1.0 PURPOSE OF ACTION AND NEED FOR POWER

On October 23, 2002, Pacific Gas and Electric Company (PG&E) filed an application with the Federal Energy Regulatory Commission (Commission or FERC) for a new license for the existing Upper North Fork Feather River (UNFFR) Project. The licensed capacity of the project is 342.6 megawatts (MW), and PG&E estimates the dependable capacity to be 357.3 MW.[7] On average, the project generates about 1,171.9 gigawatt-hours (GWh) of electricity per year. The project is located on the North Fork Feather River (NFFR), in the vicinity of the community of Chester, Plumas County, California (figure 1-1). The project occupies 1,024 acres of lands of the United States: 418 acres of the Plumas National Forest and 568 acres of the Lassen National Forest, administered by the U.S. Department of Agriculture (USDA), Forest Service (FS); and 38 acres administered by the U.S. Department of the Interior (Interior), Bureau of Land Management.

1.1 PURPOSE OF ACTION

The Commission must decide whether to issue a new license to PG&E for the UNFFR 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.

In this draft 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 draft EIS we assess the environmental and economic effects of licensing the project (1) as proposed by PG&E, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that we address include

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[7] PG&E bases its dependable capacity on load carrying ability during the critical hydrologic period coincident with its peak system load. The critical hydrologic period was in 1977, and the peak system load typically occurs during July and August. Dependable capacity is slightly greater than licensed capacity because PG&E can operate the units with slightly greater head and/or flow than rated.

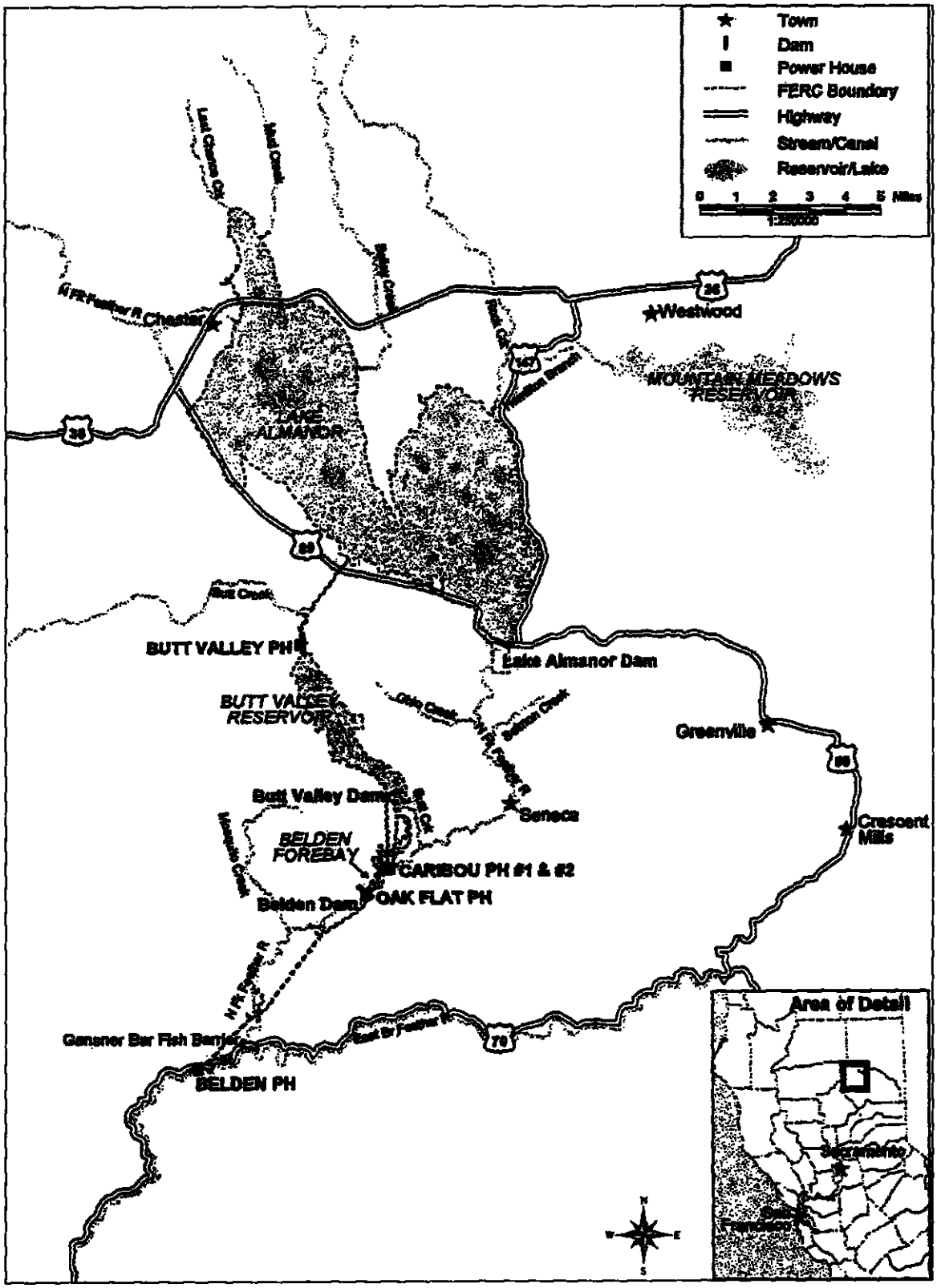

Figure 1-1. General site location of the Upper North Fork Feather River Hydroelectric Project. (Source: PG&E, 2002a)

providing appropriate minimum flows in the bