Inc. and University of California, Davis, 1985) suggested a close correlation between flows in the Pit River below Lake Britton and the ability of eagles to see and capture prey at preferred foraging sites. The study indicated that flows of 150 cfs in the Pit 4 reach and 100 cfs in the Pit 5 reach provided satisfactory bald eagle foraging habitat. The results also showed that increasing flows from 150 to 300 cfs in the Pit 4 reach could reduce the amount of preferred foraging habitat by more than 50 percent, and that increasing flows in the Pit 5 reach from 100 to 150 cfs could reduce preferred foraging habitat by over 30 percent.

Based on this information, PG&E surmised that increasing flows in the Pit 3 reach from 0 to 150 cfs would be adequate to support a prey base for bald eagles, and to provide smooth, shallow pool habitat where prey would be accessible. Following implementation of the 150-cfs releases in 1987, monitoring results showed that bald eagle use of the Pit 3 reach did increase (PG&E, 1993). Bald eagle foraging use of the Pit 3 reach remained slightly lower than use of the Pit 4 reach, but was higher in 1991 and 1992 than use in the Pit 5 reach. PG&E concluded that minimum flows in all three reaches provided a reasonable balance between instream habitat quality for fish and foraging habitat quality for the listed bald eagle. We present our detailed analysis of how alternative flow regimes affect key species of fish, including those that are known to be important bald eagle prey, in section 3.3.2, *Aquatic Resources*.

One of the objectives of PG&E's 2002 controlled flow studies, which included habitat mapping (R2, 2003), 2-D hydraulic modeling (Hardin-Davis, Inc., 2003), and a foraging assessment (PG&E, 2003), was to further investigate the relationship between flows and bald eagle foraging opportunities. Bald eagle foraging habitat was included within the "shallow/slow" habitat category that was used in the mapping study. Water depths in this category ranged from 0.25 to 1.5 feet. Velocities ranged from 0 to 0.8 fps. Open water areas of shallow/slow habitat were mapped in pool tail-outs and pool margins from existing flows up to 400 cfs, but at higher flows (e.g., 600 to 800 cfs), shallow/slow habitat shifted into vegetated bar areas. Overhanging vegetation could make these areas inaccessible to foraging bald eagles, but over time, this vegetation would likely die off as a result of inundation. Where these changes affect in-channel bars, conditions would become more favorable for bald eagle foraging. Where these changes occur along river margins, conditions would show less improvement, since woody debris would remain and it is likely new vegetation would establish.

The habitat mapping study showed small increases or decreases in shallow/slow habitat occurred at evaluation flows up to 1,800 cfs at four of the five evaluation sites. The only substantial increase in potential foraging area occurred at the fifth site, Deep Creek, in the Pit 4 reach were the maximum potential foraging habitat was measured at flows of 800 and 1,200 cfs.

Results of the 2-D hydraulic modeling study provide a somewhat different view of the amount of potential foraging area at test flows. Conditions that provide suitable bald eagle foraging habitat would be considered similar to those modeled for fry and juvenile lifestages of most species of fish in the 2-D study. Results of the 2-D study suggested that in the Pit 3 reach there would be no significant change in the amount of habitat available at existing flows and the amount that would be available at flows up to 1,200 cfs. In the Pit 4 reach, habitat area began to decrease slightly at 500 cfs and above. In the Pit 5 reach, 2-D modeling showed a more rapid decrease of foraging habitat occurring at flows over 250 cfs.

For the foraging assessment, biologists recorded the foraging behavior of adult bald eagles from the Pit 3 powerhouse, Pit Rim, and Hagen Flat territories during a period of 8 days in July, 2002 (PG&E, January 21, 2003). Observations were repeated during each of the test flow releases in August, 2002.

Adults from the Pit 3 powerhouse territory foraged in various habitats and locations on the Pit 4 reservoir during the pre-release observation period and the test flow observations. These birds spent about 12 percent of their time foraging in the Pit 3 reach prior to the test flows, and about 14 percent of their time there during the test flows.

Eagles from the Pit Rim territory used two foraging sites in the Pit 4 reach less than 1 percent of the time during the pre-release observation period and almost 20 percent of the time on the Pit 4 reach during the test flow observations. One of the sites was located just below the Pit 4 dam, and the other was located about a mile downstream. Eagles may have been attracted to these sites by the abundance of carrion fish from the dam during the releases.

Biologists did not observe the Hagen Flat pair at all during several of the visits, and they were never observed foraging in the Pit 5 reach. They were often observed using the Pit 5 reservoir near the nest and made one visit to the Pit 4 reach, but spent most their time outside the study area at a pond about 1 km southwest of the Pit 5 reservoir.

Detailed studies conducted as part of the BEFS (BioSystems Analysis and University of California, Davis, 1985) indicated that these three bald eagle pairs spent about equal amounts of time foraging in project reservoirs and the Pit River. Based on the 2002 observations, use of the Pit River bypassed reaches was fairly low prior to the test releases and very slightly higher during the releases. Although it is difficult to draw conclusions based on the extremely limited amount of data, the results of the 2002 surveys suggest that higher flows (i.e., within the test flow range of 150 cfs to 1,800 cfs) would not adversely affect bald eagle foraging in the river. Also, bald eagles would be likely to take advantage of the new flow conditions. Bald eagles are opportunistic in their foraging habits, and may alter their hunting and feeding behavior, based on factors such as season, weather, age, and experience (Stalmaster, 1987).

Implementation of minimum flows outlined in the PRCT agreement would not be likely to affect riparian forested habitat or reduce the number of available perch, nest, or roost trees along the Pit River. Evaluation of test flows in 2002 indicate that minimum flows of 600 cfs would inundate about 50 acres of riparian habitat, but most of the vegetation that would be inundated consists of torrent sedge, willow and alder shrub; only 0.19 acre of black cottonwood would be removed, even at flows as high as 1,200 cfs.

Recreation disturbance: Recreational use, which has the potential to disturb bald eagles, is highest during the summer. Boating, fishing, and hiking during spring and early summer months would coincide with the time of year when eagles are laying eggs and feeding young at the nest. Eggs hatch in mid-April to early May, and eaglets remain in the nest for 10 to 12 weeks. PG&E reports that in over 140 nesting attempts monitored in the Pit River drainage, all fledging occurred prior to August 1, and in most years, most eagles had fledged by mid-July. Eagles may be slightly less sensitive to disturbance during June and early July than they are earlier in the nesting stage, but forage availability and undisturbed access to forage can strongly affect rearing success (Johnsgard, 1990).

Disturbance to bald eagles during the winter may increase their energy demands and cause physiological stress (Stalmaster and Kaiser, 1998). However, under current conditions, recreational use of the project area is relatively low during the winter, and we conclude the risk of disturbance to bald eagles is low.

The objectives of the 1986 IBEMP were to maintain habitat conditions in nesting, foraging, and wintering areas that would support at least the nine pairs of eagles that nested in the project area at that time, and provide for three additional nesting territories (CDFG et al., 1986). With the number of nesting pairs currently at 10 (plus one nest near the Pit 6 reservoir that was active in 2000) and productivity remaining high, it appears the IBEMP is effective in protecting bald eagles under current conditions. However, several changes in project facilities and operations are proposed that may tend to increase recreational opportunities in the project area.

The FS final 4(e) condition No. 26 includes improvements at Dusty Campground and Jamo boat ramp; provision of additional day-use capacity, possibly at the Pines picnic area, North Ferry Crossing and North Shore Campground; construction of 39 additional campsites at existing or new overnight facilities; improvement of access at several dispersed sites; and upgrades to existing trails around Lake Britton.

In the Pit 3 and Pit 4 reaches, the FS would require construction of trailhead parking and trails at Powder Spur, Delucci Ridge, Rock Creek, Malinda Gulch, and Oak Flat, or at other locations acceptable to the FS. Improvements for access at the Pit 4 reservoir and Pit 3 powerhouse would be constructed. Spoil pile #4D would be converted to a scenic canyon overlook into the Pit 4 reach, and the Ruling Creek dispersed camping area would be improved. Although the PRCT agreement calls for provision of recreation flows only into the Pit 5 reach at this time (following up to 5 years of baseline data collection), the FS final

4(e) conditions would require development and maintenance of boat put in and take out access points in the Pit 3 and Pit 4 reaches.

Construction projects, including improvements to roads and existing facilities and development of new facilities, could probably be timed outside the breeding season to prevent disturbance to nesting birds, but several of these proposals have the potential to cause long-term disturbance to bald eagles. Special care would be needed to prevent adverse effects where proposed recreational sites overlap with areas that are known to provide important foraging opportunities for bald eagles (e.g., Ruling Creek, Malinda Gulch, Oak Flat, and Tunnel Reservoir).

The effects of implementing a whitewater boating program, as described in the PRCT agreement, would depend to a large extent on the timing (both time of day and time of year) of release flows. Restricting boaters to the 10:00 a.m. to 4:00 p.m. period of the day would help to avoid disturbance during prime foraging hours. Since bald eagles are thought to be less sensitive to disturbance after fledging is complete, restricting the program to the months of August and September would have a lower potential for harm than would be the case earlier in the season.

At the current time, PG&E protects bald eagles from disturbance due to recreation through its IBEMP. We agree the IBEMP should be updated to address recreational enhancements that may be included in any new license for this project and possibly higher levels of recreational use of the project area through the next license period. Compliance with the management measures specified in an updated IBEMP could be monitored by implementing an updated BCMP, that would include fish monitoring, discussed in section 3.3.2.2, *Aquatic Resources*, and bald eagle monitoring, at a minimum. The BCMP would also specify the frequency of report submission to the FWS, Commission, and other agencies, as appropriate. Updating the IBEMP would be consistent with condition 2.A of the biological opinion issued by the FWS by letter to the Commission dated October 15, 2003, and would also facilitate assistance of the FWS in the implementation of recovery efforts of the FWS for the bald eagle, as specified in the conservation recommendation in this same letter.

Foreseeable measures that we may recommend as part of this relicensing proceeding that could affect bald eagles would be addressed in the updated IBEMP, including any subsequent revisions that may occur during the term of a new license. The specific nature of many foreseeable measures would not be known until after license issuance, such as the exact location of new recreational facilities and whether or not scheduled recreational boating flows would be provided to the Pit 5 bypassed reach. In addition, details of fish and recreational use monitoring would be developed after license issuance, and details regarding a biological monitoring and adaptive management plan would be established. When such details are established, they can be incorporated into the IBEMP, as appropriate. Substantial unforeseen modifications to the Pit 3, 4, 5 Project would most likely require PG&E to file a request for a license amendment. If the proposed changes to the project have the potential to adversely affect any federally listed species, including the bald eagle, the Commission would be required to consult with FWS pursuant to the provisions of Section 7 of the ESA as part of the license amendment proceeding. With these provisions in place, we conclude that relicensing this project would be consistent with condition 2.D of the biological opinion issued by the FWS.

Condition 2.E of the FWS biological opinion would require any new owners of lands in the project area previously owned by PG&E, including holders of any conservation easements, to agree in writing to abide by the terms and conditions of the biological opinion. The Commission has the authority to enforce the terms and conditions of a license, including provisions of the biological opinion to the extent that those provisions would be included in a new license. If PG&E sells or transfers any project lands, they would not be relieved of complying with license conditions as long as those lands remain within the project boundary.

For land that would be removed from the project boundary, the Commission would consider the potential for adverse effects to project purposes, including protection of endangered species. The Commission, however, can neither impose nor enforce any conditions on that removal, including any covenants running with the land. In order to receive protection from incidental take of listed species, PG&E, and perhaps any new landowners, would have to comply with the provisions of the biological opinion. In addition, condition 2.E appears to apply to PG&E lands currently located outside the project boundary. The Commission has no jurisdiction over those lands.

FWS makes a conservation recommendation in its biological opinion that PG&E should preserve habitat for listed species, including the bald eagle, by ensuring that land in and adjacent to the project area revert to public ownership when divested from PG&E. As noted above, the Commission only has authority to ensure protection of bald eagle habitat (or that of any other listed species) within the project boundary. This protection would be afforded regardless of whether the land is owned by a public or private entity. Land outside the project boundary is not within the Commission's jurisdiction, and if PG&E-owned land is divested, the Commission has no authority to specify to which party it should be divested.

Northern Spotted Owl

PG&E is not proposing any actions that would directly affect the northern spotted owl, and does not propose any measures specifically to protect this species other than to work with resource agencies to map suitable northern spotted owl habitat that could be affected by project operations. No agencies recommended specific measures for the northern spotted owl, but the boundaries of two PACs overlap the Pit River in the Pit 3 and 4 reaches. The FWS, in its biological opinion filed with the Commission by letter dated October 15, 2003, pursuant to Section 7 of the ESA, states that all protective measures for the northern spotted owl described in our biological assessment (draft EIS) should be fully implemented and enforced.

Our Analysis

No project-related actions are proposed at this time that would alter habitat within the Chalk Mountain LSR or the two PACs that overlap the Pit River in the Pit 3 and 4 reaches. The FS and Interior have recommended that PG&E consider the use of fire prescriptions or thinning as part of the vegetation management plan to reduce fuel accumulations. Although the FS and Interior did not provide detailed information about the locations where they believe fire or mechanical means should be employed, we assume they would be implemented in young, dense forest stands or shrub-dominated sites that do not provide suitable habitat for northern spotted owls. However, the risk of uncontrolled wildfire or adverse effects of thinning or other vegetation management measures on the LSR or the two PACs should be carefully evaluated.

PG&E proposes an extensive road improvement program, and the FS has recommended improvements at a number of recreation sites. Noise from such activities (heavy equipment operation for grading, excavating, loading, hauling, culvert installation, or bridge construction) has the potential to disturb nesting owls if conducted within proximity to nests during the breeding season.

In light of the potential for unintended habitat effects and noise disturbance to northern spotted owls, consultation with the FS, FWS, and CDFG to map suitable habitat and known locations would enable existing information to be used to determine if and where field surveys or protection measures might be needed and we agree that it is warranted. Mapping and survey information would typically be needed within 0.25 miles of sites where potential disturbance of owls is a concern. Our recommendation pertaining to protection of northern spotted owl is specified in section 5.2, *Comprehensive Development and Recommended Alternative*.

Shasta Crayfish

PG&E does not propose any actions that would affect the Shasta crayfish, and does not propose any measures specifically to protect this species. No agencies have recommended specific measures for the Shasta crayfish, and no measures associated with the Pit 3,4, 5 Project are identified in the 1998 FWS Recovery plan for Shasta crayfish (FWS, 1998).

Our Analysis

Although Shasta crayfish occur in the Pit River and tributaries upstream of Lake Britton, they were not identified within the project area during targeted surveys in the Pit 3, 4, and 5 bypassed reaches. Due to the high abundance of signal crayfish, which have been found to outcompete and prey upon Shasta crayfish in the upper Pit River, it is highly unlikely that Shasta crayfish occur or could be re-established in the project area in the near future. Although the FS suggested that providing a spring freshet could help control populations of signal crayfish in the bypassed reaches, this measure is unlikely to be effective, since existing populations of signal crayfish have survived much larger flood flows as recently as 1997 and 1998 (see section 3.3.2.2, *Aquatic Resources*). Because the species has not been documented to occur within or downstream of the project, and is unlikely to be able to establish populations in the area due to the abundance of signal crayfish, we concluded in our biological assessment (draft EIS) that relicensing of the Pit 3, 4, 5 Project as proposed by PG&E would not affect the federally listed Shasta crayfish. The FWS, in its April 25, 2003 letter to the Commission, concurred with our conclusion.

Project Decommissioning

Decommissioning would not affect habitat for the VELB but it would cause temporary noise disturbance to northern spotted owls and bald eagles during dam removal and restoration. Decommissioning also would cause long-term adverse effects by reducing the amount of open water foraging habitat available for the bald eagle at Lake Britton and the Pit 4, 5 and Tunnel reservoirs. The BEFS (PG&E, 1986) showed bald eagle reliance on smooth, shallow water as preferred foraging habitat in the project reaches. Reductions in this habitat type under unimpaired conditions would likely reduce productivity of existing territories, the number of territories that could be supported in this vicinity, or both. Reductions in the number of waterfowl that currently use the project reservoirs could also affect bald eagles by reducing forage during the winter.

3.3.4.3 Cumulative effects on bald eagles: Construction of Shasta dam in 1945 blocked the upstream migration of anadromous fish that once may have provided a large, concentrated food resource for bald eagles. However, construction of the Pit 3, 4, 5 Project and other reservoirs in the Pit River watershed has provided a stable and abundant warmwater prey base for the bald eagle, and regulated flows in the Pit River maintain foraging opportunities in smooth, shallow water. Modest increases in flows, such as those proposed in the PRCT agreement, would be likely to maintain or increase the prey base, as well as foraging opportunities, and result in a cumulative benefit to the bald eagle.

3.3.4.4 Unavoidable adverse effects: None.

3.3.5 Recreational Resources

3.3.5.1 Affected environment: The project partially lies within and adjacent to the Shasta National Forest and adjacent to the Lassen National Forest, which provide a variety of formal and informal recreational facilities and opportunities. Much of the National Forest lands are open to the public for recreation. Recreational opportunities within the project area generally occur in the area surrounding Lake Britton and within the Pit River Canyon. Lake Britton provides camping, picnicking, boating, swimming, wildlife viewing, and hiking. The eastern, and more riverine, section of Lake Britton provides more primitive and dispersed recreational opportunities, and the western half of the lake, upstream of the Pit 3 dam, provides more developed recreational opportunities, such as developed campgrounds and day-use areas. The Pit River Canyon provides more undeveloped, dispersed recreational opportunities, such as trout fishing, camping, hiking, whitewater boating, and driving for pleasure and sightseeing.

PCT, a national scenic trail spanning over 2,650 miles from Mexico to Canada, passes through portions of the project area. The PCT enters the project area around Rock Creek within the Pit 3 reach, crosses the Pit 3 dam on Clark Creek road, and then parallels the southern side of Lake Britton, passing through Burney Falls State Park. The staff of the Lassen National Forest manages the portion of the PCT within the project area.

Many streams and lakes within the project region are known for their outstanding trout fishing waters, including the Sacramento, McCloud, Pit, and Fall rivers. The CDFG, under the Wild Trout Program, manages portions of the Pit 3 reach, Hat Creek, and Burney Creek within the project boundary. Streams and reservoirs designated under the Wild Trout Program are managed by CDFG exclusively for wild trout with the intent to provide a quality angling experience in an aesthetically pleasing environment.

Recreational Facilities

Table 39 describes recreational facilities within the project area. Figures 12 and 13 show the general location of the facilities, and we describe them in the following text.

Table 39. Summary of developed recreational facilities within the project area. (Source: PG&E, 2001, as modified by staff)

Recreational area	Overnight units	Picnic sites	Day-use parking	Boat launch	Toilet units	Showers	Beach/swimmin	Picnicking	Fishing	Hiking	Ownership	Season	Public/private
Upper Lake Britton area	--	--	X	X	--	--	--	--	X	X	L	April–Dec	P
Lower Hat Creek area	--	--	X	--	--	--	--	--	X	X	L	April–Nov	P
Dusty Campground	7	--	X	–	X	--	X	--	X	--	L/FS	YR	P
Jamo Point boat launch	--	--	38	X	X	--	--	--	X	--	L	YR	P
Pines picnic area	--	10	21	--	X	--	--	X	X	--	L	April–Sept	P
McArthur-Burney Falls State Park	128	52	117	X	X	X	X	X	X	X	L/State	YR	P
North Shore Campground	30	--	--	--	X	--	X	--	X	--	L	May–Sept	P
PSEA Camp Britton	8	--	--	--	X	X	--	--	X	X	PR	April Oct	PR
PSEA Camp Shasta	8	--	--	--	X	X	--	--	--	--	PR	April–Oct	PR
PSEA Camp Pit	17	--	--	--	X	X	--	--	--	--	PR	April–Oct	PR

Notes: L = licensee
FS = Forest Service
P = public PR = private

PSEA = Pacific Service Employee's Association
YR = year-round
X = facilities located at that recreational area

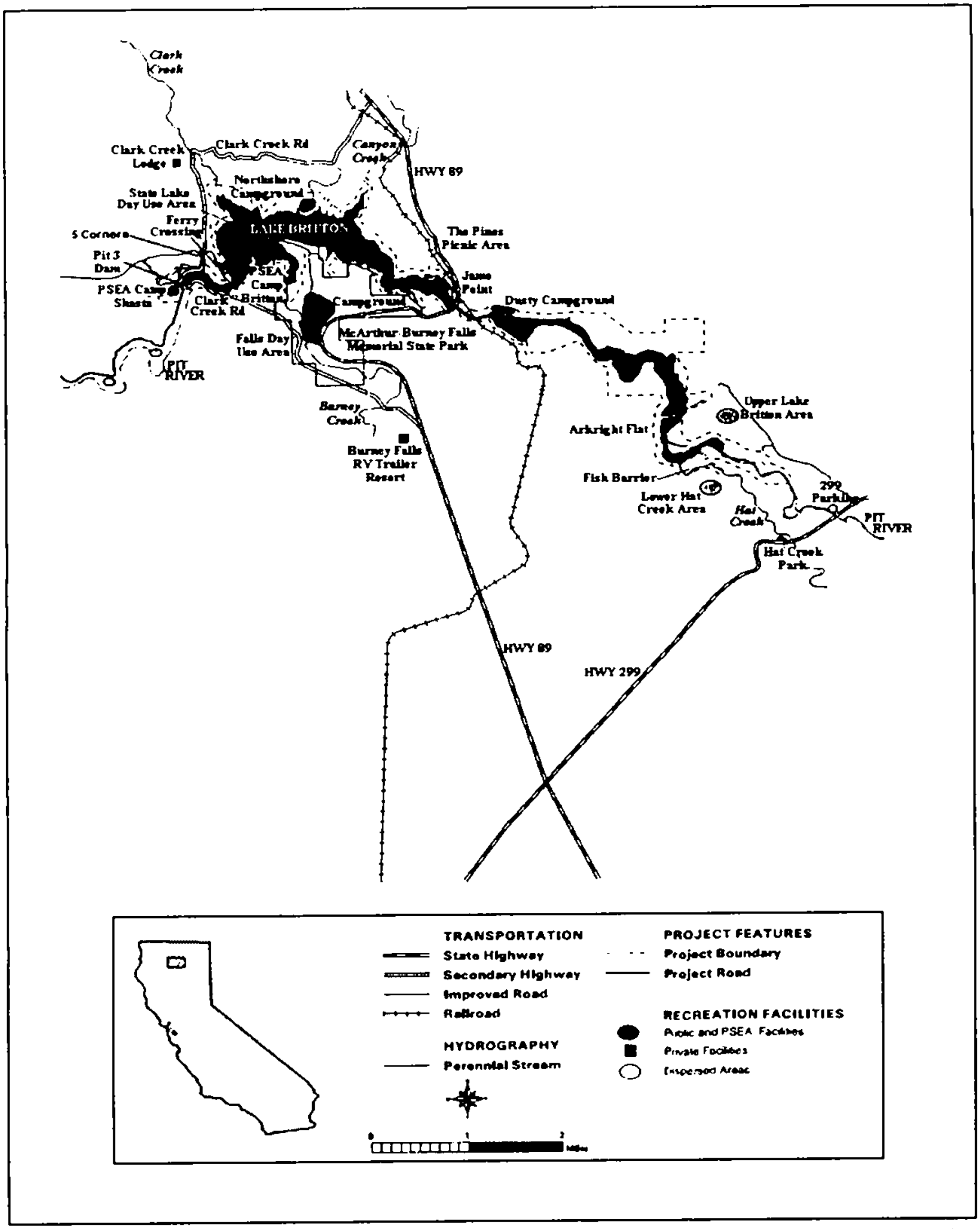

Figure 12. Recreational facilities within the upper Lake Britton and lower Hat Creek area. (Source: PG&E, 2001, as modified by staff)

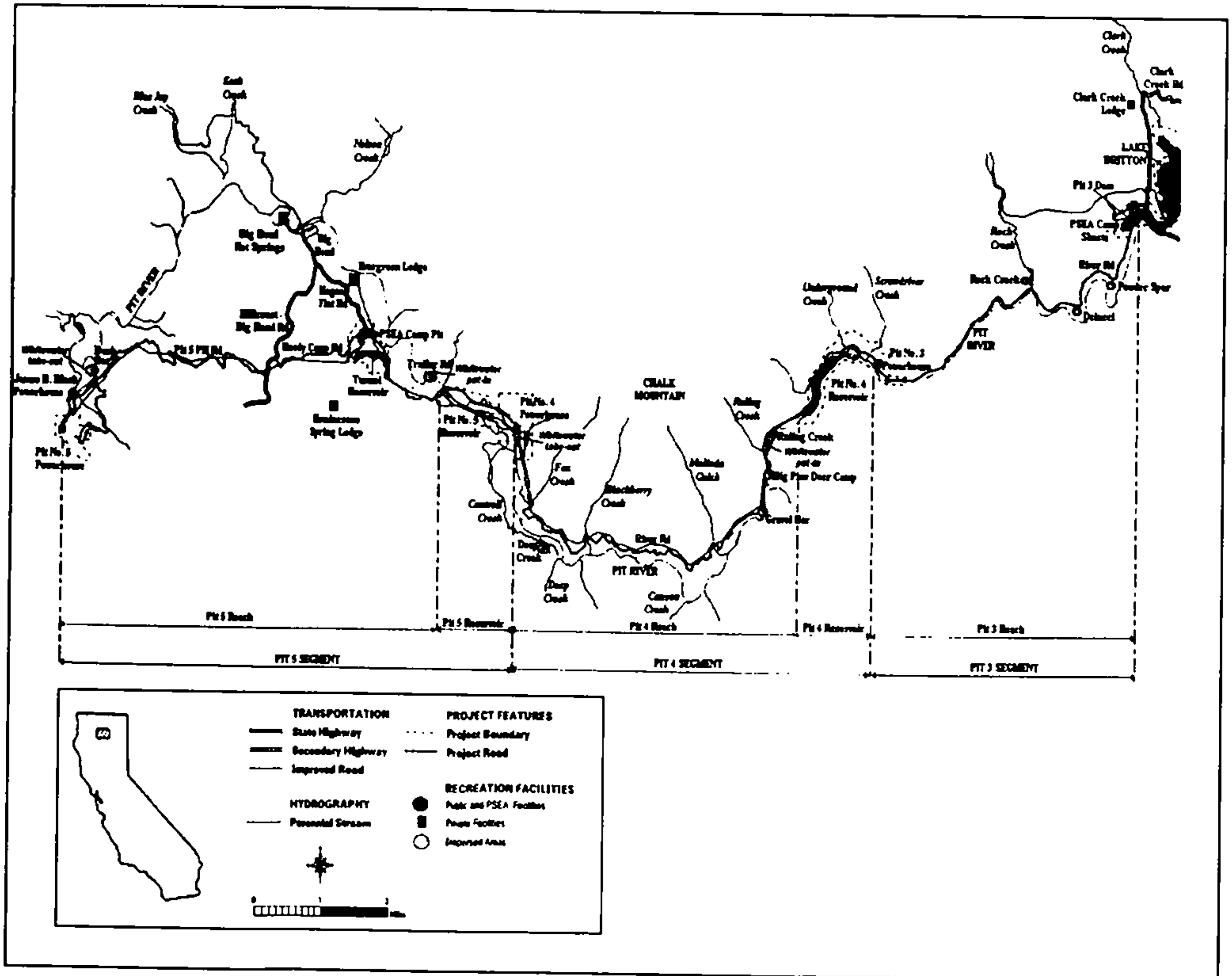

Figure 13. Recreational facilities on the Pit 3, 4, and 5 reaches. (Source: PG&E, 2001, as modified by staff)

Lake Britton Area

PG&E manages the upper Lake Britton area to provide primitive to semi-primitive recreational opportunities and to protect the sensitive resources of this area, such as threatened and endangered species and cultural resources. To help protect the sensitive resources of the area, signage is posted restricting access to sensitive areas and travel is prohibited from designated roads and parking areas. There are several designated public parking areas; one of the parking areas includes a car-top boat launch. The Highway 299 access gate is open during the fishing season—the last weekend in April to the end of December. Recreational opportunities in this area include fishing, wildlife viewing, canoeing, rafting, waterfowl hunting, and low-speed boating.

The lower Hat Creek area is located on PG&E-owned lands on the west side of Hat Creek extending about 1 mile upstream from its confluence with Lake Britton. The lower 0.6 mile of Hat Creek is located within the project boundary and includes the Hat Creek fish barrier. The Hat Creek Wild Trout Management Area, a CDFG-managed catch-and-release fishery, extends from the fish barrier about 3.5 mile upstream to the vicinity of the Hat Creek 2 powerhouse. The lower Hat Creek area access gate is opened by the last weekend in April and closed after November 15 to coincide with the trout fishing season. Two main access roads lead to two designated parking areas at the upper and lower end of the stream within the meadow area. Fishing is the primary activity in this area, although some unauthorized ORV use occurs, and the area is sometimes used for picnicking and as a take-out for tubers and rafters on Hat Creek. Hat Creek Park, located outside the project boundary upstream of the project along Highway 299, provides eight picnic tables, a parking area for eight vehicles, and Americans with Disabilities Act (ADA)-accessible restrooms. Although the park is located on PG&E-owned lands, Shasta County currently manages it. At the end of 2005, management of the park will transfer from Shasta County to PG&E.

Dusty Campground is a semi-primitive campground located within the project boundary on the north shoreline of Lake Britton on both FS-managed lands and PG&E-owned lands. The campground is open year-round and consists of five family and two group campsites, parking areas, two double-vaulted toilets, and two sandy beach areas. One restroom and one campsite is ADA-accessible. A PG&E concessionaire operates and maintains the campground facilities during the peak recreational season, mid-April to mid-September.

Jamo Point boat launch is located on the north shore of Lake Britton on PG&E-owned lands, within the existing project boundary. Facilities at the site include a two-lane boat launch, a courtesy dock, a parking area for about 38 vehicles, a double-vaulted restroom, a caretaker site, and a fishing platform. Two parking spaces, the restroom, the courtesy dock, and the fishing platform are ADA-accessible. The same concessionaire who manages the Dusty Campground manages the boat launch area. The boat launch area is open year-round, and a boat launch fee is charged during the recreational season.

The Pines picnic area is located west of Jamo Point on a small peninsula on PG&E-owned lands, within the project boundary. The picnic area facilities include 10 picnic tables, 13 grills, a double-vaulted restroom, and parking area for about 19 vehicles. The restroom and two adjacent parking spaces are ADA-accessible. The same concessionaire who manages the Dusty Campground picnic area manages the picnic area.

McArthur-Burney Falls Memorial State Park (Burney Falls State Park) is located on the south shore of Lake Britton on about 910 acres of mostly forested land. About 74 acres of the park is located within the boundary of the Shasta National Forest that the CDPR operates under a special-use agreement. About 225 acres of shoreline lands are currently leased from PG&E. PG&E and CDPR have entered into an agreement for transfer of ownership of PG&E-owned lands within Burney Falls State Park to CDPR. The transfer would provide CDPR with ownership of the Burney Falls State Park Lake day use area, Camp Britton, and the Pioneer Cemetery. In exchange, PG&E would receive from CDPR a 500-acre parcel of land known as the Ahjumawi Subject Property, between the Little Tule River and Tule River. Following the property exchange, PG&E would donate its parcel to the California Waterfowl Association, pursuant to section 1.7 of the *McArthur Swamp Management Plan*, which PG&E filed with the Commission on September 18, 2000. This management plan was developed as a negotiated settlement during the relicensing proceedings for the Pit 1 Project, and is contingent on certain lands being deleted from the boundary of that project upon issuance of a new license and approval from the California Public Utilities Commission.

A focal point in Burney Falls State Park is Burney Falls, located on Burney Creek. The NPS designated Burney Falls as a National Natural Landmark in 1984. Burney Creek is a CDFG-designated catch-and-release fishery downstream from the falls about 1 mile to Lake Briton's Burney Cove. Burney Falls State Park includes several campgrounds, the Falls Day-use Area, the Lake Day-use Area, and an internal trail system. The campgrounds include 128 family campsites, five restrooms, and two shower rooms. Seven of the campsites and one restroom are ADA-accessible. In addition, the PCT campground is located within the state park and has six campsites, two toilets, a small corral, and potable water. Two additional campsites are designated for visitors who hike and bike. There are seven hiking trails associated with Burney Falls State Park, including Rims, Falls, Headwaters, Creek, Pacific Service Employee's Association (PSEA), Pioneer Cemetery, and the PCT, totaling about 3.8 miles in length.

The Falls Day-use Area, located outside of the project boundary, includes a scenic overlook to view Burney Falls, a visitor center, a picnic area with 25 tables, a restroom area, a concession store, and parking. The Lake Day-use Area, located within the project boundary, includes a beach, marina, picnic area, and a parking area for about 80 vehicles. The beach has "imported sand" and the width varies with reservoir water levels. One parking area, restroom, and part of the beach area are ADA-accessible. The beach includes a designated swimming area, 9 picnic tables, 16 log benches, and trash receptacles. The marina includes a two-lane concrete boat launch, a courtesy slip, a floating dock with 16 slips, a canoe rack, and the concessionaire trailer. The concessionaire rents paddleboats, canoes, low horsepower fishing boats, and boat slips. The concession is open daily from Memorial Day weekend to September 30. The picnic area includes 20 tables with barbeque grills.

The North Shore Campground is located on the north shore of lower Lake Britton across from Burney Falls State Park on PG&E-owned lands, within the project boundary. The campground facilities include 30 campsite units, three double-vaulted restrooms, a caretaker campsite, and a potable water system. The individual campsites include picnic tables with food lockers and fire rings. Three campsites and the three restrooms are ADA-accessible. The shoreline adjacent to the campground provides swimming, sun-bathing, and fishing opportunities. The campground is open from mid-May to mid-September. The campground is located between two bald eagle nest sites, and the existing license accordingly has the following conditions to protect the eagles: limit of 30 campsites and delay the opening of the campground until mid-May. In addition to these restrictions, the informal boat ramp was closed, and the establishment of a beach area was not permitted so as to limit the amount of additional day-use activities in the area.

The PSEA's Camp Britton is a private organizational camp located on the west shore of Burney Cove, within the project boundary. Camp Britton is normally open from mid-April to mid-October, and the facilities include eight lodging units and a courtesy dock. The Ferry Crossing is an informal recreational area located at the northwestern end of Lake Britton and consists of about a 1,000-foot-long natural beach. Access to the beach area is by boat or walking about 0.4 mile along the old Ferry Crossing Road. Burney Falls Trailer Resort is located at the juncture of Clark Creek Road and Highway 89 in the vicinity of the project, but outside of the project boundary. The resort provides 29 recreation vehicle (RV) campsites, a swimming pool, and showers, and is open year round.

There are 20 recreation trails adjacent to the lower portion of Lake Britton and 39 trails adjacent to the upper portions of the lake, the majority of which at least a portion of the trail is within the project boundary. The average length of the trails adjacent to the lower portion of Lake Britton are 0.6 mile with about 10 percent used for fishing access, about 40 percent for hiking, and the remaining for mixed use. For the upper portion of Lake Britton, the average trail length is 0.4 mile with about 41 percent used for fishing access, 3 percent for hiking and the remainder for mixed use.

Pit River Canyon

Recreational facilities within the Pit 3 reach (the 6-mile-long section of the Pit River extending from the Pit 3 dam to the Pit 3 powerhouse) include PSEA Camp Shasta, portions of the PCT, hiking areas, and informal parking areas. Camp Shasta is a PSEA private organizational camp located on the bluff above the Pit River Canyon, on PG&E-owned lands and operated by PSEA under terms of a license agreement. Camp Shasta includes eight overnight lodging units and a swimming pool; it is generally open from mid-April through mid-October.

Within the Pit 3 reach, there are about 12 informal parking areas, with each parking area comprising 1 to 3 pullouts for a total of about 33 pullouts for river access. There are an additional 7 pullouts that are used as scenic overlooks or traffic pullouts. Along the first 3 miles of the reach, 5 informal trailhead parking areas provide trail access to the river, including the Pit 3 dam, Powder Spur, Delucci, Slope Failure, and Rock Creek. In addition, 15 other trails, which generally traverse steep banks, are located within the upper Pit 3 reach. Within the lower section of the Pit 3 reach, there are 7 parking areas along the road and about 50 short trails that are used to access the river. At least some of these informal trails are experiencing erosion, based on observations during our May 22, 2002, site visit, and we saw no signage identifying river access trails at any location.

Along the Pit 4 reservoir, four dispersed parking areas are located along the north side of the reservoir, including a dispersed camping area at an informal boat launch that PG&E uses for hydro operation and maintenance purposes. A Shasta County ordinance prohibits public boating on the reservoir because of the relatively small size, water level fluctuation, and exposed boating hazards that occur at lower reservoir elevations. Along the Pit 4 reach, the Pit 4 dam spoil pile road provides access just below Pit 4 dam, although the road is narrow and steep. Ruling Creek, Big Pine Deer Camp, and Gravel Bar access areas provide some of the best vehicle access to the Pit 4 reach and dispersed camping (with about 5 dispersed campsites at each area), and shoreline fishing opportunities within the canyon. Within the steep section of the Pit 4 reach, 7 informal parking areas and trails lead from these parking areas to the river. Vehicle access is available at the Pit 4 powerhouse tailrace. Car-top camping opportunities are available at the Canyon Creek pullout and on the east side of the Pit 4 powerhouse. The closed Deep Creek Campground, located adjacent to the confluence of Deep Creek and the Pit River, was formally managed by the FS, but is currently unmaintained. The Deep Creek Campground still has 19 primitive campsites and two pit toilets present, and is still used for dispersed camping and for day-use recreational activities.

There are several whitewater boating put-in and take-out locations along the Pit 4 and Pit 5 bypassed reaches (see figure 12). There is an informal whitewater boating put-in on the Pit 4 bypassed reach near Ruling Creek with a take-out on the peninsula upstream of the Pit 4 powerhouse tailrace. Along the Pit 5 bypassed reach, there is an informal put-in just downstream of the Pit 5 dam and the take-out is at Bush Bar, about 0.9 mile upstream of the Pit 5 powerhouse. The Pit 4 bypassed reach provides opportunities for Class IV rapids at higher flows and Class III rapids at lower flows, and provides 5 to 6 major drops. The Pit 5 bypassed reach provides Class IV/V boating opportunities, with the more difficult rapids occurring from the Pit 5 dam to Kosk Creek. Local boaters have reported that the Pit 5 bypassed reach is more difficult to boat than the Pit 4 bypassed reach, featuring more continuous rapids than the pool-and-drop character of the Pit 4 bypassed reach. The Pit 5 bypassed reach also has more boulder-choked reaches and bank vegetation that can limit rafting access at lower flows.

Along the Pit 5 reservoir, the shoreline is mostly inaccessible because of vegetation and steep terrain. There are four dispersed recreational areas in the vicinity of the reservoir, and the most popular camping area is near the dam. Shasta County ordinance prohibits boating on the Pit 5 reservoir. Within the Pit 5 reach and Tunnel Reservoir, the public can access the river at areas just downstream of the Pit 5 dam, the Tunnel Reservoir spillway, PSEA Camp Pit, the transmission line river crossing, the community of Big Bend, an unnamed creek along the James Black Powerhouse north access road, Miner Creek, Bush Bar, and areas just upstream of the Pit 5 powerhouse. Shasta County ordinance prohibits boating on the Tunnel Reservoir. Located in the northern vicinity of the Tunnel Reservoir is PSEA Camp Pit, a private organizational camp that has 18 cabins. A short trail leads from the camp to the river. Several private fishing resorts, including Henderson's Spring Lodge and Evergreen River House, are located in this portion of the Pit 5 reach, which is outside of the project boundary

Within the Big Bend community, dispersed public day-use areas are accessible by vehicle on PG&E-owned lands on the north and south shores of the river. Big Bend Hot Springs Resort is located within the Big Bend community, outside of the project boundary, and provides 12 campsites, picnic tables, and a cabin, and is open year-round. The 4.4 mile-long stretch of river from Kosk Creek to the Pit 5 powerhouse is accessible by hiking trails and the lower end, by vehicles. The Little Joe Flat Trail is the primary trail along this section, and informal trailhead parking is available. There are additional trailhead parking areas located along the Pit 5 powerhouse road. Vehicle access is available at the Bush Bar and the James B. Black Powerhouse Bridge areas and provide for dispersed day-use opportunities.

Recreational Use

PG&E collected recreational visitation information during the 1999 and 2000 recreational season through the use of attendance records at overnight recreational facilities, traffic counters, and observations at day-use areas. PG&E estimated recreational days (RDs)[17] (i.e., occupancy rates at the campground and day-use areas) and the average number of people at one time (PAOT)[18] from the data collected. Annual recreational use of Lake Britton and Pit River Canyon was estimated at approximately 200,000 RDs, with about 99,800 RD day-use and 94,100 RD overnight use. About 90 percent of this use occurred at Lake Britton.

Lake Britton Area

Within the Lake Britton area, about 65 percent of Lake Britton's recreational use occurs at Burney Falls State Park and 15 percent at Jamo Point boat launch. The remaining recreational sites each make up less than 7 percent of the remaining recreational use. Table 40 summarizes the recreational visitation in RDs for the Lake Britton area.

Table 40. Summary of estimated Lake Britton visitation in recreational days. (Source: PG&E, 2001)

Location	Season/Dates	RD Day-use	RD Night-use
Upper Lake Britton	April 29 to January 14	5,600	1,600
Lower Hat Creek	Last weekend in April to November 15	7,100	0
Dusty Campground	April 17 to October 24	0	2,000
Jamo Point boat launch	Entire Year	28,800	0
Pines picnic area	April 15 to Sept. 15	8,800	0
Burney Falls State Park day-use area	Entire Year	88,700	0
Burney Falls State Park Campground	Entire Year	0	66,000
North Shore Campground	May 21 to September 13	0	5,700
PSEA Camp Britton	April 10 to October 16	0	5,500
Day/overnight use overlap[a]		(49,600)	0
Total		89,400	80,800

[a] Day users who were also counted in overnight use were subtracted from the totals.

[17] RD is defined as a person who visits an area for recreational purposes during any portion of a 24-hour day.

[18] PAOT is defined as the number of people at a given location at one time.

Boating use on Lake Britton was highest during summer weekends with an average of 50 to 60 boats on the water surface or along the shoreline during higher use afternoon periods. Boating peaked between 100 to 155 boats during the summer weekends. Weekday boating use averaged about 30 and peaked around 60 boats. About 80 percent of the boating use occurs on the lower lake, 17 percent on the upper lake in the area between the Highway 89 Bridge and the low-speed buoys, and the remaining 3 percent on the upper portion of the lake in the low-speed, shallow areas. About 40 percent were power boats with motors greater than 25 horsepower, 30 percent boats with motors less than 25 horsepower, 12 percent personal watercraft, and 13 percent were non-powered boats, such as canoes, paddle boats, or sailboats. On the lower portion of the lake during high use periods peak densities ranged from 7 to 8 acres per boat, which reflects periods of over capacity based on boating capacity standards of 9 to 10 acres or less per boat as a high range for safe boating (Whittaker and Shelby, 2001; BOR, 1977; Warren and Rea, 1989).

For the upper Lake Britton area, overnight camping was primarily associated with the annual Black Powder Shoot conducted during the Memorial Day weekend and the camping occurred away from the shoreline area. Other than Memorial Day weekend, recreational visitation on average was about 4 to 6 PAOT on average and during the waterfowl season average use rose to 16 PAOT and peaked between 30 to 40 PAOT. The primary activities observed in the upper Lake Britton area were driving (35 percent), fishing (15 percent), relaxing or walking (15 percent), camping (8 percent), hunting or shooting (7 percent), and the remaining were other activities, such as canoeing and kayaking.

For the lower Hat Creek area, on average 4 to 7 PAOT were observed and use peaked during the Memorial Day weekend and during the opening weekend of fishing season to between 40 to 50 PAOT. The primary recreational activity observed was fishing (45 percent), followed by driving (25 percent), and relaxing or walking (15 percent), with the remaining participating in other activities, such as hunting or shooting and wildlife observation.

At Dusty Campground, the primary recreational use occurs during April through October. During the summer, the average monthly occupancy rate was 50 percent and weekend occupancy rate was 70 percent. The campground reached capacity 18 times during 1999, and 15 times during the 2000 season. Recreators rated Dusty Campground as crowded during the weekend and holiday periods.

At the Jamo Point boat launch area, the average PAOT during the summer season afternoon periods average use ranged between 12 to 45 PAOT and peaked to 107 PAOT. During the summer period, the average occupancy of the parking area was about 13 percent during weekdays, 47 percent during weekends, and 45 percent during holiday weekends. The primary recreational activities observed were launching or retrieving a boat (40 percent), relaxing (36 percent), fishing (18 percent), and the remaining were other activities, such as swimming.

The Pines picnic area is open to the public between mid-May and Mid-September. Average use was about 10 to 20 PAOT during the weekend periods and peaked at 64 PAOT. Recreational activities observed included picnicking (40 percent), relaxing (40 percent), fishing (10 percent), swimming (6 percent), and the remaining were other activities.

The Burney Falls Day Use area is the most popular shoreline day-use area in the vicinity of Lake Britton. Average use was about 180 PAOT during the weekdays, 200 to 220 PAOT during non-holiday and holiday weekends, and peak use ranged from about 360 to 470 PAOT. About 45 percent of the visitors were campers from the Burney Falls State Park Campground. Recreational activities observed at Burney Falls day-use area were relaxing (34 percent), walking or standing (25 percent), swimming (17 percent), picnicking (9 percent), fishing (4 percent), and the remaining were other activities. Typical occupancy of the parking lot was about 45 percent during weekdays and 70 percent during holiday and non-holiday weekends. Recreators rated Burney Falls day-use area as crowded during the summer season. At the Burney Falls Campground, the occupancy rate was generally less than 15 percent from October to April, about 30 percent in May, about 70 percent in June; approached or exceeded capacity during July and August; and then dropped to about 45 percent in September. During 1999 and 2000 seasons, the campground reached or exceeded capacity on average 56 times a year. Recreators rated Burney Falls Campground as crowded during the summer season, both during the weekdays and the weekend and holiday periods.

North Shore Campground generally is open from mid-May to mid-September. During the summer season the campground sites were occupied on average about 40 percent during weekdays and 54 percent during weekends. The campground reached capacity twice during 1999 and 2000. Recreators rated North Shore Campground as crowded during the summer and non-summer season during the weekend and holiday periods.

PSEA Camp Britton, a private organizational camp, is open between early April through mid-October, and the eight cabins were at or near capacity during most of the summer. During 1999 and 2000, the camp on average reached capacity 85 times.

Pit River Canyon

Within the Pit River Canyon, for day-use activity use, the Pit 3 reach receives about 60 percent, the Pit 4 reach about 30 percent, the Pit 5 reach (including the Pit 5 reservoir, bypassed reach, and Tunnel Reservoir) about 7 percent, and the remaining day-use occurs at the Pit 4 reservoir. In terms of overnight use, the Pit 3 reach receives about 10 percent, the

Pit 4 reach receives about 40 percent, and the Pit 5 reach about 50 percent of the camping visits. Table 41 summarizes the estimated annual recreational visitation within the Pit River Canyon.

The Pit 3 reach is designated as a catch-and-release wild trout stream[19] and is the most popular recreational area within the Pit River Canyon (see section 3.3.2, *Aquatic Resources*; figures 3 and 4). Average use (not including Camp Shasta use) during the fishing season was about 9 PAOT during weekdays and 15 PAOT during the weekends, and peaked during Memorial day weekend at about 61 PAOT. Pit 3 dam is the most popular day-use trailhead within the reach and canyon. The PSEA Camp Shasta average occupancy rate was 70 percent during the fishing season, and during the summer the camp often reaches capacity. Recreational activities observed included driving (50 percent), fishing (30 percent), relaxing (10 percent), whitewater boating and bicycling (2 percent), and the remaining were other activities.

Table 41. Summary of estimated Pit River Canyon visitation in recreational days. (Source: PG&E, 2001)

Location	Season	RD day-use	RD night-use
Pit 3 reach	Last weekend in April to November 15	7,600	300
Pit 4 reservoir	Last weekend in April to November 15	900	0
Pit 4 reach	Last weekend in April to November 15	3,600	800
Deep Creek Campground	Last weekend in April to November 15	400	300
Pit 5 reservoir	Last weekend in April to November 15	300	1,000
Tunnel Reservoir	Last weekend in April to November 15	100	100
Pit 5 Reach	Last weekend in April to November15	600	400
PSEA Camp Shasta	April 8 to October 14	0	4,300
PSEA Camp Pit	April 8 to October 14	0	6,100
Day/overnight use overlap[a]		(3,100)	0
Total		10,400	13,300

[a] Day users who were also counted in overnight use were subtracted from the totals.

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[19] The Pit 3 reach is managed under reduced harvest regulations, with a minimum size limit of 18 inches and a catch limit of two fish.

The Pit 4 reservoir receives minimal use with less than one PAOT observed using the reservoir during the fishing season. Recreational activities observed at the Pit 4 reservoir included driving (52 percent), fishing (25 percent), relaxing (15 percent), and picking berries (9 percent).

At the Pit 4 reach, an average of 6 to 8 PAOT were estimated during the weekday period, about 10 to 13 PAOT during the weekend period, and peaked up to 50 to 65 PAOT during the opening of fishing season and Memorial Day weekends. Ruling Creek, Big Pine Deer Camp, Gravel Bar, and Deep Creek Campground were the most frequented areas. Recreational activities observed included relaxing (37 percent), driving (27 percent), fishing (18 percent), camping (10 percent), and the remaining were other activities, such as wildlife observation, whitewater boating, and woodcutting. The Pit 4 reach also has a high-quality trout fishery reputation.

Within the Pit 5 reservoir, bypassed reach, and Tunnel Reservoir, visitation ranged from 5 to 7 PAOT during weekends and peaked at about 40 PAOT during the opening of fishing season weekend. Day-use visits typically occurred at Bush Bar and camping use generally occurred around the Pit 5 reservoir, particularly on the south side. Recreational activities observed included driving (26 percent), fishing (25 percent), relaxing (23 percent) camping (14 percent), whitewater boating (4 percent), swimming (3 percent), and the remaining were other activities.

3.3.5.2 Environmental effects:

Recreation Management Plans

Recreation Plan

In its October 11, 2002, letter, PG&E proposes to develop within 1 year of license issuance a recreation plan for the project area, in consultation with the FS, CDPR, and the Tribe, that would include site design drawings and an implementation schedule. In addition, PG&E proposes to prepare a recreational site vegetation management plan in consultation with the FS and the Tribe within 1 year of license issuance that would address management of the overstory and understory at PG&E's existing and proposed developed recreational areas (see also section 3.3.3, *Terrestrial Resources*).

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop a Lake Britton facilities plan in consultation with the FS and other interested parties, within 1 year of license issuance. The plan would address recreational and sanitation facility development for the purpose of alleviating sanitation and recreational resource issues on lands adjacent to the lake, including FS lands. The FS also stated that PG&E should implement the plan upon FS approval and after filing the plan with the Commission.

In its October 9, 2002, letter, Interior recommended, as Section 10(j) and 10(a) measures, that PG&E develop a recreation management plan in consultation with the FS, FWS, NPS, CDPR, CDFG, SWRCB, the Tribe, AWA, California Trout, Trout Unlimited, and other interested stakeholders currently participating in the PRCT within 1 year of license issuance. The plan would examine the protection and maintenance of recreational activities relating to fish and wildlife resources, including angling and wildlife viewing and the effect of recreational activities on fish and wildlife resources. The plan would include the following:

(1) site-specific recreational PM&Es including facilities, erosion control related to recreational use, and access to both Lake Britton and the Pit River Canyon;

(2) a cost estimate for proposed PM&Es;

(3) an operations and maintenance plan for all recreational facilities and areas;

(4) a law enforcement strategy in coordination with the FS and appropriate county agencies;

(5) appropriate phases for construction of additional recreational facilities or resource protection measures based on use or resource condition triggers;

(6) a road maintenance and management plan, including appropriate road closures to protect sensitive species and cultural resources; and

(7) specific site designs for all phases of potential development.

The first phase of development identified in the plan would be implemented within 3 years of license issuance, with additional phases implemented based on monitoring and management triggers, or as directed in the plan. Prior to submittal of the plan to the Commission, PG&E would provide the consulting agencies with a draft of the plan and a 30-day review and comment period and would incorporate agency comments into the final plan or explain how agency concerns were addressed.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E develop a phased adaptive recreation management plan in accordance with the recreation management plan for the Pit River Canyon recreational facilities and dispersed-use areas. Management actions would be based on management indicator triggers that would be developed in consultation with the FS, FWS, NPS, CDPR, CDFG, SWRCB, the Tribe, AWA, California Trout, Trout Unlimited, and other interested stakeholders. Potential phases would include phase 1—annually monitor site effects and clean litter from the sites, educate visitors about self-contained sanitation facilities and fire regulations, increase Ranger contact/management presence to reduce law enforcement problems and encourage resource protection; phase 2—use natural appearing site modifications to limit amount of use so substantial effects are not created; phase 3—mark allowable camping locations with active (River Ranger) monitoring; and phase 4—several options discussed thus far include eliminate camping to preserve shoreline for day-users in heavily used areas, provide primitive-type restrooms, and provide primitive-type restrooms at some sites and close others off to camping.

In its October 9, 2002, letter, Interior also recommended, as a Section 10(a) measure, that PG&E develop a plan within 1 year of license issuance in consultation with the FS, the Tribe, and NPS to limit new recreational developments, such as campgrounds and day-use areas, that may affect cultural resource sites within the APE (see section 3.3.7, *Cultural Resources*). Prior to submittal of the plan to the Commission, PG&E would provide the consulting agencies with a draft of the plan and a 30-day review and comment period and would incorporate agency comments into the final plan or explain how agency concerns were addressed.

In its October 3, 2002, letter, CDFG recommended that PG&E develop a recreation plan in consultation with appropriate parties, such as the FS, CDFG, NPS, the Hat Creek TAC, CDPR, and locally active angling organizations. CDFG states that the Recreation and Resource Management Plan being developed by the Hat Creek TAC should be considered during the development of the project's recreation plan to help avoid conflicts and coordinate measures within the lower Hat Creek and Pit River watersheds.

In its October 9, 2002, letter, the FS made a Section 10(a) recommendation that PG&E develop a socioeconomic plan within 2 years of license issuance that would address how the project would provide economic value to the adjacent communities. The FS recommended that this plan include development of recreational facilities either on PG&E or other private lands to provide a better balance of public recreational opportunities; development of an economic action plan in consultation with various stakeholders; measures to assess economic effects on third-party water users as a result of PG&E's operation under new license requirements; and measures to ensure that the proper proportion of recreational use of the project is being provided to the public.

The FS, in its final 4(e) condition No. 26, recommends that within 1 year of license issuance, PG&E file with the Commission a recreation management plan developed in consultation with the FS, NPS, CDPR, FWS, CDFG, SWRCB, the Tribe, and other interested parties. PG&E would obtain FS approval on the components of the plan that affect National Forest System Lands, including final designs of any facilities on such lands, prior to submitting the plan to the Commission for approval. PG&E would consider sensitive resources in locating, designing, and constructing recreational facilities described in the plan. We describe the specific facilities and recreational enhancements recommended by the FS and other entities later in this section.

Our Analysis

PG&E's proposed recreation plan and recreational site vegetation management plan would provide measures to manage recreation resources over the term of any license. However, PG&E does not specify what would be included in the plans. We consider it to be appropriate to identify the specific plan components so that consulted entities and the Commission have a clear understanding of what would be include in the plan. We discuss such specific components later in this section.

The FS originally recommended Lake Britton facilities plan would provide the means to manage sanitation measures related to recreational use associated with the Lake Britton area. Recreational use within the project area has led to the need for sanitation management in the area surrounding Lake Britton and areas associated with project facilities within the Pit River Canyon. Therefore, we concur that sanitation management measures should be incorporated in the development of any project recreation plan.

Interior provided recommendations for specific components to be included in a recreation management plan. We concur that several of the recommended items should be included in a project recreation plan, including a description, preliminary designs, and cost estimate for the proposed recreation PM&Es, and operations and management measures for all project-related recreational facilities. These measures would provide an inventory of the existing and proposed recreation facilities and operations and maintenance measures that would help in the management of project-related recreation resources over the term of a new license. We do not recommend that PG&E provide as part of the recreation management plan a law enforcement strategy or road maintenance and management plan. We do not consider it to be a licensee's responsibility to develop law enforcement strategies. We consider it most appropriate to address road maintenance and management as a stand alone plan, rather than as a component of a recreation management plan, although we agree that there are inter-related elements. In section 3.3.6, *Land Use Resources*, we discuss recommendations related to road management and law enforcement issues.

Interior also recommended that PG&E incorporate resource condition triggers and an adaptive recreation management plan that would guide management actions based on indicator triggers. We concur that PG&E should identify recreation monitoring indicators that would help define the minimum acceptable conditions for recreation-related conditions associated with the project's recreation facilities. Monitoring would also help to determine when new recreational facilities or enhancements may be needed. Monitoring these indicators would help guide management of the recreation resources in an adaptive manner over the term of a new license.

Interior recommended that PG&E develop a plan to limit new recreational development that may affect cultural resource sites within the APE. We concur that PG&E should provide measures to assess the potential effects of proposed facilities on the project area's sensitive resources and develop appropriate site-specific mitigation measures, if needed, and coordinate the development of the plan with other resource plans, such as the HPMP. These measures would help ensure that future recreational development would not have an adverse effect on cultural and sensitive resources within the project area.

CDFG's recommendation that PG&E develop a recreation plan that would be coordinated with the Recreation and Resource Management Plan being developed by the Hat Creek TAC and consultation with the TAC would help to coordinate measures related to recreational facility management and development within the lower Hat Creek and Pit River watersheds. Therefore, we concur that PG&E include the Hat Creek TAC as a consulting party in the development of the recreation management plan.

A recreation management plan for the project area would help coordinate the development, management, and maintenance of recreational opportunities and facilities associated with the project. In addition, developing a recreation management plan as part of a LHMP (see section 3.3.6, *Land Use Resources)* would help ensure that the development and management of recreational facilities is coordinated with other resource management plans for the project area. As discussed below and in section 3.3.3, *Terrestrial Resources*, and section 3.3.1, *Water Resources*, some of the issues related to recreational use within the project area are associated with effects of recreational use on sensitive resources, such as the bald eagle and cultural resources, and the need to limit recreational facility development and control recreational access. Other issues relate to facilities that are at or near capacity, such as periods of near or over capacity recreational use at Burney Falls Park, and whether additional facilities should be developed to accommodate increased demand. A recreation management plan would provide the means to address capacity issues and measures to control dispersed use that would, in turn, help limit the adverse effects of recreational use on project-area resources.

We do not recommend that PG&E develop a socioeconomic plan as the FS recommended. The recommended recreation management plan would provide measures to ensure that public recreational access and facilities are provided within the project area. It is outside of the Commission's jurisdiction to require the licensee to develop an economic action plan that would necessitate a regional assessment of economic factors and to assess the economic effect on third-party water users.

Recreational Use and Monitoring Plan

In its October 11, 2002, letter, PG&E proposed to develop a recreational use and monitoring plan in consultation with the FS, CDPR, and the Tribe within 1 year of license issuance. The recreational use and monitoring plan would provide measures to assess levels of recreational use, the need for additional resource protection measures, and the need for facility expansion. The plan would define recreational monitoring indicators, such as recreational facility occupancy rates, dispersed site occupancy rates, perceived crowding, reservoir boating use levels, river shoreline use densities, number and area of user created dispersed areas, litter and debris, recreational facility condition, and cultural resource, bald eagle, aquatic, and water quality effects. The plan would also include standards that would help define the minimum acceptable condition for each indicator. The plan would identify the frequency the indicators would be monitored and measures for stakeholders to meet to discuss monitoring results. The results of the monitoring would be used to help determine if recreational use should be limited due to effects on resources or if recreational use would be allowed to grow and additional facilities constructed to accommodate growth in recreational use.

The FS recommended, as a preliminary Section 4(e) condition, that PG&E consult with the FS, appropriate agencies and interested parties in the form of an in-person meeting every 6 years (coinciding with the FERC Form 80 submittals) to review and adjust project-area recreational management objectives. The FS recommended that, at a minimum, the review address capacity, including developed and dispersed sites, roads, trail, water bodies, and river reaches; types and condition of facilities; types, quality, quantity, and range of opportunities; health and safety; and user and resource conflicts. The FS final 4(e) condition No. 26 is similar to the preliminary condition, but adds two items for discussion during the review meeting: possible strategies and adjustments to management of facilities and dispersed areas in order to mitigate negative impacts and changes in ADA guidelines and possible modifications to facilities planned or constructed.

In its October 9, 2002, letter, the FS also recommended, as a preliminary Section 4(e) condition, that PG&E conduct a recreational survey and prepare a report on recreational resources once every 6 years from the date of license issuance. The FS recommended that the recreational survey include, but not be limited to, questions related to changes in the type of use and use patterns on both water and land surfaces; user preferences in recreational activities; kinds and sizes of RVs, including boats; preference for day use versus overnight use; and recreational user trends within the project area. In addition, the FS recommended that PG&E monitor boat use numbers and activity types from Memorial Day weekend through Labor Day weekend on all areas of Lake Britton and incorporate this information into the FS's recommended report on recreational resources, and that report include a summary of the regional and statewide trends in recreation based on available surveys and reports. The survey methods would be reviewed and approved by the FS and a copy of the survey results would be provided to the FS. Finally, the FS recommended that the report comply with the Commission's regulations at 18 CFR Section 4.51(f) and be filed with the Commission after FS approval. The FS final 4(e) condition No. 26 is similar to the preliminary 4(e) condition, except the FS corrects the Form 80 regulation citation to 18 CFR Section 8.11. The FS also recommends that recreational monitoring and reporting procedures be included in a plan developed within 1 year of license issuance, in consultation with the FS, CDPR, NPS, FWS, and SWRCB.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E, in accordance with the development and implementation of the recreation management plan and in consultation with the PRCT and other stakeholders, determine the preferred management option for accommodating or limiting use when recreational resources and facilities reach capacity based on monitoring and management triggers. Potential options would include completely limiting additional campground expansion; expanding Dusty Campground by two to five sites; increasing North Shore Campground site density; or constructing a new campground at Ferry Crossing, the bluff adjacent to PSEA Camp Britton, or the bluff adjacent to PSEA Camp Shasta.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E, in accordance with the development and implementation of the recreation management plan and in consultation with the PRCT and other stakeholders, develop a recreation monitoring plan. The recreation monitoring plan would require PG&E to provide a report to the Commission every 6 years in conjunction with the FERC Form 80 submittals. At a minimum, the report would include the following:

(1) annual recreational use figures by activity;

(2) a discussion of the adequacy of PG&E's recreational facilities at the project to meet recreational demand;

(3) a description of the methodology used to collect all study data;

(4) if data indicate that established management triggers have been reached, a proposal and development schedule to implement the next phase of recreational development, per the submitted adaptive recreation management plan;

(5) identification of unforeseen management factors or issues that were not addressed in the original recreation management plan;

(6) documentation of agency consultation and agency comments on the draft report prior to submittal to the Commission; and

(7) specific descriptions of how the consulted parties' comments are addressed or reasons why they were not adopted.

Interior recommended that monitoring would include the following locations and measures: Dusty Campground visitor effects; Pines picnic area visitor effects and resource protection and erosion control measures; boat launch parking area use; request for Sheriff boat patrol officers to conduct 2 p.m. Lake Britton water-surface boat counts on the weekends from Memorial Day to Labor Day every 6 years; summary of annual boating accident information; bald eagle breeding and foraging success; day-use effects and need for additional day-use facilities; and effectiveness of boulders and road closures to protect sensitive resources. Interior recommended that PG&E allow a minimum of 30 days for agency comments and recommendations prior to filing the report with the Commission and hold one meeting with stakeholders and agencies at the end of the 30-day comment period to review monitoring results and, if appropriate, develop management options to address potential future safety, carrying capacity, and resource concerns.

Our Analysis

A recreation monitoring plan would provide the means for the assessment of the adequacy of the recreational facilities and assessment of the effects of recreational use on the project area's resources over the term of the license. The recreation monitoring plan would provide measures to assess recreational-use capacity issues and the opportunity to adjust recreational facility development and management over the term of the new license. This would help ensure that minimal adverse effects on the project area's sensitive resources, such as cultural resources, would occur from project area recreational use.

PG&E's proposed recreation monitoring plan and development of recreation indicators would help provide the means to monitor recreational resources over the term of a license. In addition to PG&E's proposed plan, the FS-recommended consultation and recreational survey and report every 6 years (to coincide with the FERC Form 80 submittals) would provide data and information to help determine the appropriate measures for recreational management. Both the FS and Interior provide recommendations for specific data collection measures and monitoring locations. We suggest that the methodology and extent of the data collection and information to be incorporated into the recreational survey and report be determined through consultation in the development of the recreation monitoring plan. This would provide the opportunity for input from all of the consulted parties during the development of the plan. Interior's recommendations for including measures to apply the results of the monitoring, and identification of unforeseen factors that were not addressed in the original recreation management plan would also help in the long-term monitoring of project-related recreational resources.

Interpretive and Education Plan

In its October 11, 2002, letter, PG&E proposed to develop an I&E plan for the Lake Britton and Pit River Canyon areas in consultation with the FS, CDPR, and the Tribe within 1 year of license issuance. The I&E plan would provide information about topics such as the Pit River Hydroelectric System, Native American history, local history, and project area aquatic, botanical, and wildlife resources. The I&E Plan would also provide the public with information on appropriate recreational behavior such as leave-no-trace practices, fire safety, and potential consequences of effects on recreational resources. The I&E plan would include information about resource management that is occurring and planned for the projects area; maps showing recreational roads, parking areas, developments, and trails; and information related to publically available real-time river flow.

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop an interpretive, education, and public information plan within 2 years of license issuance in consultation with the FS and appropriate agencies and interested parties. The plan would include themes, design, audience, delivery methods, and schedule for implementation. In addition, the FS recommended specific projects as part of the plan, including: (1) informational kiosks at 5 Corners, Pit 3 powerhouse, Big Bend Interagency Fire Station, Jamo Point boat launch, or other locations as agreed upon; (2) interpretive signs at Highway 299 and the Red Cinder Road, Highway 299 and Sand Pit Road, Pit 3 dam, Big Bend Road and Pit 5 Powerhouse Road, and other locations as agreed upon; (3) brochures of various topics including a scenic loop drive; and (4) an informational web site. The FS stated that the I&E plan would provide the means to coordinate the types and delivery of information to assist existing recreation users and orient potential users to project resources. The FS final 4(e) condition No. 26 is similar to the preliminary 4(e) condition and the FS recommends that the plan be developed in consultation with the FS, CDPR, NPS, FWS, CDFG, the Tribe, and interested parties.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E, in accordance with the development and implementation of the recreation management plan, develop an interpretation and education plan that addresses wildlife information, hydro system operation and history, local history, Native American history, human resource effects, appropriate behavior (fire use, leave-no-trace ethics, etc.), management direction and changes users would see, and ADA-accessible facilities that are available in the project area. The plan would include one or more of the following methods: interpretive signs; brochures; information included in other publications, such as area guides; viewing platforms or areas; and directional signs. The plan would include detailed costs, operations, and maintenance plans for establishing River Road as a scenic driving tour with interpretation and education stops shown on both road signs and a brochure; developing, printing and distributing a river access map showing trails, trailheads, dispersed and developed camping area; trail and dispersed area sign posts along River Road; angling regulations and fish pictures on interpretation and education signs; and provisions for the establishment of a vista point along the upper Lake Britton riverside road with appropriate interpretation and education signs. Interior stated that other appropriate locations for interpretation and education signs would include: Pit 3 dam; the 5 Corners area of Lake Britton; Jamo Point; Hat Creek Park (in coordination with Shasta County); Burney Falls State Park day-use area; the proposed Lake Britton day-use area; Pit 3 and 4 powerhouses, Pit 4 overlook and penstocks; future campsites; future whitewater put-ins and take-outs; and directional signage at Highway 299/Big Bend intersection and at Big Bend Road and Hagen Flat Road intersection.

Our Analysis

Development of an I&E plan would help provide a means to disseminate information regarding project area resources and management issues to members of the public who are using the project area. This information would provide a means to help educate the public about safety factors to consider within the project area, and the potential effects of recreational use and ORV use on sensitive project area resources. Accordingly, we concur with the need for an I&E plan as proposed by PG&E and recommended by resource agencies.

Recreational Facilities and Access

PG&E did not originally propose any specific recreational enhancements. In addition, in its October 11, 2002, letter, PG&E stated that recreational development should be at the level to accommodate the existing use and be expanded only to accommodate future growth if such growth and recreational development can be accomplished without posing substantial effects on natural and cultural resources and desirable recreational experiences. PG&E also stated that modification to trails should be made only to restore and protect sensitive resources and that site development should be intended to control use and related resource damage rather than to encourage more use of the area. In the following sections, we discuss agency-recommended recreation facilities and access at the project.

Lake Britton Area

Trails and Dispersed Areas

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E close the parking area (located due north of the Hat Creek fish barrier) on the north side of the lake. In addition, the FS recommended that PG&E maintain recreational access to FS and PG&E lands on the south side of Hat Creek and at the fish barrier parking area, and construct a hardened ADA-accessible path, compatible with the ROS classification, for fishing access to the river. The FS final 4(e) condition No. 26 is consistent with the preliminary 4(e) recommendation.

In its October 9, 2002, letter, the FS recommended, as a Section 10(a) measure, that PG&E reconstruct and operate the Hat Creek Park to provide ADA-accessible day-use river fishing. The FS recommended that improvements include new restrooms, ADA-accessible picnicking facilities, and an ADA-accessible river fishing access. The FS revised final 10(a) recommendations, filed with the Commission by letter dated November 14, 2003, do not include this measure. The FS also recommended that PG&E maintain the road to the Hat Creek south parking area to provide recreational access to the river. The FS revised final 10(a) recommendation is consistent with its earlier recommendation.

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E improve and maintain the road to the car-top boat launch south of the gas pipeline, in the upper (eastern) Lake Britton area (see figure 12), by grading and cindering the road and cindering the launch ramp. The FS final 4(e) condition No. 26 is similar to its preliminary recommendation, but specifies that PG&E should improve the usability of the car-top boat launch by improving the road into the site to a FS maintenance level 3 or higher and adding sanitation measures. Interior recommended, as a Section 10(a) measure, that PG&E keep the gas line gate in the upper Lake Britton and Hat Creek area open until the end of each calendar year to allow access through the majority of the waterfowl hunting season (see also section 3.3.6, *Land Use and Aesthetic Resources)*

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E consult with the PRCT stakeholders and the Tribe to evaluate management options for the Ferry Crossing area. Interior recommended potential management options, including: maintaining walk-in and boat-in only access to the shoreline with more frequent monitoring and clean-up and leaving parking where it exists near 5 Corners; moving parking farther down the road to improve access and providing restrooms near the parking area with no other improvements; fully developing walk-in campsites and a day-use area to help disperse recreation around the lake with mitigation or diversion measures from sensitive resource areas; and limiting access to this area complete with law enforcement measures to enforce closure.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E install pedestrian warning signs on both sides of Clark Creek Road to increase safety for visitors using the PCT and accessing the Pit 3 reach at the Pit 3 dam. Interior also recommended that PG&E develop a parking strategy that evaluates the feasibility and options for providing additional, safer parking on the north side of the dam and implement that parking strategy within 2 years of license issuance.

In its October 9, 2002, letter, the FS recommended, as a Section 10(a) condition, that PG&E construct and maintain a 0.33-mile-long hiking trail from Lake Britton at the mouth of Clark Creek easterly to Clark Creek Falls. The FS also recommended, as a preliminary Section 4(e) measure that PG&E in consultation with the FS, create an interpretive drive loop road from existing roads on the north side of Lake Britton, part of which is the Red Cinder Road between Highway 299 and Soldier Creek, to include road cindering, locational and interpretive signing and/or brochure, and designated and improved scenic viewpoints. In its comments on the draft EIS dated May 19, 2003, the FS stated that the recommendations for the trail near Clark Creek and the interpretive drive are withdrawn as recommended 10(a) and 4(e) conditions. However, the FS final 4(e) condition No. 26 states that PG&E should work with the FS and interested parties to develop measures to maintain and upgrade existing trails around Lake Britton, including Clark Creek Falls Trail, in order to decrease erosion and increase usability.

In its October 9, 2002, letter, the FS recommended, as preliminary Section 4(e) and Section 10(a) measures, that PG&E construct a new day-use area on Lake Britton within 3 years of license issuance. The new day-use facility would include a regularly maintained sandy beach area, restrooms onsite or nearby, access by road, parking, trash collection, regular monitoring by a host or licensee employee, and law enforcement patrol. The FS recommended that potential locations for the facility include the Ferry Crossing area or between the Pines picnic area and Jamo Point boat launch. The FS stated that a new day-use area would help to facilitate access and use of the project area by visitors. The FS final 4(e) condition No. 26 modifies its preliminary recommendation for a new day-use area. The final 4(e) condition states that within 3 years of license issuance, PG&E would provide additional beach day-use capacity around Lake Britton that would increase the existing capacity by 100 PAOT. PG&E would concentrate on enhancing existing sites or disturbed areas before any new locations are considered. Possible locations to be considered include the exiting Pines picnic area, the North Ferry Crossing area, and North Shore Campground. Day use areas would include the following: regularly maintained beach sand, if needed; access to the shore designed to minimize erosion; restrooms on site or nearby; access by road or boat; designated parking, if access is by road; trash collection; and regular monitoring by a host or PG&E employee.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E identify the most feasible location for an additional day-use beach, in consultation with the PRCT recreation subgroup and the Tribe, to be located near the Interior-recommended RV camping area near the Highway 89 Bridge North or other site along the north side of Lake Britton. Interior also recommended that PG&E determine the feasibility of providing potable water at this site or another site along the north side of Lake Britton.

Interior also recommended, as a Section 10(a) condition, that PG&E work with the California Department of Transportation (CalTrans) to design a CalTrans-funded Highway 89 entrance improvement. Interior also recommended that PG&E evaluate options for locating a day-use beach on the shoreline between Jamo Point boat launch and Pines picnic area in consultation with the PRCT recreation subgroup and the Tribe, and if a beach is constructed in this area, leave the beach open for the shoulder season.[20] In addition, Interior recommended that PG&E continue the fall and spring facility inspection and maintenance program.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to close the parking area due north of the Hat Creek fish barrier, improve the cartop boat launch near the gasline crossing of Lake Britton, evaluate management options for the Ferry Crossing area, and cooperate with Shasta County regarding installation of pedestrian warning signs at the Clark Creek Road crossing of the Pit 3 dam.

Our Analysis

The results of the recreational-use survey conducted by PG&E in 2000, indicated the desire for small-scale improvements in the upper Lake Britton and Hat Creek fish barrier areas. Maintaining and enhancing recreational access to this area would provide the means to ensure that public recreational access would be provided to this portion of the project area over the term of any new license. Recreational use should be provided in a manner so as not to conflict with the project area's sensitive resources, such as archaeological sites and bald eagle nesting and foraging areas. Therefore, we concur with the resource agencies that PG&E should provide for public access to this portion of Lake Britton, but any such

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[20] Although Interior does not define shoulder season, it is typically defined as the period of recreation activity prior to and after the primary recreation season (i.e., spring before Memorial Day weekend, and fall after Labor Day weekend).

facilities should be developed after careful consideration of the potential effects on this area's sensitive resources.

We concur that PG&E should close the parking area located due north of the Hat Creek fish barrier because of its proximity to sensitive resources in this area. Closing this area to the public would better protect these resources from vandalism and inadvertent disturbance. We also concur that PG&E should provide measures to improve the car-top boat launch south of the gas pipeline and keep the gas line gate open from the last Saturday in April through December 31 to allow access through the majority of the waterfowl hunting season. These types of enhancements would be consistent with the user-identified desire for small-scale improvements at upper Lake Britton and the Hat Creek fish barrier areas. We do not recommend that PG&E provide upgrades to Hat Creek Park, as originally recommended by the FS, because Shasta County currently operates Hat Creek Park, and the park is located outside of the project boundary and is not associated with project lands or waters.

The Ferry Crossing area currently provides informal recreational access to the lower Lake Britton area. The lower Lake Britton area receives the highest recreational use within the project area. The development of more formalized recreational facilities in this area would provide more managed recreational access in the Ferry Crossing area. Therefore, we agree that PG&E should assess upgrade and management options associated with the Ferry Crossing area, as Interior recommends, to include maintaining existing access with more frequent monitoring and providing trash receptacles, or upgrading the access area through provision of restrooms, picnic areas, trash receptacles, and parking upgrades or expansion. We conclude that this assessment should take place even if an alternative location for increased day-use capacity is agreed upon, because we expect that the on-going informal public use of this area would continue, and strategies to address this continued use should be in place. The assessment and resultant recommendations could be included as a component of a recreation management plan. In addition, to help ensure public safety in the area along Clark Creek Road that is used by persons recreating at Lake Britton and the upper portion of the Pit 3 bypassed reach, we conclude that PG&E should provide pedestrian warning signs on Clark Creek Road, and assess the feasibility and options for providing additional and safer parking on the north side of the Pit 3 dam.

There are numerous existing trails in the Lake Britton area, including the 1.3 mile Clark Creek Falls Trail, located in the vicinity of the new Clark Creek Trail, originally recommended by the FS. We agree that PG&E should cooperate with the FS in the provision of measures to maintain and upgrade (i.e., address soil erosion problems) existing trails within the project boundary surrounding Lake Britton. Therefore, we do not recommend that PG&E provide a new hiking trail at Clark Creek. The development and implementation of an interpretive driving loop, as originally recommended by the FS, would entail development of facilities mostly outside of the project boundary with no specific connection to the project facilities and the provision of public recreational access. Therefore, we do not recommend that PG&E develop an interpretive driving loop for the project area.

Currently, recreational use of the lower Lake Britton area is at or near capacity at certain locations and periods. As we discussed during the August 28, 2003, 10(j)/FS clarification meeting, overcrowding at recreational facilities can be addressed effectively by several approaches: (1) restricting available parking and directing the public to alternative areas; (2) expanding existing facilities; or (3) creating new facilities (see Commission's meeting summary issued September 22, 2003). The best approach for a specific area entails a certain degree of judgement. The upgrade and expansion of existing facilities would help to limit potential adverse effects of recreational use on the project area's sensitive resources, compared to the creation of additional new recreational access areas within the Lake Britton area. Therefore, we do not recommend that PG&E develop a new day-use area or new day-use beach at Lake Britton area at this time.

However, we agree that increasing the beach day-use capacity by 100 PAOT within 3 years of license issuance, as specified in the FS final 4(e) condition, instead of constructing a new day-use area, would serve to gain control over informal public swimming that already is occurring and enable establishment of protective measures for sensitive resources and public safety to be implemented. Providing an increase in day-use capacity at Lake Britton would also enable project facilities to better meet the recreational needs of the area. We also agree that PG&E should, as part of a recreational monitoring plan, monitor future recreational use in this area and identify recreational capacity triggers as part of that plan. This would provide the means to assess specific recreational facility demands over the term of the new license. At such time that recreational capacity triggers are reached, PG&E could provide an assessment and recommendation for the provision of additional facilities or measures (such as limiting recreational access at certain locations once capacity is reached and informing the public of alternate recreational facilities) to address the capacity issues.

Campgrounds

Dusty Campground—In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E on a schedule approved by the FS improve facilities at Dusty Campground, including: adding picnic tables to all campsites, constructing or modifying one campsite and adjacent restroom to be ADA-accessible, adding up to four campsites; developing a potable water source within the campground; maintaining and augmenting sand at the beach area; and, after approval by the FS, expanding the beach area, designating a swimming beach area to separate swimming and wading from boat beaching and mooring; and continuing to manage and maintain the campground under an operations agreement with the FS. The FS final 4(e) condition No. 26 is consistent with its preliminary recommendation and specifies that PG&E should better define the parking areas for day use to help with overcrowding issue and parking competition with overnight users.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E provide enhancements to Dusty Campground, including: providing inter-visible turnouts on access roads to the campground to allow vehicles to pass each other; installing and maintaining a sign at the highway turnoff to indicate that the campground is not designed for trailers; expanding the access road turnaround; installing and maintaining buoys at the swimming area to establish separation from boats; limiting the expansion of the existing day-use area and providing interpretive signs to inform users of alternate day-use sites in the area; providing picnic tables at existing campsites; moving the ADA site to campsite 5; providing three to five shoreline picnic tables, with one ADA-accessible, near campsite 5 and the day-use parking area; continuing to provide yearly maintenance at the beach area; and limiting the expansion of the campground to prevent intrusion into sensitive resource areas.

In its October 9, 2002, letter, CDPR stated that demand for quality campsites is increasing within the project area and recommended that PG&E upgrade Dusty or North Shore campgrounds to provide a comparable camping experience to the frequently full Burney Falls Park Campground.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to develop plans for the following at Dusty Campground: limited day use expansion; I&E signs identifying alternative day use areas; at least one new campsite; shoreline picnic tables; ADA campsite adjacent to a restroom; potable water; a designated swim beach; and options to reduce shoreline erosion.

North Shore Campground—The FS recommended, as a Section 10(a) measure, that PG&E consult with the FS and implement improvements to North Shore Campground within 3 years of license issuance. The recommended improvements include: installing flush toilets and showers; creating and maintaining beaches on the west shore of the campground and at the old launch ramp; instituting measures to reduce shoreline erosion due to beach use; designating swimming areas to separate swimming from boat mooring and beaching; and providing directional entrance signage at Clark Creek Road and the campground access road. The FS also recommended that PG&E keep the North Shore Campground open through September and continue maintenance and policing. The FS revised final 10(a) recommendation is consistent with its original recommendation.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E evaluate the need for and feasibility of constructing additional road pullouts on the North Shore Campground access road. In addition, Interior recommended that PG&E implement the following measures at the North Shore Campground, including: continuing to provide a campground host and authorizing the host to sell firewood and ice; allowing boat launch access for campers only, to be regulated by the campground host; implementing ADA-upgrades for the facilities; providing and maintaining beaches with possible locations at west cove, east bluff, and old east cove boat launch area; providing swimming buoys from east bluff across east cove; building and maintaining a swimming platform inside the buoyed area; providing 10 to 15 parking spaces for day-use only near the boat launch or east bluff beach access areas; providing showers and flush toilets; and installing a larger entrance sign at Clark Creek Road.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to do the following at the North Shore Campground: shoreline erosion control measures; designated swim beach; designated boat beaching or mooring area; directional signs; and road improvements, as needed. Consideration is also being given to providing firewood and ice, additional day use parking, and seasonal restrictions to protect nesting bald eagles.

New Campground Sites and Areas—In its October 9, 2002, letter, the FS recommended, as a Section 10(a) measure, that PG&E construct a new campground at Lake Britton to accommodate up to 40 sites when the North Shore Campground reaches 70 percent occupancy on weekends between Memorial Day and Labor Day. The new campground would include: water; flush toilets; showers; paved interior roads and spurs; and, if feasible, hookup sites for RVs. Possible locations would include the North Ferry Crossing or near Camp Shasta.

The FS has modified its original 10(a) recommendation pertaining to new camping capacity and combined it with its final 4(e) condition No. 26. The final 4(e) condition would require PG&E to provide 25 percent more public overnight developed camping units over the life of the license (an increase of 39 sites). At least half of the capacity would be added during the first 10 years from license issuance and the balance within 15 years of license issuance. Additions to capacity should be within the project boundary or within a 1.5 mile radius of project waters. New capacity would emphasize expansion of existing sites and use areas over the development of new sites and use areas. As a component of the FS revised final 10(a) recommendation, the FS indicates that a portion of the total overnight capacity requested should be met by PG&E funding a portion of the California State Parks Master Plan for the McArthur-Burney Falls State Park, in order to increase single-family overnight camping capacity near the project. The CDPR would own and manage all facilities constructed with these funds.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E determine the preferred management option for accommodating or limiting use when recreational resources and facilities reach capacity, based on monitoring and management triggers. Interior recommended several potential options, including completely limiting additional campground expansion; expanding Dusty Campground by two to five sites; increasing North Shore Campground site density; or constructing a new campground at Ferry Crossing, the bluff adjacent to PSEA Camp Britton, or the bluff adjacent to PSEA Camp Shasta.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E design and develop an overflow RV camping area on the future abandoned bridge site at Highway 89 Bridge North. Interior also recommended that PG&E design and develop a walk-in, reservation group camping area north of the Pines picnic area and provide potable water and construct ADA-accessible picnic tables, trails, and restrooms.

Our Analysis

Based on our review of PG&E's recreational use report, Burney Falls State Park Campground during the 1999–2000 season reached capacity during the prime recreational season, primarily from late June to late August. Dusty and North Shore campgrounds were between 50 to 60 percent capacity on average during the summer months and between 70 to 90 percent capacity on the weekends during this period, with Dusty Campground receiving a higher level of use. The results of the 2000 recreational survey assessment indicate that upgraded facilities or a new campground on the lake would partially satisfy unmet demand during the period when Burney Falls State Park Campground is full. The results indicate that less than 20 percent of the Burney Falls State Park campground users felt that either the North Shore or Dusty campgrounds were satisfactory substitutes in their current state. Recreators stated a preference for the development of additional potable water locations, additional picnic tables, flush toilets, and in some areas, trash cans and fire rings or grills at the existing campground facilities.

Additional management and enhancement measures would help address the existing recreational-use demand within the project area and to help ensure that potential adverse effects on project area resources do not occur as a result of recreational use (e.g., cutting standing timber for firewood, use of informal latrines near the edge of Lake Britton, increased turbidity from bathing at the informal "beach" at North Shore, increased erosion at areas used for bathing and boat access). We conclude that PG&E should provide additional management and enhancement measures at Dusty and North Shore campgrounds. Furthermore, we would encourage PG&E to continue to manage and maintain the Dusty Campground under an operations agreement with the FS.

At this time, we do not recommend that PG&E keep the North Shore Campground open through September and continue maintenance and policing because there is no demonstrated need for extending the season at this location. As we explain later in this section, we now agree with the need for PG&E to provide for trash removal and maintenance of rest room facilities at the Jamo Point boat launch and Pines picnic area on weekends through September, which would facilitate public access to project waters during this period of diminishing recreational use. We do not see the need to provide for additional public access by keeping the North Shore Campground open through September. Although the Commission is responsible for ensuring reasonable public access to project waters, it is not responsible for ensuring that recreators have overnight accommodations adjacent to project waters.

We also do not recommend that PG&E allow boat launch access for campers only, as recommended by Interior. Our understanding is that the existing informal boat launch has been closed to minimize potential disturbance of nearby bald eagles nests. If the informal boat launch should be opened in the future, restricting the use of the launch to campers only could serve to minimize potential disturbance to eagles, but we consider it most appropriate to address measures to avoid disturbance of bald eagles in an updated Interagency Bald Eagle Management Plan.

Finally, we do not recommend that PG&E build and maintain a swimming platform inside the buoyed area because no justification of why such a platform should be required as a license provision has been provided. We agree, that if bathing at this campground is to be promoted (which may not necessarily be consistent with a goal to minimize disturbance of nearby bald eagles), a platform within the designated bathing area could be an appropriate amenity. However, we do not consider this to be a necessary enhancement that the Commission should require of PG&E. We do agree that PG&E should authorize the host to provide firewood at the North Shore Campground (either by sale or free of charge at specified locations) because doing so would help to reduce the frequency of campers obtaining firewood (living or dead) from the vegetation in the surrounding area. Although the sale of ice would also be an attractive amenity, we do not consider it to be appropriate for the Commission to require that it be sold.

We do not recommend the development of new campgrounds at this time for reasons similar to our reasons for not recommending the development of new day-use or beach access areas. Creating new campgrounds, rather than upgrading and expanding existing campgrounds, would open up areas that are currently relatively undisturbed to new human-induced effects associated with most campgrounds. Considering the abundance of sensitive resources in the vicinity of Lake Britton (e.g., bald eagle nesting habitat and cultural resources), creating new focal points of recreational activity would be more likely to have incrementally greater effects than implementing carefully controlled expansion of existing sites.

The upgrade and expansion of existing facilities would help to limit potential adverse effects of recreational use on the project area's sensitive resources as compared to the creation of additional new recreational access areas within the Lake Britton area. We concur with the approach taken in the FS final 4(e) condition that provision of new overnight camping capacity should emphasize expansion of existing camping areas. The existing campground at McArthur-Burney Falls State Park is outside the existing project boundary (see figure 12), and therefore beyond the Commission's jurisdiction, unless a nexus to project purposes can be established. We would not recommend that the Commission require PG&E to contribute funds to CDPR that could be used to address overnight campsite shortages in the area. However, if a set capacity increase of 39 sites is established, as specified in the FS final 4(e) condition, and PG&E contributes funds to CDPR to meet that goal, we would expect the new sites that such funding would provide to be credited to the net capacity increase goal. We also conclude, that PG&E should explore capacity management triggers and options to address capacity issues at the campgrounds surrounding Lake Britton, such as potential locations and the potential effects of facility development on sensitive resources, as part of a recreation monitoring plan. This would help provide a mechanism to assess capacity issues and the effects of recreational use on sensitive resources over the term of a new license.

Boating Access and Management

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) measure, that PG&E, within 1 year of license issuance, implement several measures related to boating use management, including the following:

- Increase the amount of lake area open to fishing, change the no boating buoy line at Ferry Crossing to a 5 mph speed zone, and, in consultation with interested agencies, establish a new "no boats" buoy line closer to the Pit 3 dam in accordance with applicable regulations.

- Change the Highway 89 Bridge "no ski" zoning to a 5 mph speed restriction from the Highway 89 Bridge to the end of the narrow channel before reaching Dusty Campground and work with Shasta County to modify the current county ordinance so that the county would enforce the speed limit.

- Continue the existing 5 mph speed restriction on upper Lake Britton and Hat Creek area.

- Beginning the season following issuance of a new license and annually thereafter, monitor for high-speed boating use conflicts with bald eagles during the morning bald eagle foraging hours in upper Lake Britton between Highway 89 Bridge and east end of Slalom Bay between April 1 and August 1. If the water-based use increases by 20 percent over baseline, a speed limit of 5 mph between dawn and 9 am until August 1 would be enacted if considered necessary by the FS, and PG&E would seek a Shasta County ordinance to implement the speed limit and would post and enforce the rule.

The FS final 4(e) condition No. 26 is consistent with the concepts presented in its preliminary recommendation and specifies that the "no boating" barrier be moved as originally recommended, but recognizes that establishing boating restrictions is beyond the Commission's jurisdiction to require of a licensee. Instead, the final condition calls for PG&E to establish a reservoir water surface zoning plan that documents existing speed zones and displays recommended changes. PG&E would recommend the boating restrictions specified in the preliminary recommendation for Shasta County approval and pursue with the county additional modifications recommended during annual monitoring meetings or, as the result of other license planning efforts.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E move buoys in the Pit 3 dam area from the existing location to a location closer to the dam create a 5 mph speed zone in an expanded area to provide additional boat fishing and swimming opportunities. Interior also recommended other boating management options, including surveying boaters for management option acceptance; charging fees to reduce usage and cover increased management costs; implementing a one-on/one-off policy at boat launches; implementing speed limits; or restricting certain types of watercraft and/or activities.

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E within 2 years of license issuance, make the following modifications and improvements at Jamo Point boat launch area, in consultation with the FS: modify the existing boat launch to provide an ADA-boat loading platform; modify the fishing platform to accommodate a fluctuating water level and to make it ADA-accessible; designate parking space for vehicles with trailers and require the site host to monitor for compliance; provide a picnic table between the restroom and shoreline; and develop a potable water source at Jamo Point boat launch or Pines picnic area. The FS final 4(e) condition No. 26 is consistent with its preliminary recommendation except that the provision to modify the fishing platform to accommodate a fluctuating water level is eliminated and the potable water source is to be accessible to recreationists at all times. The FS recommended, as a Section 10(a) measure, that PG&E extend the term of the host at Jamo Point boat launch until September 30 to keep the facility clean and orderly, and that PG&E extend the season of the Pines picnic area by opening the facility on weekends in September. The FS revised final 10(a) recommendation is consistent with its preliminary recommendation.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E provide a host presence along the north side of Lake Britton; improve use of parking lots by stenciling curbs or spaces; continue to maintain and clean restrooms through the shoulder season, and provide a solar fan for a restroom vent; install and implement ADA improvements and evaluate other options to improve accessibility of the boat launch and fishing dock; install a sign that prohibits shoreline fishing between the boat launch and fishing platform; and redesign or modify the Jamo Point fishing platform to accommodate a fluctuating water level.

Interior also made an additional Section 10(a) recommendation that PG&E not increase boat trailer parking at the boat launches and that PG&E maintain the upper Lake Britton boat launch as a car-top launch with no improvements to accommodate trailered boats. In addition, Interior recommended that PG&E boulder Ferry Crossing ramps to prohibit use by trailered boats.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to move the no boating buoy line closer to the Pit 3 dam, assess boating management options, and consider providing an ADA boat loading facility and designated vehicle trailer parking at Jamo Point.

Our Analysis

Currently, about 80 percent of the boating use occurs on the lower portion of Lake Britton. The relocation of the buoys at Ferry Crossing would open up some additional water surface area for boating in this higher use area. Commission safety guidelines call for safety buoys to be placed at least 300 feet of project dams and the buoys are currently a considerably greater distance upstream. Therefore, we concur that PG&E should move the buoys to a location closer to the dam, consistent with the Commission's dam safety regulations provided in the Commission's *Guidelines for Public Safety at Hydropower Projects* (FERC, 1992). We do not, however, recommend that PG&E create any speed management zones, because it is the county's responsibility, not the licensee's, to provide such boating safety and enforcement measures. However, we encourage PG&E to work with Shasta County to help assess, update, and publicize the speed zones, as necessary, to help limit potential adverse effects of boating use on bald eagle populations and shoreline erosion from boat wakes within the project area. The reservoir water surface zoning plan, now recommended by the FS, would help to facilitate this goal.

We agree that PG&E should provide measures to enhance the existing Jamo Point boat launch area, including designating parking spaces for vehicles with trailers; providing a picnic table between the restroom and shoreline; and developing a potable water source at Jamo Point boat launch or Pines picnic area to help improve the recreational user experience at this area. Based on our observations during the May 22, 2002, site visit, there are existing designated spaces for vehicles with trailers. However, we conclude that additional signage to ensure that these designated spaces remain available during high-use periods is warranted. We do not recommend that PG&E modify the fishing platform because there is already a platform in place that provides suitable access for fishing opportunities. We agree that PG&E should extend the term of the host at Jamo Point boat launch during weekends until the end of September, or provide alternative staffing provisions, to provide for trash removal and restroom facilities at Jamo Point boat launch because without such oversight, uncontrolled public use could adversely affect project lands and waters. Although agree with the need for a potable water supply in the vicinity of the Jamo Point boat launch, we do not necessarily agree that it should be available to the public "at all times," as specified in the FS final 4(e) condition. There are times of the year when recreational use of the Lake Britton area is relatively light and, on occasion, below freezing conditions may exist, which could severely damage the plumbing needed to provide potable water. At such times it may be prudent to shut down and drain the potable water source.

We agree that PG&E should develop, as part of a recreation management plan, recreational boating management options, such as charging fees to reduce usage and/or cover increased management costs; implementing a one-on/one-off policy at boat launches; or restricting the development of additional trailered boat launch areas to help control potential recreational use conflicts and potential adverse effects on area resources, such as the bald eagle population.

Burney Falls State Park

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E restrict additional parking at the Burney Falls State Park day-use area to limit over-capacity visitor use at that site. Interior proposed that PG&E work with state park staff to pursue California boating and waterways funding to augment the $50,000 provided by PG&E for an ADA-accessible fishing pier at the day-use area. In addition, Interior recommended that PG&E provide electricity to the day-use area and evaluate options for beach enhancements and expansion, buoys around the swimming area, and enhancements such as tables, benches, trees, and trash cans.

In its October 9, 2002, letter, CDPR recommended that PG&E provide funding for the construction and maintenance of a group campground at Burney Falls Park to provide the equivalent of 15 additional family campsites. CDPR also stated that within the term of a new license, the recreational facilities within Burney Falls Park would require improvements and replacements and recommended that PG&E provide funding for capital improvements to help fund items such as underground electrical and campsite hook-up, extension of electrical lines to the boat launch, and marina area improvements that could withstand flooding.

Our Analysis

As stated in PG&E's November 25, 2002, response to comments, PG&E provided about $365,000 in 1995 as a contribution to the implementation of the General Plan for facility enhancement purposes. Therefore, we do not recommend that PG&E provide any facility expansion or development measures at the Burney Falls State Park, other than that PG&E ensure that buoys are provided at the swimming area to help ensure public safety. As previously discussed, if a cap of 39 new campsites around Lake Britton is specified as a condition of any license that may be issued for this project, PG&E could provide funding to enable the cap to be partially met at the State Park, but we would not recommend that PG&E contribute such funding to CDPR.

Pit River Canyon

Pit 4, Pit 5, and Tunnel Reservoir Access

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E construct an accessible fishing day-use area at the Pit 3 powerhouse on the east side of the tailrace in consultation with the FS and on an FS-approved schedule. The proposed facilities would include a cantilevered platform over the water for fishing, accessible toilet, potable water, trash receptacles, and improvements to the parking area to meet ADA standards. In addition, the FS recommended that PG&E pursue modifying the designated wild trout fishing area boundary with CDFG so that the day-use area would be located outside of the wild trout fishery designation. The FS final 4(e) condition No. 26 modifies some aspects of the preliminary recommendation. Although the FS still calls for construction of ADA-accessible fishing access, it no longer specifies that this should consist of a cantilevered platform over the water. The final 4(e) condition specifies that PG&E should work with the FS and CDFG so that this day-use area would not conflict with the designated wild trout fishery regulations in this vicinity.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) condition, that PG&E consult with the CDFG and FS to consider relocating the allowable bait angling line of demarcation from just below the Pit 3 powerhouse tailrace to about 200 feet upstream of the tailrace or to the most appropriate line determined after consultation. In addition, Interior recommended that PG&E design and construct an ADA-accessible fishing area at the Pit 3 powerhouse, to include a fishing structure, vault toilet, picnic tables, and potable water.

Interior also recommended, as a Section 10(a) measure, that PG&E design and construct a limited day-use area at either the Pit 4, Pit 5, or Tunnel reservoirs. Interior recommended that the day-use area include parking for three to four cars, picnic tables, and a trash receptacle and recommends that PG&E monitor use of the area to evaluate the need for restroom facilities.

In its October 9, 2002, letter, the FS, as a preliminary Section 4(e) and 10(a) condition, recommended that PG&E pursue within 1 year of license issuance a change in the county ordinance in consultation with the FS and other appropriate agencies to open the Pit 4 and 5 reservoirs to non-motorized boats, boats with battery-powered trolling motors, and float tubes between August 1 and December 31. The FS also recommended that PG&E pursue a change in the county ordinance to initiate a 5 mph speed limit at both reservoirs. If the county ordinance is changed, then the FS recommended that PG&E modify its unimproved boat ramp at the Pit 4 reservoir to accommodate any new public use that may be permitted by the county. In addition, the FS recommended that the area be signed and modified to indicate the new regulation to allow public boating use at the reservoirs, and that PG&E install a restrictive buoy near the intake structures. The FS final 4(e) condition No. 26 slightly modifies some aspects of its earlier recommendation. The boating use period of August 1 through December 31 for the Pit 4 reservoir is not included (although it remains in the 10(a) recommendation for the Pit 5 reservoir), and picnic tables and provisions for trash collection would be included at the modified boat ramp site.

Similarly, Interior recommended, as a Section 10(a) measure, that PG&E open the Pit 4 and 5 reservoirs for non-motorized and electric motor boating use in accordance with the Commission's safety regulations, including installation of a static line before the dams, and that PG&E request that Shasta County modify the boating regulations to allow this use. In addition, Interior recommended that PG&E design and establish parking (three to five spaces) and car-top walk-in launches at the reservoirs for public use and to accommodate administrative trailered boat use, and that vehicle access to the shoreline be limited by locking gates or through other similar methods.

In its October 9, 2002, letter, CDFG recommended that PG&E provide access for non-gasoline powered boating and access to angling and hunting opportunities at the Pit 4 and 5 reservoirs.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to construct a day use fishing area at the Pit 3 powerhouse tailrace that would include toilet facilities, potable water, trash receptacles, and parking.

Our Analysis

Provision of additional recreational access at the Pit 4 and 5 reservoirs would provide other options for recreationists within the project region for boating and angling opportunities. Currently, the reservoirs are under a Shasta County ordinance that prohibits boating use in these areas. We encourage PG&E to consult with Shasta County to modify the existing boating restrictions and to assess the potential to provide boating access and the period of the year that boating would be permitted at the Pit 4 and 5 reservoirs. However, the Commission has no jurisdiction over Shasta County. Consequently, if the county ordinances prohibiting boating on these two reservoirs is not changed, we would not expect PG&E to proceed with development of non-gasoline powered boating access points on both reservoirs.

We agree that PG&E should provide new day-use facilities at the Pit 3 tailrace and at either the Pit 5 or Tunnel reservoirs. The provision of the day-use areas would provide additional recreational access and opportunities to the project's recreational resources. We do not recommend the construction of a cantilevered fishing platform at the Pit 3 tailrace area, as originally recommended by the FS, because we conclude that adequate fishing access could be provided in this area without constructing such a platform. We also conclude that it may be possible to provide non-gasoline powered boat access to the Pit 4 reservoir at the Pit 3 tailrace area, rather than at the PG&E unimproved boat ramp near the Pit 4 dam. We expect that if the county ordinance is changed to allow boating on the Pit 4 reservoir, boaters would put-in at a Pit 3 tailrace day-use area regardless of whether the boat access was formally developed. Formalizing boat access at the Pit 3 tailrace could serve to prevent erosion from informal access and provide safer put-in conditions. The Pit 4 reservoir is small enough that two boating access sites should not be needed. If the county ordinance is changed to allow boating on the reservoir, consideration could then be given to whether boating access should be provided near the Pit 3 tailrace, near the Pit 4 dam, or at both locations.

We also agree that if a Pit 3 tailrace day-use area is developed, PG&E should first consult with CDFG and the FS to determine if the demarcation line for the Pit 3 reach wild trout fishery designation should be moved from just downstream of Pit 3 powerhouse tailrace to about 200 feet upstream of the tailrace or an alternative location. Currently, CDFG seeks to enhance the fishery in the wild trout area by restricting the harvest to two fish over 18 inches in length per angler per day, and restricting the gear to barbless artificial flies and lures. Such restrictions may hinder some anglers with disabilities from effectively fishing in the Pit 3 powerhouse tailrace. Consultation with the CDFG may lead to a design of the day-use area, including angler access, that is consistent with CDFG's fishery management objectives. In the event that boating access regulations are modified, PG&E would be required to provide appropriate boating safety measures at each reservoir where boating is allowed (e.g., warning signs and buoy lines upstream of the dams), independent of this proceeding.

Trails and Dispersed Access

In its October 3, 2002, letter, CDFG recommended that PG&E implement measures to enhance public access to the fishery resources within the project area. In its October 8, 2002, letter, the Fly Fishers recommended that recreational facility development in the canyon reaches of the project be minimized. The FS, in its final 4(e) condition No. 26, recommends that PG&E, in consultation with the FS, include in its recommended recreation management plan a section on general dispersed areas along the Pit 3 and Pit 4 reaches. This section would address opportunities and problems unique to the Pit reaches, such as fire prevention, sanitation, parking, "site creep," crowding, and length of stay limits. Although the FS does not define site creep, we interpret it to mean the unintentional expansion of the area affected by use of discrete dispersed recreational facilities such as trails and primitive camping areas.

Pit 3 Reach—In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E, on a time line approved by the FS, construct and maintain to a standard approved by the FS, three river access trails within the Pit 3 reach at Powder Spur, Delucci Ridge, and Rock Creek, or other locations as agreed to by the FS. The FS recommended that PG&E, at each trail location, improve trailhead parking by leveling, adding barriers and signage, and addressing erosion control. In addition, the FS recommended that PG&E at Powder Spur construct trailhead parking to accommodate up to 10 vehicles on the north side of the Pit 3 road across from the trail. The FS recommended, as a preliminary Section 4(e) condition, that PG&E, on a time line approved by the FS, improve parking at Talus Siren within the Pit 3 reach by removing road debris piles on the south side of the road. The FS final 4(e) condition No. 26 is consistent with its preliminary recommendation.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E improve and stabilize trails within the Pit 3 reach, including the Pit 3 dam, Powder Spur, and Delucci trails, and recommended that these trails be stabilized for resource protection and not be fully ADA-accessible, to allow for a primitive to semi-primitive experience.

Pit 4 Reach—In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E, on a time line approved by the FS, construct and maintain to a standard approved by the FS, river access trails within the Pit 4 reach at Malinda Gulch and Oak Flat, or other locations as agreed to by the FS. The FS recommended that PG&E at each trail location, improve trailhead parking by leveling, adding barriers and signage, and addressing erosion control in a manner appropriate to the ROS for that area. The FS final 4(e) condition No. 26 is consistent with its preliminary recommendation. The FS recommended, as a preliminary Section 4(e) condition, that PG&E, on a time line approved by the FS, reconstruct and maintain the Deep Creek Trail from Deep Creek Camp about 0.5 mile to a point across from Oak Flat to provide fishing access to the Pit River. The FS does not include this specific measure in its final 4(e) conditions.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E improve and stabilize trails within the Pit 4 reach, including Malinda Gulch and one of the Oak Flat trails, and recommended that these trails be stabilized for resource protection and not be fully ADA-accessible, to allow for a primitive to semi-primitive experience. Interior also recommended, under Section 10(a) of the FPA, that PG&E evaluate the need for picnic tables and trash receptacles at dispersed sites in the Pit River Canyon in the first phase of management associated with the development of the recreation plan, focusing on Ruling Creek, Big Pine Deer Camp, and Gravel Bar.

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) measure, that PG&E develop a site plan for FS approval to convert the existing 240,000 cubic yard spoil pile (pile 4D) in the Pit 4 reach (covering about 3.35 acres) into a canyon scenic overlook. The FS recommended that the site plan include measures for: removal of all non-native materials visible on the surface of the pile; stabilizing and erosion control to prevent further erosion into the active river channel and avoid further collapse of the southern canyon wall; revegetating with native plants and reduction of star thistle invasion; cease any use of the site as a disposal site; submitting a sampling plan for 5 years of testing at annual intervals to ensure there are no hazardous materials leaching into the ecosystem, unless completed tests can demonstrate there are no hazardous materials buried in the piles; designating parking and pathways; and adding safety barriers at the edge and interpretive signage. The FS final 4(e) condition is consistent with its preliminary recommendation. The FS also recommended, as a preliminary Section 4(e) condition, that PG&E provide a trash collection location at the Pit 4 powerhouse for recreationists and a potable water source for recreationists in the Pit 4 reach. This measure is not included in the FS final 4(e) conditions.

Pit 5 Reach—In its October 9, 2002, letter, the FS made a Section 10(a) recommendation that PG&E reconstruct and maintain to FS standards, the Little Joe Flat Trail from the Blue Jay Creek trailhead to Iron Canyon Road. This measure is not included in the FS final 10(a) recommendations.

In response to our recommendations in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, agreed to make improvements to the following trails, provided the scope is limited to protection of resources and erosion control measures: Powder Spur; Delucci Ridge; Rock Creek; Malinda Gulch; and Oak Flat. In addition, PG&E agrees to improve the parking area at Talus Siren and develop spoil pile 4D into a scenic canyon overlook.

Our Analysis

Based on PG&E survey results in 1999 and 2000, recreators indicated that they were generally satisfied with the overall experience (91 percent) and about 60 percent indicated that they were satisfied with the trails in the Pit River Canyon reaches. However, those that were not satisfied with the trails indicated that the trails were not maintained and not designated properly. Recreationists indicated that trash cans (44 percent), restroom facilities (33 percent), and potable water (32 percent) were the top facilities needed in this area, followed by shore access trails (24 percent), hiking trails (20 percent), picnic facilities (18 percent), and camping facilities (17 percent).

Based on the survey results and our observations during the May 2002 site visit, we agree that PG&E should provide upgrades to recreational trails that exist as a result of project roads and that experience the most use. Without such upgrades, erosion associated with these trails could adversely affect water quality in the Pit River and use by the public could be hazardous. These upgrades should be designed and implemented so that a primitive recreational experience that is consistent with the FS ROS objectives for this area, Roaded Natural and Semi-Primitive Motorized (see section 3.3.6, *Land Use and Aesthetic Resources,*) is provided and maintained.

Some of the recommendations for trail development and enhancement are located outside of the project boundary and are not accessible from project roads and facilities, and therefore, there is no connection to project purposes and the associated mandate for the licensee to provide public access to these areas. Accordingly, we do not recommend that PG&E provide upgrades to trails within the project reaches that are not accessible as a result of project roads or facilities, such as the trail from the Deep Creek Trail from Deep Creek Camp in the Pit 4 reach, or the Little Joe Flat Trail from Blue Jay Creek trailhead to Iron Canyon road located within the Pit 5 reach.

The spoil pile areas were created as a result of project construction and currently detract from the area's natural beauty. Conversion of spoil piles into scenic overlooks or vista points would create additional opportunities for visitors to enjoy the scenery of the project area. Therefore, we concur that PG&E should convert spoil pile 4D at the Pit 4 reach into a canyon scenic overlook.

Dispersed Camping Areas

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop and implement a site improvement plan consistent with the ROS setting for the Ruling Creek dispersed camping area within the Pit 4 reach. The FS recommended that site improvements include: providing a portable, vault-style toilet; removing road debris piles; implementing noxious weed mitigation; realigning the road away from the river; eliminating use of the site as a spoil pile disposal area; addressing the existing 40,000 cubic yards of tunnel spoil materials and incorporating use of this material, where feasible, into the site plan; and addressing erosion control needs associated with the spoil pile disposal and riverbank erosion associated with the old roadbed. The FS final 4(e) condition is similar in most respects to its preliminary recommendation, but the tunnel spoil pile elements are eliminated from this measure (they would be included in the spoil pile management plan) and an option to incorporate material from the road debris pile into the site design is offered. In addition, three new elements are added: (1) creation of camping and parking locations; (2) installation of metal fire rings; and (3) improved pedestrian access to the river.

In its October 9, 2002, letter, the FS recommended, as a Section 10(a) measure, that PG&E, within 5 years of licensing, construct a full-service campground with at least 20 units near Camp Pit and the Tunnel Reservoir. The FS recommended that the campground accommodate both RV and tent camping, and include showers, flush toilets, and power/water RV hookups. The FS final 10(a) recommendation is consistent with this measure. The FS also recommended in its preliminary 10(a) recommendation that PG&E remodel and open to public rental at least three cabin units of Camp Pit, with at least one unit fully accessible. This measure is not included in the FS final 10(a) recommendations. The FS also made a preliminary 10(a) recommendation that PG&E improve the Trailer Road for dispersed camping opportunities by grading to a maintenance level 3 and conducting regular patrols by a host or sheriff to prevent long-term occupancy. This measure is similar to the FS final 10(a) recommendation, but the final measure does not specify the entity that should patrol to prevent long-term occupancy.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) measure, that PG&E evaluate and design options for a campground in the Pit River Canyon and construct a campground in this area in accordance with resource protection goals. Interior recommended that options for the location would include the north or south shore of the Tunnel Reservoir or the area north of Camp Pit. Interior also recommended that PG&E explore use triggers for a developed or primitive campsite at Bush Bar and consider re-establishing Deep Creek Campground.

In response to our recommendation in the draft EIS, PG&E, by letter filed with the Commission on June 19, 2003, indicated that it accepts our recommendation to enhance the Ruling Creek dispersed camping area, and considers this site to be one of a few in the Pit River Canyon that could be developed with minimum risk of damaging sensitive resources. PG&E also states that it is willing to consider the development of a campground adjacent to the Pit 5 reach, providing a site could be found that would have minimal effect on sensitive resources (e.g., cultural sites and bald eagle nesting territories), does not conflict with neighboring land owners, is compatible with desired recreation experiences, and is project related. PG&E points out that the community of Big Bend has expressed concerns over inducing additional recreational use along the Pit 5 reach.

Our Analysis

Recreational enhancements in the Ruling Creek area would provide facilities to help manage existing informal use that already occurs and would make improvements to the area, such as trash and sanitation facilities, to help accommodate recreational use. Enhancements at this site would also serve to facilitate use of this site as a put-in site for recreational boating use in the Pit 4 bypassed reach. Therefore, we concur that the measures recommended in the FS final 4(e) condition should be implemented at the Ruling Creek site.

We do not recommend that PG&E develop new campground areas at this time within the Pit River Canyon. Our assessment of the need for additional camp site capacity focused on the potential expansion and upgrade of existing facilities to accommodate recreational use in order to help limit the potential adverse effects of recreational use on the project area's sensitive resources and help maintain the primitive and semi-primitive nature of the Pit River Canyon area. Although there may be opportunities to develop a formal campground that could accommodate RVs near Camp Pit or the Tunnel Reservoir, input that we received during our scoping meeting in the community of Big Bend made it clear to us that such that such a formal facility would be considered disruptive to the local community.

We agree that campgrounds can provide a means for providing public access to project lands and waters, and should be considered when assessing potential new project-related recreational enhancements. Therefore, we conclude that PG&E should explore capacity management triggers and options to provide primitive camping areas within the project boundary or adjacent to project facilities or roads and the potential effects of facility development on sensitive resources as part of the recreation monitoring plan. PG&E's assessment should include identification of potential sites for a primitive campground and consultation with CDPR, FWS, CDFG, and representatives of the community of Big Bend (including the fire chief). This would help provide a mechanism to determine whether or not a primitive camp ground should be established along the Pit 5 reach to provide dispersed area recreation management and to assess the effects of recreational use on sensitive resources and the affected community over the term of a new license. The results of PG&E's assessment, with specific recommendations about whether a new camp ground should be developed either in a near or long term timeframe, would provide the Commission with a basis to determine whether such a camp ground is warranted.

Whitewater Boating Access

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E develop within 1 year of license issuance, whitewater boating access locations in consultation with local communities, resource agencies, and interested parties, and that any conflicts between these access areas and archeological sites be addressed in the HPMP. The FS final 4(e) condition No. 26 modifies its preliminary recommendation to have PG&E develop and maintain two whitewater boating access points in each river reach consisting of a "put in" and "take out." Access points could be coordinated with the development of other FS recommended recreation sites.

In their October 9, 2002, letter, AWA, Shasta Paddlers and Chico Paddleheads recommended that PG&E provide whitewater boating access at the following locations; on the Pit 3 reach, improve egress from the river in the vicinity of the powerhouse; on the Pit 4 reach, improve egress from the river in the vicinity of the powerhouse, grade the parking lot, and provide a vault toilet; and on the Pit 5 reach, improve ingress to the river by improving Trailer Road on river left and providing additional parking, and at the take-out just upstream of the Pit 5 powerhouse, grade and gravel the parking area and provide a vault toilet.

In response to our recommendation in the draft EIS, PG&E, by letter to the Commission dated June 19, 2003, accepted our recommendation to provide whitewater boating access points to the Pit 3, 4, and 5 bypassed reaches. PG&E notes that a potential put-in location for the Pit 3 reach could be the recommended improved river access trail near Rock Creek

Our Analysis

Although minimal whitewater boating activity currently occurs within the project area, development of whitewater boating access locations would help provide access to the river reaches from the Project roads, for both whitewater boating and other recreational opportunities. Implementation of measures to improve public awareness of real-time flow conditions in the bypassed reaches and the potential for implementation of scheduled recreational boating releases (discussed later in this section) could increase whitewater boating use in the future. Therefore, we agree that PG&E should develop appropriate whitewater access sites at all three project bypassed reaches.

We agree with PG&E that a river access trail to the Pit 3 reach in the vicinity of Rock Creek could also be used as a whitewater boating access point, and would entail much less effort by boaters trying to reach the river than use of the existing trail at the Pit 3 dam. We conclude that egress from the Pit 3 reach could readily be accommodated in the design of a day use area in the vicinity of the Pit 3 powerhouse. Similarly, a whitewater boater put-in site for the Pit 4 reach could readily be incorporated into the design of proposed improvements at the Ruling Creek dispersed camping area. Establishing a defined take-out point near the Pit 4 powerhouse could double as a day use access area for the Pit 5 reservoir. Improvements to the informal put-in site for the Pit 5 reach at Trailer Road would enhance access to this reach by both whitewater boaters and anglers, as would enhancements to the informal take-out site in the vicinity of bush bar.

Reservoir Elevations

PG&E originally did not propose any changes to their current operations of Lake Britton or the Pit 4 and 5 reservoirs. However, in the PRCT agreement, PG&E now proposes to operate all three project developments in accordance with a specific operating protocol. For Lake Britton, the minimum water surface elevation would be 2,731.5 feet (NGVD). During the primary recreation season (Memorial Day weekend through Labor Day weekend), the maximum normal water surface elevation would be 2,737.5 feet (NGVD) (also see section 3.3.2, *Aquatic Resources*). The PRCT agreement also specifies that the normal operating elevation of the Pit 4 reservoirs would be between elevation 2,414.5 and 2,422.5 feet (NGVD). Finally, the PRCT agreement specifies that as inflow to the Pit 5 reservoir exceeds the full capacity of the Pit 5 powerhouse, PG&E would operate the Pit 5 dam spillway gates to maintain an approximately constant water surface elevation of 2,040.5 feet (NGVD).

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E operate the Lake Britton reservoir year-round so that the maximum instantaneous reservoir surface elevation does not go below 2,730.5 feet NGVD feet. The FS also recommended that in the summer, maximum reservoir elevation should not exceed 2,736.5 feet NGVD so as not to inundate recreational sites on the lake. The FS final 4(e) condition No. 17 replaces its preliminary recommendation and is consistent with the PRCT agreement. Interior recommended that PG&E minimize Lake Britton fluctuation levels during the recreational season, especially during periods of high use, and to minimize damage to Burney Falls State Park beach day-use area. As discussed in its October 9, 2002, letter, CDPR would like to see priority given to maintaining a high pool elevation during high recreational use days. CDFG recommended, in its October 3, 2002, letter that from March 1 to May 31, the Lake Britton surface elevations be held to between 2,736.5 and 2,734.5 feet NGVD to protect the warmwater fish habitat as well as general recreational use. The FWS, NPS (both within Interior), the FS, CDPR, and CDFG are all signatory parties to the PRCT agreement, and we therefore consider the agreement to replace the original recommendations of these agencies.

Our Analysis

Our discussion of reservoir elevations is confined to Lake Britton, where most formal lake-oriented recreation occurs. Water level management at the Pit 4 and Pit 5 reservoirs is primarily intended to minimize the ecological effects of sudden increases and decreases of flow to the bypassed reaches.

At full pool elevation of 2,737.5 feet (NGVD), recreational sites could be inundated at Lake Britton, particularly at the beach area at Burney Falls State Park day-use area. The recreational use survey conducted by PG&E in 1999 and 2000 indicated that only 5 percent of those surveyed reported constraints with recreational activities as a result of water conditions, with less than half of those individuals commenting on concerns associated with lake level elevations. The higher lake level elevations currently typically occur during the spring period, when recreational use levels are low (although under the PRCT agreement, the spring water levels would be maintained at lower elevations). Although under the PRCT agreement, Lake Britton could be filled to elevation 2,737.5 feet (NGVD) during the summer recreation season, we expect that instances when the lake would actually fill to this level to be infrequent. Under the protocols specified in the PRCT agreement, when inflow to Lake Britton causes the maximum specified elevation to be approached, PG&E would deflate a bladder gate to lower the prevailing water surface elevation and keep it deflated until streamflow in the Pit 3 reach recedes to the required minimum flow. Although this protocol is primarily designed to ensure that flows recede gradually in the Pit 3 bypassed reach, it would also serve to keep the water level of Lake Britton below elevation 2,737.5 feet (NGVD) when flows are controllable by PG&E. We conclude that because the management entities directly responsible for recreational resources at Lake Britton have signed the PRCT agreement, they are in agreement that additional summer maximum lake level elevation restrictions are not needed.

Although Lake Britton can be drawn down to elevation 2,724.5 feet (NGVD), it is typically not drawn down below 2,730.5 feet during the spring and summer period. The FS's original elevation limits are consistent with how PG&E currently voluntarily operates Lake Britton during the recreation season (between 2,730.5 and 2,736.5 feet NGVD) to facilitate public access to the lake and maintain visual quality. The PRCT agreement would increase the year-round minimum reservoir elevation to 2,731.5 feet (NGVD). This should provide a slight enhancement to public access (and the aesthetic experience of recreationists) to the lake during the spring and summer, and a more substantial enhancement during the fall and winter, when PG&E historically drew the impoundment to the minimum allowable level of

2,724.5 feet (NGVD). We discuss Lake Britton water level management further in section 3.3.2, *Aquatic Resources*.

Bypassed Reach Flows and Ramping Rates

Minimum Flows and Ramping Rates

In its October 11, 2002, letter, PG&E originally proposed to maintain a year round minimum flow release of 150 cfs for the Pit 3 reach, 200 cfs for the Pit 4 reach, and 250 cfs for the Pit 5 reach for the protection of fish and aquatic resources. On average, PG&E's originally proposed flow for the Pit 3 reach would provide flows in the lower third of the reach that range from about 205 cfs during September through October to greater than 300 cfs during February through April, excluding spill events. PG&E's originally proposed flow for the Pit 4 reach would on average result in flows in the portion of the reach downstream of Deep Creek that range from about 260 cfs during September through October to greater than 325 cfs during February through April, excluding spill events. PG&E's originally proposed flow for the Pit 5 reach would on average result in flows in the reach below Kosk Creek that range from 308 cfs during September through October to greater than 800 cfs during February through April, excluding spill events. PG&E proposed to develop a plan in consultation with the FS, CDFG, SWRCB, and FWS to address ramping the tail end of spill flows to avoid rapid termination of spills when river flow comes under control of the project.

In its October 9, 2002, letter, the FS, as a preliminary Section 4(e) condition, recommended year-round minimum flows of 400 cfs in the Pit 3 reach, 450 cfs in the Pit 4 reach, and 500 cfs in the Pit 5 reach. The FS recommended, as a preliminary Section 4(e) condition, that PG&E conduct an FS approved safety analysis of existing data (from this project or other comparable projects) or develop a study to determine appropriate upramping rates to ensure river user safety. Upon completion of the analysis or study, PG&E would propose, for FS approval, the maximum allowable upramp rate which would then be filed with the Commission. The FS also recommended, as preliminary Section 4(e) and Section 10(a) conditions, that when flows in the bypassed reaches are less than 4,000 cfs, PG&E downramp natural spills (inflows to the bypassed reaches that exceed the capacity of the reservoirs and diversion structures) at about the same rate as the natural attenuation of the inflow that caused the spill or downramp slowly enough so as not to produce stage changes exceeding one inch per hour.

In its October 9, 2002, letter, Interior, as a Section 10(a) condition, recommended minimum flows of 600 cfs during April through October and 800 cfs during November through March for the Pit 3, 4, and 5 reaches. Interior also recommended, as a Section

10(a) condition, that PG&E file a ramping rate plan with the Commission to minimize flow fluctuations uncharacteristic of natural seasonal stream conditions.

In its October 3, 2002, letter, CDFG recommended minimum flows from a low of 600 cfs during August and September to a high of 1,350 cfs during March for the Pit 3, 4, and 5 bypassed reaches. The CDFG recommended that a maximum rate of 1 inch of stage change per hour be incorporated into the bypass flow regime condition to minimize effects of flow fluctuations on aquatic organisms.

The PRCT agreement specifies higher minimum flows than originally recommended by PG&E, but lower minimum flows than those recommended by the agencies (see table 27). The flows vary by month and are also tied to spillage events. The PRCT agreement also includes a ramping rate plan, which generally calls for upramping and downramping rates of 0.5 feet per hour with several operational protocols designed to allow flow changes in the bypassed reaches to more closely resemble conditions in an unregulated stream. The PRCT agreement does not call for a river user safety analysis to determine an appropriate upramping rate, as originally recommended by the FS. All entities that made original specific recommendations pertaining to minimum flows and ramping rates (PG&E, the FS, FWS, NPS, and CDFG) signed the PRCT agreement, which we therefore presume replaces the original recommendations of these entities. The FS final 4(e) condition No. 17, is consistent with the PRCT agreement and does not include a provision for a recreation user safety analysis to determine and appropriate upramping rate. We discuss minimum flow and ramping rates in detail in section 3.3.2, *Aquatic Resources*.

<u>Whitewater boating flows</u>

PG&E originally did not propose to provide any scheduled whitewater boating flows or development of a whitewater boating plan for the project area. PG&E proposed, as part of the Interpretive and Education Plan, to provide information related to real-time river flows; however, PG&E did not specify how this information would be provided to the public.

In its October 9, 2002, letter, the FS recommended, as preliminary Section 4(e) and 10(a) conditions, that PG&E develop a whitewater boating plan in consultation with the FS and other appropriate agencies and communities within 1 year of license issuance. The recommended plan would include three components: (1) description of the whitewater boating flows; (2) measures to provide public information regarding flow information; and (3) whitewater boating access points. The FS recommended that real time and peak flow data be made available year round and that flow information for the Pit 3, 4, and 5 bypassed reaches be provided to the public via the Internet and telephone. The FS recommended that the flow information be posted on the Internet at PG&E and AWA web sites with links to other pertinent web sites. Phone information would provide peak flows for the past three days that occurred between 8:00 a.m. and 6:00 p.m., as well as any forecasted dry-year freshet flow releases. The FS recommended that as part of the plan development, whitewater boating access areas be developed in consultation with local communities, resources agencies, and interested parties. The FS recommended that any potential mitigation for potential whitewater boating and archeological site conflicts be addressed in the HPMP.

In its October 9, 2002, letter, the FS recommended, as a preliminary Section 4(e) condition, that PG&E provide dry-year freshet flows (see section 3.3.2.2, *Aquatic Resources*) and stated that these flows would result in flows of 1,500 cfs for 2 days (and then ramping down linearly to the base flows) and would provide 10 continuous days of acceptable whitewater boating flows between 1,100 and 1,500 cfs during the first part of March. These flow releases would occur if there had been no spills equal to or greater than 1,500 cfs by March 1, and if water temperatures meet the criteria related to protection of foothill yellow-legged frogs. The FS stated that in average and wet precipitation years, when the freshets flows would not be required, there would be naturally occurring spill flows in the river to meet or exceed flows suitable for whitewater boating.

In its October 9, 2002, letter, Interior recommended, as a Section 10(a) condition, that PG&E develop a whitewater boating release plan, in consultation with the FS, NPS, CDPR, CDFG, SWRCB, FWS, the Tribe, AWA, California Trout, Trout Unlimited, and other interested stakeholders. Interior stated that as part of this plan, PG&E would create a Recreational Flow Adaptive Management Task group that would establish the recreational flow release schedule and adaptive management plan for the term of the license that protects and is consistent with the conservation and restoration of the project area's aquatic ecosystem.

In its October 3, 2002, letter, CDFG stated that intentional variation of flows beyond the magnitude, duration, frequency, or season can overwhelm the resiliency of native species and substantially affect aquatic communities, and as such, do not support the provision of artificially variable flows outside the bounds of "normative" parameters. In its October 23, 2002, letter, the CWTPS stated that the Pit River is California's single most productive river for fly fisherman and that if flows are raised for whitewater boating, the delicate balance of the aquatic ecosystem would be disturbed. Trout Unlimited recommended that future license conditions provide for dynamic seasonal flows that mimic the unimpaired hydrograph in regard to timing, duration, magnitude, frequency, and rate of changes, while avoiding unseasonal flow fluctuations.

In its October 8, 2002, letter, the Fly Fishers commented that the availability of recreational opportunities should be based on the flows of a normative hydrograph, with recreational boating opportunities maximized during times of the year when flows would be naturally high. The Fly Fishers also stated that anecdotal information from the fishability studies conducted during August 2002 confirms that a substantial increase in flow on weekends during trout fishing season would make angling very difficult and substantially increased flows for boating during trout fishing season would inappropriately eliminate angling opportunities during those periods. In addition, the Fly Fishers stated that studies conducted elsewhere have raised serious questions regarding the potential negative effect of out-of-season high flows on the health of the river system.

In their October 9, 2002, letter, AWA, Shasta Paddlers, and Chico Paddleheads recommended scheduled whitewater boating flow releases within the Pit 3, 4, and 5 bypassed reaches. For the Pit 3 reach, the originally recommended releases would include maintaining flows during June starting at 900 cfs and tapering to 600 cfs at the month's end. For the Pit 4 and 5 reaches the following flow schedule was recommended: for June provide 1,800 cfs on the fourth weekend of the month with releases into the Pit 4 reach on Saturday and Pit 5 reach on Sunday; for July provide 1,700 cfs on the second and fourth weekend with Saturday releases in the Pit 4 reach and Sunday releases in the Pit 5 reach; for August provide 1,500 cfs releases on the second and fourth weekend with Saturday releases in the Pit 4 reach and Sunday releases in the Pit 5 reach; for September provide 1,250 cfs releases on the second and fourth weekend with Saturday releases in Pit 4 reach and releases in the Pit 5 reach on Sunday.

The AWA, Shasta Paddlers, and Chico Paddleheads also recommended provision of publicly accessible flow information via the Internet and a toll-free flow line. The recommended flow information would include annual streamflow release schedules, weekend flow forecasts, and flows associated with run-off, storm events, and project operations provided during various period in various formats. These periods and formats would include: by April 10, a preliminary forecast of the dates and flow targets of scheduled whitewater releases, updated by May 10, with weekly updates if changes occur thereafter through October 15; post on the Internet site for the current and prior 7 days, hourly averages of streamflows below the Pit 3, 4, and 5 diversion dams within 4 hours of a snowmelt, storm and/or project operations flow event, rounding cfs values to the nearest even hundreds value and plots or tables showing the data labeled "these provisional data have not been reviewed or edited and may be subject to significant change"; install and maintain one simple staff gage in the Pit 3, 4, and 5 bypassed reaches and provide a rough rating table to be posted at the nearby recreational area that reasonably correlates the gate height with flow measured in cfs, and update the rating tables annually.

In its October 3, 2002, letter to the Commission, CDPR recommended the installation and maintenance of one staff gage or depth indicator in each of the Pit 3, 4, and 5 bypassed reaches and the provision of rough rating tables posted at nearby recreational access areas or areas that are easily accessible for the public. These tables should correlate gage height with flow measured in cfs and should be updated annually to ensure that the depth measurements correspond reasonably well to the flow measurement values.

Numerous attendees of the scoping meeting held at Big Bend stated concerns regarding safety in the Pit 5 reach, particularly related to any changes of the flow regime in the Pit 5 bypassed reach to accommodate whitewater boating. Comments included: concerns that whitewater flows would prevent safe swimming in the portion of the bypassed reach near their community during the hottest periods of the summer; concerns that additional recreationists would be drawn to the area and this could lead to an increased fire risk because of improperly attended campfires; concerns that there would be increased litter from the increased recreational usage; and statements that the local fire department is not trained in whitewater rescue techniques and would incur additional costs to procure the proper training.

The PRCT agreement establishes provisions for making freshet flow releases, following periods when relatively high flow events have not occurred naturally. The freshet flow release plan in the agreement would entail publicizing scheduled freshet flows, so that whitewater boaters could take advantage of such releases. When freshet flows are released, the peak flow portion of the release, 1,500 cfs for a period of two days, would be scheduled such that it occurs on a weekend.

The PRCT agreement also provides for PG&E to develop a plan for providing annual recreation flow releases to the Pit 5 reach that would be suitable for whitewater boating, in consultation SWRCB, CDFG, FWS, NPS, CDPR, the Tribe, AWA, and other parties who request involvement. This plan would entail three components. The first component would involve collecting up to 5 years of ecological baseline data. The second component would establish a recreation streamflow release schedule that would initially entail releases of 1,500 cfs from 10 AM to 5 PM on two consecutive weekend days in August, and 1,200 cfs from 10 AM to 5 PM on two consecutive weekend days in September. These releases would occur for a period of at least 3 years. The third component would entail environmental and boater use monitoring during scheduled releases. The data from this monitoring would form the basis for making adjustments to the release schedule. We describe this proposed measure and the proposed freshet flow releases in more detail in section 3.3.2.2, *Aquatic Resources*.

Finally, the PRCT agreement calls for PG&E to make streamflow information available to the public beginning no later than 1 year after license issuance. Unless otherwise noted, the information would be available via a toll-free phone and the Internet, and may be accomplished through a third party. The streamflow information protocols may be modified by mutual agreement among PG&E, the FS, and other responsive parties who request involvement, and approval by the Commission. Specific information that would be provided would include hourly average flow below each of the Pit 3, Pit 4, and Pit 5 dams for the current day and the past 7 days, posted within 4 hours of collection. The PRCT rationale statement indicates that by providing current day and the previous 7 days of flow information, users can assess if flows are trending up or down as they plan trips to the Pit River. Flows would be rounded up to the nearest 50 cfs, and all plots and tables showing these data would be labeled: "These provisional data have not been reviewed or edited, and may be subject to significant change." PG&E would also provide by January 5, the proposed dates and magnitude of any freshet flow release, with updates by February 15 and within 2 days of any changes in plans. By July 1, PG&E would provide the proposed dates for any scheduled recreation releases, with updates at least 2 weeks and 1 week in advanced of each proposed release date. In addition, PG&E would install a simple staff gage/depth indicator at publicly accessible locations within 2 years of license issuance at PG&E gage PH30 below the Pit 4 dam, PG&E gage PG27 at the Big Bend Bridge, and below the Pit 3 dam, if a suitable location is identified. PG&E would provide a means to reasonably correlate staff gage readings with cfs. PG&E would also notify the community of Big Bend and the Big Bend Rancheria in advance of planned freshet flow and recreational flow releases by posting bulletins on public bulletin boards located in those communities.

Many of the elements in the PRCT agreement pertaining to whitewater boating flows capture specific aspects of earlier proposals and recommendations made by specific entities. We presume an earlier recommendation by a signatory party to the PRCT agreement would be replaced by the agreement. The FS final 4(e) conditions are consistent with the provisions of the PRCT agreement. In the case of earlier recommendations by AWA, Shasta Paddlers, and Chico Paddleheads, which were jointly filed with the Commission, we assume that they are still in place because only AWA signed the PRCT agreement.

The Tribe, by letter to the Commission dated October 30, 2003, stated that, although they agree with the majority of the resource goals reached by members of the PRCT, they are not willing to sign off on the PRCT agreement because of the proposed recreation stream flow releases. The Tribe requests that the Commission adopt the measures specified in the PRCT agreement with the exception of the recreation streamflow release measure. The Tribe's objections relate to the potential ecological consequences of out-of-season releases, as well as potential adverse effects of the releases on cultural resources and traditional cultural values. The Tribe requests that substantial baseline data be developed and potential impacts on aquatic and cultural resources assessed prior to any decision regarding implementation of recreation streamflow releases. If scheduled recreation released occur, the Tribe fully supports a monitoring plan to evaluate and assess potential environmental effects. The Tribe would object to any discontinuation of such monitoring, because as long as there is recreation use, monitoring for environmental and cultural impacts would need to continue. The Tribe does not object to the PRCT agreement measure that would require

PG&E to provide streamflow information to the public. The Tribe also recommends that consideration be given to publicizing large unexpected releases or spills at designated locations so that the public that may not have telephones or Internet access who may be at risk from a safety perspective could be notified.

Our Analysis

During 2002, PG&E conducted a flow assessment for recreational use within the Pit 3, 4, and 5 bypassed reaches (Whittaker and Shelby, 2003). The study assessed recreational opportunities, such as whitewater boating, swimming, and angling, within the bypassed reaches and the effects of flows on these activities. The study identified optimal flow ranges for various recreational opportunities in these reaches (table 42).

Table 42. Summary of optimal recreational flows for the Pit 3, 4, 5 bypassed reaches. (Source: Whittaker and Shelby, 2003)

Reach	Lowest for quality fishing	Fly fishing	Bait fishing	Technical boating[a]	Standard boating[b]	Big water boating[c]
Pit 3	155 cfs	≤250 cfs	≤400 cfs	500-750 cfs	750 - 1,500 cfs	>1,500 cfs
Pit 4	150 cfs	≤350 cfs	≤400 cfs	800-1,200 cfs	1,200 - 1,900 cfs	>1,900 cfs
Pit 5	150 cfs	≤250 cfs	≤400 cfs	800-1,300 cfs	1,300 - 1,800 cfs	>1,800 cfs

[a] Technical boating is defined as technical or playboating whitewater trips at low to medium flows.

[b] Standard boating is defined as whitewater trips at somewhat higher flows that feature stronger hydraulics but offer less technical routes.

[c] Big water boating is defined as whitewater trips at higher flows that feature more powerful hydraulics and large waves.

The study found that, in average years, angling flows (≤400 cfs) would be available about 300 days per year on each reach and would provide high quality angling, tubing, and swimming during the recreation season. The study also found that, in average years, two to three weeks of spill flow provide standard or technical boating opportunities with additional high water flow periods occurring during March and April. The study concluded that higher flows would diminish swimming quality at some locations on the Pit 5, and possibly Pit 4, reach, and that the optimal flows for swimming were at about 150 to 400 cfs. Finally, the study concluded that providing high flows would likely result in substantially altered wading-based fly angling opportunities.

The Pit River reaches currently provide excellent trout fishing opportunities, and portions of the reaches are designated as a catch-and-release wild trout stream by the CDFG, as indicated previously. The provision of scheduled high flows associated with the AWA, Shasta Paddlers, and Chico Paddleheads originally-recommended whitewater boating flows during the summer when flows are typically low could adversely affect the trout fishery in these reaches and the associated angling recreational opportunities, which are an existing regional recreational attraction. In addition, numerous individuals during the scoping meetings indicated safety concerns about providing high flows during the summer periods, as summarized above.

Based on our review of flow information from USGS gages within the project area during 1975 to 2001, whitewater boating flows were available, on average, for at least a month in all three bypassed reaches (table 43). This is reasonably representative of current conditions, although the modification of the minimum flow regimes during the time period analyzed may have somewhat influenced the results. Whitewater boating opportunities would typically be available during the spring, high-flow period (February through May), and the public distribution of flow information would help alert potential whitewater boating enthusiasts to periods when high flow for whitewater boating opportunities are available.

According to the rationale statement that accompanied the PRCT agreement, the primary purpose of the reservoir operation protocols is to assure that winter and spring spill flows increase and recede naturally and avoid a sudden increase in streamflow due to the initiation of spills or a sudden reduction of spill flows due to increasing flow through a generation unit or exercising reservoir storage capacity. However, the rationale statement states that a secondary benefit of the operating protocols would be a slight increase in the frequency and duration of spill events at Lake Britton. We conclude that any such increases in frequency and duration of spill events could result in an increase in the number of days when boatable flows are available at the Pit 3 reach and consequently enhance whitewater boating opportunities, although we have no means to estimate the quantity of such an increase in opportunities.

Table 43. Boating opportunities at the Pit 3, 4, 5 Project bypassed reaches under current conditions. (Source: Staff)

	Pit 3	Pit 4	Pit 5
Optimal flow for technical boating[a]	500-750 cfs	800-1,200 cfs	800-1,300 cfs
Representative technical boating flow analyzed	≥600 cfs	≥1,200 cfs	≥1,200 cfs
Average and median days of technical boating/year	77/60 days[b]	31/22 days[c]	38/28 days[d]
Optimal flow for standard boating[a]	750-1,500 cfs	1,200-1,900 cfs	1,300-1,800 cfs
Representative standard boating flow analyzed	≥900 cfs	≥1,800 cfs	≥1,800 cfs
Average and median days of standard boating/year	54/38 days[b]	22/15 days[c]	28/15 days[d]

[a] From definitions of boating types presented in table 42 footnotes.

[b] Flows derived by subtracting the calculated inflow to Lake Britton from the flows at the Pit 3 powerhouse gage (1975-2001).

[c] Flows from the USGS gage at the Pit 4 bypassed reach (1975-2001).

[d] Flows from the USGS gage at Big Bend (1975-2001).

In the draft EIS, we documented the concerns that we and numerous other entities had with the potential for adverse environmental effects if out-of-season scheduled recreational releases were to be implemented. After our review of the study results from the controlled flow studies that were conducted during the summer of 2002, our concerns about potential ecological effects remain (see sections 3.3.2.2, *Aquatic Resources*, and 3.3.3.2, *Terrestrial Resources*). The PRCT rationale statement acknowledges that the effects of recreational releases on the Pit 5 ecosystem are currently unknown. Although foothill yellow-legged frogs have not been observed in recent years, they were observed in 1999, and if small populations should still be present in the Pit 5 bypassed reach, releasing recreational flows may adversely affect the remaining populations. The issues raised by the community of Big Bend and the Big Bend Rancheria regarding the effect of increased recreational use that would likely occur if scheduled releases in August and September, such as increased fire risk, the need to train local fire department personnel in whitewater rescue techniques, the potential for increased litter, and the effect of increased recreational use on sensitive cultural resources, have not been directly addressed, although forums for addressing these issues would be established in some of the recreation-related plans and the HPMP that have been proposed and recommended.

We also agree the studies to date have been short term and that the more extensive baseline data collection that targets the Pit 5 reach, where scheduled releases are now proposed in the PRCT agreement, would form a much more robust basis for decision making about whether or not to implement scheduled recreational releases. The PRCT agreement calls for the collection of up to 5 years of baseline data. The PRCT rationale statement for this measure indicates that the length of time required to establish baseline conditions and the timing relationship between acquisition of baseline data and implementation of the recreation flow releases were matters of considerable discussion within the PRCT. Consequently, the details of these aspects of the proposed measure would be finalized during the development of a recreation streamflow release plan. We understand the complexity of this issue and would not object to this approach. However, we also agree with the Tribe that, prior to making a decision to implement scheduled streamflow releases, sufficient baseline data should be collected to ensure the protection of environmental resources. Any recreation streamflow release plan that is developed should therefore clearly address the basis that would be used for determining when and if scheduled releases should occur. We are confident that the entities identified in the PRCT agreement that PG&E would consult with during the development of this plan (SWRCB, CDFG, FWS, NPS, CDPR, the Tribe, AWA, and other parties who request involvement) should sufficiently represent the appropriate affected stakeholders. Prior to implementing any scheduled recreation releases, PG&E should provide the Commission with sufficient documentation to support the decision to implement the releases, developed in consultation with the stakeholders, including the ecological and human-related consequences, and proposed measures to minimize any adverse effects. Releases could then be implemented following Commission approval. We agree that the environmental and boater-use monitoring proposed in the PRCT agreement represents an appropriate approach to adaptively manage and adjust recreation streamflow releases, if they are implemented.

The PRCT rationale statement indicates that presently, the public has limited ability to obtain streamflow information in advance of arriving at the river. We agree that PG&E should provide real-time and peak flow information for the Pit 3, 4, and 5 reaches to the public (including anglers and boaters) via an Internet site and telephone. This information would help inform the public about flow-related recreational opportunities within the river reaches, both from scheduled events, if implemented, or other times of the year. The PRCT rationale statement also indicates that members of the Tribe gather food such as fish and mussels from the river. Providing direct notification of any substantial flow releases to the Big Bend Rancheria and the community of Big Bend would enable these communities to plan accordingly. In addition, we agree that PG&E should incorporate measures into a recreation management plan for placing staff gages and informational rating tables that would enable the public to correlate river flow with stage. This information could deter unqualified boaters from beginning a run that is too dangerous for their skills.

In the draft EIS, we agreed that PG&E should conduct a safety analysis of existing data (from this project or other comparable projects) or develop a study to determine appropriate upramping rates to ensure that the public (i.e., swimmers, anglers, and boaters) has sufficient time to exit the river prior to substantial flow releases to the bypassed reaches, as originally recommended by the FS and in our draft EIS. Our review of the proposed operational protocols and the ramping rate plan specified in the PRCT agreement indicates to us that controllable changes in the flow rate should often mimic what would be expected on an unregulated stream, and that the specified ramping rate for most instances of flow change to the bypassed reach (0.5 feet per hour) should provide ample opportunity for recreators in and along the bypassed reaches to safely exit the water. We now conclude that an upramping safety analysis is no longer necessary at this time. However, if scheduled whitewater boating flow releases are implemented, they would occur during August and September, when flows would typically be low, and swimmers and anglers would be more likely at risk from increasing flows. We conclude that it would be appropriate to include in the proposed recreation streamflow release plan a description of whether or not a river user safety analysis would be conducted prior to implementing recreational releases (with reasons for reaching the conclusion). We also conclude that following baseline data collection in the Pit 5 bypassed reach, if scheduled recreational releases are recommended, PG&E should specify in the information provided to the Commission to support the recommendation, the safety measures that would be implemented to protect other river users from rapidly rising water levels, besides the proposed notifications regarding when releases are scheduled.

We present the estimated cost of all measures that pertain to recreational resources in chapter 4.0, *Developmental Analysis*, and make our final recommendations regarding these measures in section 5.2, *Comprehensive Development and Recommended Alternative*.

Project Decommissioning

In the event of project decommissioning, as we have defined it in section 2.3 of this EIS, hydroelectric operations would cease and the dams would be removed, but the other project structures would remain. Project intakes and the tunnels would be sealed off such that all flows would be directed through the bypassed reaches. The project reservoirs would convert to more riverine conditions. Recreational use within the project area would change substantially resulting from the conversion of the project reservoirs and the Pit River back to more riverine conditions.

Under the decommissioning with dam removal alternative, the Commission would no longer have jurisdiction over the PG&E facilities. PG&E could no longer be required to reconstruct or maintain existing recreational facilities, some of which would likely be dewatered following dam removal. Boat launches, docks, lakeside picnic and camping areas would likely no longer be used. Recreational facilities throughout the project area may become degraded over time, unless a new owner or another agency takes over the operation and maintenance responsibilities. Following decommissioning, PG&E would no longer maintain access roadways to provide safe egress to and from recreational areas (see section 3.3.6, *Land Use and Aesthetic Resources*). Likewise, PG&E would no longer require the project lands for project operations, thus ownership of those lands currently owned by PG&E may change. Dependent on the subsequent landowner, public access to some parts of the project area and recreational opportunities may be eliminated.

Lake Britton Area

The area surrounding Lake Britton would be converted from lacustrine to riverine environment. The removal of the Pit 3 dam would cause water levels to drop and would likely dewater the developed recreational sites along the shorelines of Lake Britton with the possible exception of those sites near the confluence with the Pit River. Lower water levels would change recreational uses in the Lake Britton area from flat water based opportunities such as motor boating, boat fishing, and flatwater canoeing to more river based, such as shore fishing and whitewater boating.

The bottom of the sluice pipe used for flow releases to the Pit 3 bypassed reach is at elevation 2,645.5 feet NGVD, near the bottom of the dam. Following removal of the Pit 3 dam, water levels would approximate this elevation, which is 91 feet below the maximum water surface of Lake Britton. The fluctuation during normal summer operations between the high pool of 2,736 feet NGVD and the low pool of 2,730.5 feet NGVD, a drop in water elevation of 6 feet, is highly visible at recreational areas such as North Shore Campground and Burney Falls State Park along the shoreline (see section 3.3.6, *Land Use and Aesthetic Resources*). A drop in water elevation of over 90 feet would adversely affect shoreline recreational areas. North Shore Campground would likely lose its appeal since the drawdown of the lake would leave large mudflat areas in the short-term and re-established vegetated areas in the longer term in place of the existing lake access and recreational opportunities. Burney Falls State Park would experience similar effects if the Pit 3 dam were removed. The beach, marina, and picnic areas would likely no longer function as the area would be dewatered. Jamo Point boat launch would no longer be usable. Additionally, such a boat launch would no longer be necessary since the flatwater lake would be converted to a free flowing river that would not support motor boating. Pines picnic area and Dusty Campground in the eastern portion of Lake Britton would undergo similar effects as the lake levels are lowered.

Removal of the Pit 3 dam would require rerouting travelers that use the Clark Creek Road Bridge and rerouting the PCT, which uses the Clark Creek Road Bridge to cross the Pit River. Both vehicles and the PCT could be rerouted over the State Route 89 bridge (see section 3.3.6, *Land Use and Aesthetic Resources*). However, if the PCT is rerouted, it would no longer pass through Burney Falls State Park and by the Burney Falls, which provide additional recreational opportunities. Removing the Pit 5 dam could require the rerouting of River Road, which currently crosses the Pit River over the dam.

Pit River Canyon

Project decommissioning with dam removal would have less effect on the Pit 4, Pit 5, and Tunnel reservoirs than Lake Britton because they are smaller, have steeper embankments, and have no existing formal recreational developments along their shorelines. However, decommissioning would still result in lower water levels and exposed shorelines in these reservoirs.

Decommissioning would include removal of Pit 4 and 5 dams, thus restoring the reaches to a more natural river environment in the vicinity. Downstream of the Pit 3 dam, decommissioning would increase flows in the bypassed reaches because water would no longer be diverted to the powerhouses. Higher flows would support more whitewater boating and may convert popular angler access areas into stopover locations for whitewater boaters. Dispersed recreational areas along the Pit River would still provide recreational opportunities unless they are located close enough to the river bank that the increased flows flood the areas.

Project decommissioning with dam removal would result in higher flows in the bypassed reaches of the Pit River as flows would no longer be diverted through the project tunnels. The Pit River would return to a more natural free flowing river. AWA, Shasta Paddlers, and Chico Paddleheads, in their October 9, 2002, letter, stated that suitable whitewater flows would be 1,200 to 1,800 cfs in the Pit 4 reach and for the Class IV run in the Pit 5 reach. Flows of 600 to 900 cfs would be suitable for a Class III run in the Pit 5 reach and provide opportunities for novice and intermediate boaters. Table 42 shows a similar range of flows needed for whitewater boating opportunities based on the controlled flow study. Without the project dams, scheduled whitewater flow releases would not occur. However, the FS's analysis of unimpaired flows in the Pit 3 reach, in appendix I of its October 9, 2002, preliminary 4(e) conditions, shows that without the dams in place, whitewater flows would occur 365 days a year. Under natural river conditions, even during a low-water year such as 1994, the FS indicates that flows would exceed 1,500 cfs for most of the year and would still exceed 1,400 cfs from July to September. During an average-water year, such as 1995, the FS shows flows in the Pit 3 reach in excess of 2,000 cfs for the entire year with peaks exceeding 11,000, 15,000, and 17,000 cfs during late January, late March, and late May, respectively.

Drawdown of Lake Britton and higher flows in the Pit River reaches would substantially change fishing opportunities. Flows in the Pit 3, 4, and 5 bypassed reaches would be suitable for whitewater boating year-round and would likely make fishing these reaches difficult. The higher flows combined with the steep terrain in the canyon would make access to the shoreline difficult, and fishing from boats nearly impossible. Fishing in the Lake Britton area would change from lake species to more riverine species (see section 3.3.2, *Aquatic Resources*). Current fishing access points such as Jamo Point boat launch, North Shore Campground, and areas within Burney Falls State Park would no longer provide lake fishing access. However, the restored Pit River may provide new shoreline angling opportunities. Fishing opportunities in upper Lake Britton, in the vicinity of the Hat Creek Fish Barrier would remain largely unchanged, since the flows in this area are largely unaffected by backwater from the Pit 3 dam.

3.3.5.3 Unavoidable adverse effects: None.

3.3.6 Land Use and Aesthetic Resources

3.3.6.1 Affected environment:

Land Use

The Pit 3, 4, 5 Project developments span a 30-mile reach of the Pit River and encompass roughly 4,330 acres of land within the project boundary (see figures 14 and 15). Of the lands within the boundary, about 3,259 acres (about 75 percent) are owned by PG&E, about 746 acres (about 17 percent) are federally owned lands that the FS manages, and the remaining 325 acres (about 8 percent) are privately owned. Project and adjacent lands upstream of the Pit 4 powerhouse are within the Shasta National Forest. The FS Shasta-Trinity National Forest staff, however, only manages a small portion of these lands–a 6-mile-wide strip of land between the Pit 3 and 4 powerhouses located adjacent to Screwdriver Creek. National Forest lands east or upstream of the Pit 3 powerhouse, including lands around Lake Britton, while within the Shasta National Forest, is managed by the Lassen National Forest. Project lands downstream of Pit 4 powerhouse, including the Pit 5 development, are entirely outside of FS-managed land boundaries and are part of unincorporated Shasta County. Figures 14 and 15 denote the general location of the land management areas within the project vicinity.

The project boundary includes the project reservoirs and some lands surrounding the reservoirs, but does not include the project's bypassed reaches. Upstream of Lake Britton, the boundary extends along the Pit River about 1 mile upstream of the Hat Creek confluence and about 0.25 mile up Hat Creek. There are about 340 acres of roads within the project, of which about 111 acres are on FS lands. The boundary varies between 50 to 200 feet wide along project roads. Lands within the project also include a 40-foot-wide utility right-of-way for a 12-kV transmission line and project telephone line link between each project development (which generally runs alongside project roads), and a 100-foot wide-segment along each of the three diversion tunnels. Currently, lands associated with the Pit 3 and Pit 5 230-kV transmission lines are included in the project boundary.[21]

The few developed areas within the project area are mostly upstream of Pit 3 dam around Lake Britton and include industrial operations, such as mining, logging, sand and gravel operations, and power generation; rural residential areas; agriculture; and developed recreation. The unincorporated community of Burney, on Route 89 south of Lake Britton, has about 3,400 residents and is the commercial hub for the region. There also is a small rural residential community north of the McArthur-Burney Falls Memorial State Park (Burney Falls Park). Project lands along the southern shore of Lake Britton are within the boundaries of Burney Falls Park. Of the 910 acres within the park, 225 acres along the southern shore are owned by PG&E and leased to the state; however, PG&E is currently transferring ownership of these lands to the state. Other developed recreation areas include the licensee-operated North Shore Campground, Pines picnic area, Jamo Point boat launch, and Dusty Campground (see section 3.3.5, *Recreational Resources*). Just south of the Burney Falls State Park is a logging yard and rock quarry operated by Hat Creek Construction. Immediately west of Lake Britton, Dica Lite Minerals Corporation operates two open-pit diatomite mines. Cattle grazing operations north of Lake Britton in the Cayton Valley and south of Lake Britton in Goose Valley are beyond the project boundary. PG&E does not allow grazing on project lands and terminated its grazing leases in the upper Lake Britton area in the late 1980's to protect sensitive areas and water quality. There is some

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[21] These lands total about 268 acres, of which 47 acres are licensee-owned, 51 acres are federally owned and FS managed, and 170 acres are privately owned. PG&E applied to FERC on April 3, 1998, to amend the project boundary to remove the project lands associated with these transmission lines. On December 22, 1998, FERC approved the removal of the 268 acres, contingent on authorization from the FS. The FS is requesting that PG&E prepare environmental and related documentation prior to its approval.

Figure 14. Land management areas on upper Lake Britton, lower Hat Creek, and the Pit 3 reach. (Source: PG&E, 2001, as modified by staff)

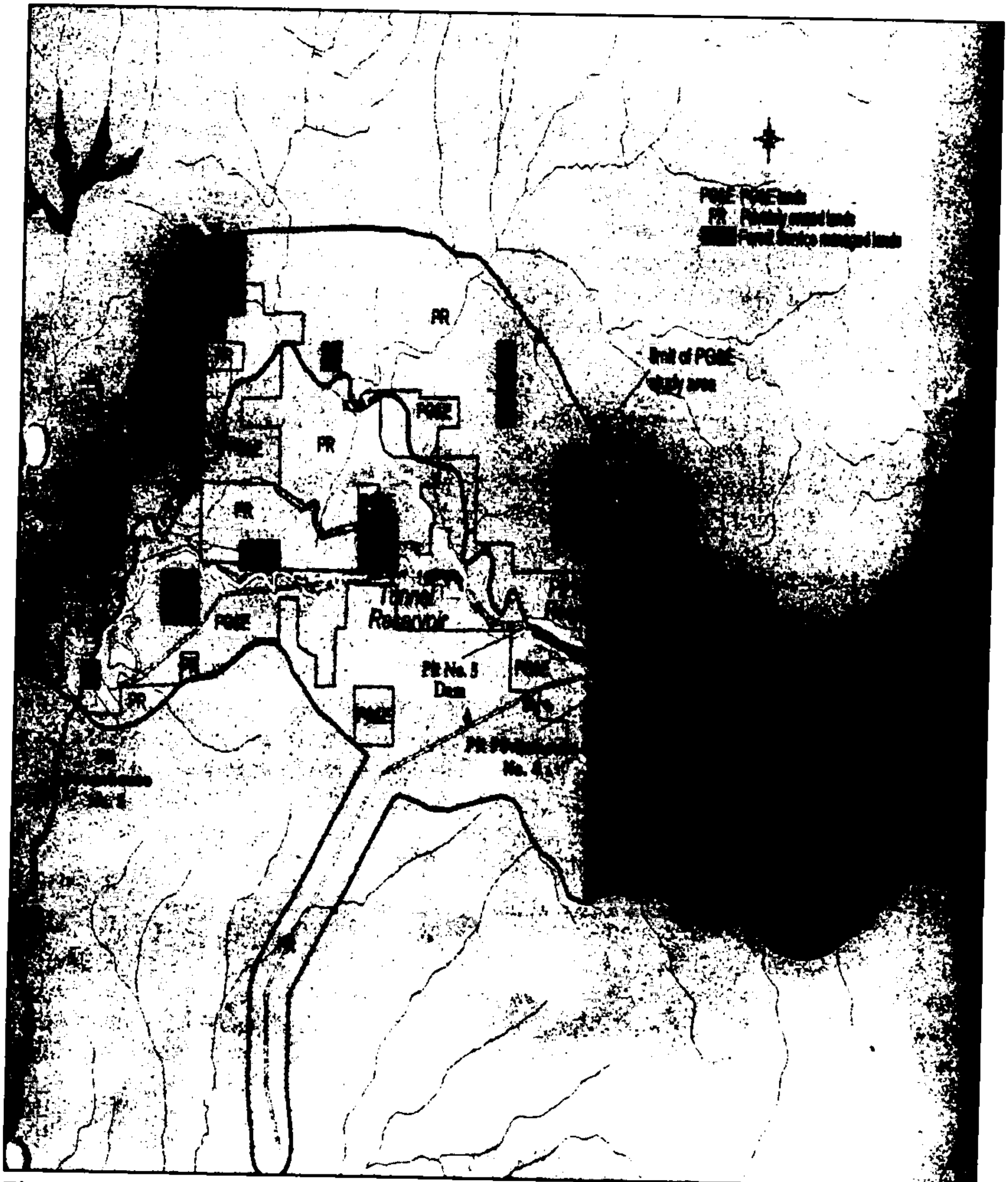

Figure 15. Land management areas on the Pit 4 and 5 reaches. (Source: PG&E, 2001, as modified by staff)

evidence of grazing near Dusty Campground; however, the FS indicates this is from the grazing allottees not maintaining fences to keep cattle out of developed recreation sites.

The stretch from the Pit 3 dam to the Pit 4 powerhouse is characterized by a narrow canyon valley that is thickly forested. The lower stretch from the Pit 5 dam to the Pit 5 powerhouse is also heavily wooded, but with less steep terrain. Timberland and open space are the dominant land uses. This area also includes dispersed recreational opportunities and private recreation facilities (see section 3.3.5, *Recreational Resources*). There are several small rural residential communities in the area, and the community of Big Bend, with a population of about 750 residents, lies along the Pit 5 bypassed reach.

Land Management Plans

The project area falls within several different land management areas and therefore is subject to several land management plans as described below.

Northwest Forest Plan—In April 1994, the Northwest Forest Plan was implemented through a Record of Decision to manage FS and Bureau of Land Management (BLM) lands within the range of the northern spotted owl. Within the project vicinity, this plan applies to all FS lands, except those north of upper Lake Britton and east of State Route 89, which are outside of the known range of the northern spotted owl. Implementation of the Northwest Forest Plan requires each National Forest to amend its existing LRMP to incorporate the Northwest Forest Plan guidelines. It creates seven new land prescriptions on FS and BLM lands within the range of the northern spotted owl, of which three apply to the FS-managed lands within the project vicinity: LSRs, Riparian Reserves, and Matrix land designations. The Northwest Forest Plan also includes an ACS, which applies to all lands covered under the plan and consists of nine objectives aimed at restoring and maintaining the health of watersheds and aquatic ecosystems within public lands.

LSRs are designed to protect existing populations of old-growth dependent wildlife and flora. Development within LSRs is on a case-by-case basis; however, existing facilities such as dams, transmission lines, and supporting buildings may remain and be maintained. Within the vicinity of the project, LSRs cover most of the area from the Pit 3 dam to the Pit 5 reservoir. Riparian Reserves are generally located in all Pit River drainage channels and along water bodies and overlay the LSR designation along the Pit 3 and 4 bypassed reaches. The objective of managing these areas is to maintain or enhance riparian areas, wildlife and fisheries habitat, and water quality by emphasizing streamside and wetland management. Matrix designated lands are all lands not included in one of the other six categories under the Northwest Forest Plan. These lands are subject to the ACS as well as any additional land prescriptions designated by the underlying forest plan. Most timber harvest and silvicultural activities occur within Matrix designated lands (FS and BLM, 1994a).

Lassen National Forest Land and Resource Management Plan—The Lassen National Forest LRMP was finalized in 1992 and prescribes land management measures for FS lands within or administered by the Lassen National Forest. Within the project vicinity, the Lassen LRMP applies to FS lands surrounding Lake Britton and the Pit River upstream of the Pit 4 dam. Although the area is within the boundary of the Shasta National Forest, it is administered by the Lassen National Forest under the Lassen LRMP.

All the project lands and lands influenced by project operations that are managed under the Lassen National Forest LRMP fall within the Britton Management area, one of 48 management areas designated by the Lassen LRMP. Within the project vicinity, there are five applicable land use prescriptions, three of which are within, and two of which are adjacent to, project lands. The Riparian/Fish designation applies to most of the FS-managed lands around upper and lower Lake Britton and calls for maintenance and improvement of riparian-dependent resources such as water quality, fish habitat, wildlife habitat, water-associated aesthetics, and riparian hardwoods and other vegetation. Late Successional Prescription (different than LSR) applies to the FS-managed lands north of the North Shore Campground and an area just north of the project boundary halfway between state routes 89 and 299. This designation "provide[s] vegetative diversity through maintenance of old growth ecosystems, and to maintain or improve habitat to provide high habitat capability for species that are at least partially dependent on old (late successional) timber stands with large diameter trees and obvious stand decadence" (FS, 1992). The third prescription is View/Timber, which applies to small areas in the Pit River Canyon, just below Pit 3 dam, north of Lake Britton along State Route 89, and south of upper Lake Britton halfway between state routes 89 and 299. View/Timber areas are between the upper portions of the Pit 3 tunnel and bypassed reach. The emphasis in these areas is to "provide scheduled timber harvests while maintaining and enhancing scenic qualities in areas that are visually sensitive or have high scenic value" (FS, 1992).

The two Lassen LRMP land use prescriptions that are adjacent to the project lands are Timber and Range/Wildlife. Timber areas are located south of Burney Falls State Park and south of the upper reaches of the Pit 3 bypassed reach. The Timber prescription emphasizes wood production and use, while maintaining other resources, and includes scheduled timber harvesting. The Range/Wildlife prescription applies to lands north of upper Lake Britton along the project boundary and north of the Late Successional area. The Range/Wildlife prescription emphasizes forage for livestock and wildlife by improving soil and vegetation conditions.

The Lassen LRMP recognizes the Lake Britton area as an important winter range for the mule deer and an interface between the northern spotted owl and the California spotted owl (see sections 3.3.3, *Terrestrial Resources*, and 3.3.4, *Threatened and Endangered Species*). The area adjacent to Lake Britton and the Pit River has one the largest populations of bald eagles within the continental United States. The LRMP calls for management procedures to protect and enhance the bald eagle habitat and the deer winter range. Prescribed burns have been used for deer winter range enhancement.

The LRMP also calls for management consistent with protecting the integrity of the 11,500-acre Lake Britton Archaeological District (District), which is listed in the National Register of Historic Places (NRHP). The District includes Lake Britton and 26 miles of shoreline (see section 3.3.7, *Cultural Resources*).

Shasta-Trinity National Forest Land and Resource Management Plan—The Shasta-Trinity LRMP was finalized in April 1995 and prescribes land management for FS-managed lands from the Pit 3 to the Pit 4 powerhouse. All project lands, and those influenced by project operations, that are subject to the Shasta-Trinity LRMP are within the Chalk Mountain LSR within the Pit Management Area. They are managed to maintain the health and diversity of the forest including the use of thinning and prescribed fire (FS, 1995). Dispersed recreation is consistent with the management of LSRs. Management objectives for lands within the Shasta-Trinity National Forest include maintaining diversity and protecting habitat for deer, elk, turkey, and black bear; protecting bald eagles, peregrine falcons, and northern spotted owls; protecting and enhancing sensitive plant species; and maintaining water quality in the Pit River drainage at a high level to meet a variety of objectives including promoting trout fisheries.

The Lassen and Shasta-Trinity LRMPs provide guidelines for the preferred ROS of land managed under each prescription. The ROS provides a framework for classifying the types of outdoor recreational opportunities that the public may desire and identifies the portion of the ROS that any given area may be able to provide. In designating the ROS, factors include qualities provided by the natural setting (i.e., vegetation, topography, scenery), associated with recreational use (i.e., type and level of recreational use), and related to management (i.e., development, access, and regulations). Table 44 presents LRMP management and ROS classifications for land within the project area or influenced by project operations. Table 45 summarizes ROS classifications and guidelines.

Table 44. Summary of Lassen and Shasta-Trinity National Forests management and ROS classifications for FS lands within the project area or influenced by project operations. (Source: FS, 1992, 1995)

Location	Management classification	ROS classification
Lands around Lake Britton and upper Lake Britton	Riparian Reserves and Matrix Lands (Northwest Forest Plan); Riparian/Fish, Late Successional, View/Timber,	Roaded Natural

Location	Management classification	ROS classification
	Timber, and Range/Wildlife (Lassen LRMP) (Britton Management Area)	
Project lands from Pit 3 dam to Pit 3 powerhouse and bypassed reach from Pit 3 dam to Pit 3 powerhouse	Late Successional Reserves, Matrix Lands and Riparian Reserves (Northwest Forest Plan) Riparian/Fish, View/Timber, and Timber (Lassen LRMP) (Britton Management Area)	Roaded Natural
Project lands from Pit 3 powerhouse to Pit 4 powerhouse and bypassed reach from Pit 3 powerhouse to Pit 4 powerhouse	Late Successional Reserves and Riparian Reserves (Pit Management Area)	Semi-Primitive Motorized (access by gravel-surfaced road (River Road))
Small area near Deep Creek Campground	Late Successional Reserves (Pit Management Area)	Rural

Table 45. Summary of ROS classifications and guidelines. (Source: FS, 1992, 1995)

ROS classification	Guidelines
Semi-Primitive Motorized	Provide for minimum evidence of onsite disturbance. Only subtle modifications to an otherwise natural environment. Motorized use of roads and trails is allowed.
Roaded Natural	Provide for low-to-moderate interaction between users. Sights and sounds of others are clearly evident.
Rural	Natural environment is substantially modified. Structures are readily evident. Controls and regulations are obvious and law enforcement visible.

Sierra Nevada Forest Plan Amendment—The Sierra Nevada Forest Plan Amendment establishes the management direction for five problem areas, including old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and lower westside hardwood forest ecosystems. It amends the LRMPs for nine National Forests within California including the Lassen LRMP. It also amends the Regional Guides for the Intermountain and

Pacific Southwest Regions. The Sierra Nevada Forest Plan Amendment only replaces standards and guidelines of the LRMPs that conflict with it. Within the project area, this plan applies only to FS lands managed under the Lassen LRMP, namely the area surrounding Lake Britton and the Pit River upstream of the Pit 4 dam (FS, 2001).

The management direction of the Sierra Nevada Forest Plan Amendment focuses on providing for species conservation with explicit Californian spotted owl and fisher conservation strategies. It also focuses on integrating species conservation with aquatic management and fire and fuels management, recognizing the need to reduce fire threat to human communities. Under the Sierra Nevada Forest Plan Amendment, forest lands north and east of Lake Britton are General Forest, while the area from Pit 3 dam to Pit 4 dam, including project lands and the bypassed reach, is Old Forest Emphasis. Additionally, the area immediately surrounding upper Lake Britton is within the Urban Intermix Zone, which overlaps the other land prescriptions extending 1.5 miles out from areas where the population density indicates at least one structure per 40 acres. Management of Old Forest Emphasis Areas focuses on developing larger aggregations of old forest over time through reducing hazardous fuel conditions and re-introducing fire to reduce fuels and meet ecological goals. General Forest refers to lands outside other land prescriptions. The management focus of these lands limits fuel treatments to 75 percent of the stand and works toward increasing the amount of forest with late-successional characteristics such as diverse species composition, multi-layered canopy, and higher density of large diameter trees. Management in the Urban Wildland Intermix zone gives high priority to fuel reduction activities to protect human communities from wildland fires as well as minimizing the spread of fires that might originate in urban areas (FS, 2001).

McArthur Burney Falls Memorial State Park Plan—CDPR completed the General Plan for Burney Falls State Park in 1997. The plan is composed of a series of elements including: (1) resources element, which establishes directives for protection restoration, management, and use of natural and cultural resources; (2) land use and facilities element to enhance public enjoyment and establish design criteria for park development; (3) interpretive element for park regulations and public education; (4) concession element to evaluate concession services and location; and (5) operations element to develop operation and maintenance goals for the park (CDPR, 1997). The plan was developed to manage park resources and meet expected needs of the public over the next two decades. Generally, the plan seeks to enhance vehicle safety and access, restore Burney Falls to a more natural state, and provide adequate recreation facilities to meet demand. The plan recognizes PG&E's management of Lake Britton to support its hydroelectric facility and that the maximum lake operating level could inundate part of the park's marina parking lot. As a long-range planning goal, the plan suggests that the PG&E-leased land bordering Lake Britton on the northen end of the park would be a good opportunity for land acquisition. PG&E plans to transfer 225 acres within the park to the state of California.

Shasta County General Plan—The Shasta County General Plan presents goals and policies concerning private lands within the county and serves as a basis for all decisions regarding land use within the county. The plan elements most relevant to the project include flood protection, dam failure inundation, timberlands, water resources and water quality, fish and wildlife habitat, open space, and recreation and heritage resources. Related policies include limiting development in floodplains and implementing flood control measures; developing an emergency plan for dam failure; preservation of timberlands; encouraging protection and enhancement of stream and river water quality; protecting riparian habitats and avoiding adverse effects on endangered and/or threatened species, especially bald eagles and wild trout; protecting recreational resources; and minimizing degradation to heritage resources such as the Lake Britton Archeological District. The Shasta County General Plan also includes the Shasta County zoning ordinance, which prescribes regulations governing land use, parcel sizes, and placement of structures. Private lands within and adjacent to the project boundary are within Timberland Production Zones (TPZs). These areas are reserved for timberland production and compatible uses. The TPZs cover most of the land near Lake Britton and along the Pit River from the eastern edge of the project boundary to Lake Britton and from Pit 5 reservoir to Pit 5 powerhouse. Zoning designations within the surrounding area include pockets of Rural Residential, Industrial, Commercial Recreation, Mixed Use, Mineral Resource, and Agricultural Zones.

Shoreline Land Management

PG&E states that the reservoir buffer zone is coterminous with the FERC project boundary, thus varying in width around each of the project reservoirs. The majority of the Lake Britton shorelines are open to the public because they are either FS lands or PG&E lands. Areas not accessible to the public include areas near the intakes, control gates, and other appurtenant facilities. PG&E maintains a public recreational policy that allows access to the project lands without compromising public safety, environmental resources, or interfering with the operation of the project for hydroelectric power generation. Although vehicular access is limited to developed recreation sites, numerous informal trails provide access to the shorelines. PG&E's policy also includes providing appropriate recreational facilities for public use, without discrimination, and providing general information about availability of recreational use through brochures, notices, and signs.

PG&E allows certain non-project uses and occupancies of project lands such as bridges, docks, piers, and other utilities. PG&E seasonally closes roads around Lake Britton to minimize disturbance to bald eagles, and permanently gates abandoned roads to prevent vehicular damage to archaeological sites. PG&E authorizes non-project-related development on a case-by-case basis, consistent with the terms of its existing license, if the proposed use is consistent with operational requirements, public safety, and the project's recreation and other resource management plans.

Two existing PG&E management plans, the HPMP and the IBEMP, provide additional measures for land management within the project area (for further discussion, see sections 3.3.7, *Cultural Resources*, and 3.3.4, *Threatened and Endangered Species*). The existing, operative HPMP prescribes land management policies aimed at protecting archaeological and historic resources and minimizing the effects of public use including: vandalism, vehicular access, erosion, cattle grazing, and recreational use (Goldberg, 1987). The existing, operative IBEMP provides measures for land management designed to protect sensitive bald eagle habitat and minimize conflicts between uses. Specifically, the IBEMP discourages development of new recreation areas within essential bald eagle habitat, recommends timber management that maintains a constant supply of suitable nesting trees and perch and roost sites, and encourages streamside and lakeside vegetation with cutting prohibited in essential eagle habitats (CDFG et al., 1986). Both the HPMP and the IBEMP recommend restricting access to sensitive cultural and environmental resources through seasonal road closures and prohibiting ORV use to minimize erosion potential and degradation of cultural resources and bald eagle habitat.

Traffic Use

Nineteen project area road segments are used (or historically were used) by project personnel for O&M as well as by recreationists accessing project lands and waters. These nineteen road segments are listed in table 46. Of these, six roads are wholly within the project boundary, including Pit 3 Reach Road, River Road, project road from Hillcrest-Big Bend Road to PSEA Camp Pit, Pit 5 Powerhouse Road, Rock Creek Road, and Clark Creek Road Crossing of Lake Britton (Pit 3 dam). The project boundary is 50 feet wide along the Pit 3 Reach Road, 100 feet wide along River Road, and 200 feet wide along the project road from Hill-Crest Big Bend Road to PSEA Camp Pit and along Pit 5 Powerhouse Road.

River Road (FS #50) is the primary access road to the project facilities in the Pit River Canyon below Lake Britton, and roughly parallels the Pit River from Pit 3 dam to the Tunnel Reservoir. Reedy Camp Road connects to River Road just north of the Tunnel Reservoir and terminates at Hillcrest-Big Bend Road, which is not a project road. Roughly 1,700 feet south along Hillcrest-Big Bend Road, Pit 5 Powerhouse Road starts and continues westward terminating at the Pit 5 powerhouse. Clark Creek Road is a Shasta County Road that loops around Lake Britton from State Route 89 on the north side to State Route 89 on the south side. Only the portion crossing over Pit 3 dam is within the project boundary. The rest of the project area road segments provide access to specific facilities, campgrounds, and other recreational areas. The FS, in its November 14, 2003, letter transmitting the final 4(e) conditions, lists four additional project roads affecting National Forest System Lands: the bald eagle management area road, Pit 4 reservoir spurs, Big Pine Deer Camp Road, and gravel bar road. State Routes 89 and 299 cross the project area. State Route 89 runs north-south from McCloud to Mt. Lassen, crossing Lake Britton between

Dusty Campground and Jamo Point boat launch. State Route 299 runs east-west from Burney to Fall River Mills crossing the Pit River near the eastern project boundary.

CalTrans provided traffic data that projected that traffic would increase 56 percent on State Route 89 (1,800 to 2,800 average daily traffic) by 2022, which is likely to cause increased visitation to the project area, especially at the recreational facilities and the road to the Jamo Point boat launch and Pines picnic area. PG&E monitored traffic within the project area at seven locations throughout the 2000 season. The Pit 3 and Pit 4 reaches of River Road experienced their peak use on Memorial Day weekend (198 vehicles per day (vpd) and 119 vpd, respectively) and the opening of fishing season (118 vpd and 98 vpd, respectively). The averages for the Pit 3 and 4 reaches of River Road from May to October 2000 were 60 vpd and 39 vpd, respectively. Parallel to the Pit 5 Reach, traffic peaked on Pit 5 Powerhouse Road over Fourth of July weekend (183 vpd) and the opening of fishing season (173 vpd); however, average use from May to October 2000 was 81 vpd. In its *1990 Traffic Safety and Signage Plan,* PG&E concluded that at 200 vpd[22] on River Road, only 3 minutes would pass before one vehicle would meet another. PG&E recommends traffic safety improvements, if this 200 vpd threshold is met.

Table 46. Summary of road segments within the project area. (Source: PG&E, 2001; FS letter commenting on the draft EIS dated May 19, 2003; and FS letter transmitting final 4(e) conditions dated November 14, 2003)

Road	Sign	Surface	Land ownership	Main-tenance	Seasonal closure	Gates	Notes
Pit 3 reach of River Road	No	Paved	FS; PG&E use under FS Special-Use Permit (1/11/32)	PG&E	No	No	FS #50; narrow; portions owned by PG&E

[22] In their draft EIS comment letter, dated May 19, 2003, the FS clarified that based on their discussions with PG&E, the 200 vpd refers to a seasonal average (Memorial Day to Labor Day). It is not intended as a one time threshold.

Road	Sign	Surface	Land ownership	Main-tenance	Seasonal closure	Gates	Notes
River Road	No	Gravel	FS/PG&E	PG&E	No	No	FS #50 (from Pit 3 power-house to Pit 5 dam)
Pit 3 Surge Tank Road	?	?	FS/PG&E	?	?	?	
Reedy Camp/Hagen Flat Road	No	Gravel	PG&E	PG&E	No	No	
Pit 5 Powerhouse Road	Yes	Paved	PG&E/ private	PG&E	No	No	
Pit 4 Valve House Road	?	Gravel	FS/PG&E	?	No	Yes	Gate doesn't meet FS safety stand-ards: access to valve house, surge tank, pen-stocks
Pit 4 Surge Tank Road	?	?	FS	?	?	?	

Road	Sign	Surface	Land ownership	Main-tenance	Seasonal closure	Gates	Notes
Rock Creek Road	No	Gravel	FS	PG&E	No	Yes	Lightly used to access power conduit
Clark Creek Road crossing of Lake Britton	Yes	Concrete	PG&E	PG&E	No	Yes	Section of county road on Pit 3 dam
North Shore Campground Road	Yes	Paved	FS/PG&E under FS Special-Use Permit (January 27, 1965)	PG&E	Yes	Yes	Closed Septem-ber to May; PG&E only owns lower portion
Jamo Point boat launch/Pines picnic area	Yes	Paved	PG&E	PG&E	No	Yes	Closed evenings
Dusty Campground Road	Yes	Paved/ Native surface	FS/PG&E	PG&E	No	Yes	
Upper Lake Britton/Gas Pipeline Road loop	No	Native surface	PG&E	PG&E	Yes	Yes	
Lower Hat Creek Road loop	No	Native surface	PG&E	PG&E	Yes	Yes	

Road	Sign	Surface	Land ownership	Main-tenance	Seasonal closure	Gates	Notes
State Park Lake Road	Yes	Paved	PG&E	State Parks	No	Yes	Exten-sion of main State Park Road; land current-ly in process of being transfer-red to state
Bald Eagle Mgt. Area Road	?	?	FS/PG&E	?	?	?	No evidence of link to project purposes
Spoil Pile 4D Road	?	Native surface	FS	?	No	No	
Pit 4 Reservoir Spurs	?	?	FS/PG&E	?	?	?	FS indicates these as access to possible disposal pile site
Ruling Creek Dispersed Site Road	?	Gravel	FS	?	No	No	

Road	Sign	Surface	Land ownership	Main-tenance	Seasonal closure	Gates	Notes
Big Pine Deer Camp Road	?	?	FS	?	?	?	No evidence of link to project purposes
Deep Creek Campground Road	Yes	Native surface	FS	FS	No	No	FS #36N36 and 36N60; not a project facility
Gravel Bar Road	?	?	FS	?	?	?	No evidence of link to project purposes
Bush Bar Road	No	Gravel	PG&E	PG&E	No	No	Unim-proved; leads to old school house founda-tion and gravel bar

PG&E rated all of the project area roads using the FS's classification system. The main roads servicing the Pit 3, 4, and 5 bypassed reaches (River Road, Reedy Camp Road, and Pit 5 Powerhouse Road) were rated as traffic service level B, which is congested during periods of heavy traffic, slower speeds, and high dust, but accommodates all legal vehicles. North Shore Campground Road, Jamo Point boat launch/Pines picnic area Road, and State Park Lake Road were also rated with a traffic service level B. Rock Creek Road, Dusty

Campground Road, Upper Lake Britton/Gas Pipeline Road loop, Lower Hat Creek Road loop and Deep Creek Campground Road were rated as traffic service level C, which has interrupted traffic flow, limited passing facilities, and low-design speeds; is unstable in certain traffic or weather conditions; and may not be able to accommodate some vehicles. Bush Bar Road was rated traffic service level D, which has slow or blocked traffic flow and rough and irregular surface, is difficult for two-way traffic, and accommodates high-clearance vehicles. There was no rating for the other roads listed in Table 46.

As part of the last relicensing process for the project, PG&E has been actively managing roads to protect sensitive resources and for project operation and safety purposes. In the upper Lake Britton area, boulders have been placed along access roads and parking areas to prevent off-road travel and minimize effects of travel in non-designated roadways. Additionally, gates are closed at the FS property boundary near Soldier Creek during bald eagle nesting season. In the lower Hat Creek area, fences, boulders, and signs keep RVs out of sensitive areas. In lower Lake Britton, boulders have been placed at Ferry Crossing to protect shoreline resources and around North Shore Campground to prevent access to bald eagle nesting areas.

However, there are road segments within the project area that are in need of repair. Pit 3 Reach Road has been described as having aging and deteriorating pavement with longitudinal cracking, edge breaking, and raveling, poor bridge railings, and faint pavement markings. Pit 5 Powerhouse Road is also described as having aging pavement and several warning and advisory signs have fallen down.

On several occasions (October 9, 2002 preliminary 4(e) conditions; December 18, 2002 response to PG&E comments; May 19, 2003 comments on the draft EIS; and November 14, 2003 letter transmitting final 4(e) conditions), the FS expressed concerns about the existing conditions of the project area roads. Many of the project roads were constructed by PG&E during project construction starting in the 1920s. The FS comments that there have been limited road improvements and rehabilitation of the roadways to bring them up to current FS road standards. As a result, the FS states that there are areas where repairs are urgently needed, especially in the Pit 3 Reach Road as evidenced by photographs included in the FS October 9, 2002 submission showing segments of the road that are undercut by erosion. The road is a single lane road with two-way traffic that abuts the canyon with no shoulder. Erosion along the edge of the road poses a public safety hazard. Likewise, portions of roads require general road upkeep such as repaving, reinstalling missing signs, filling potholes, and repainting fog lines.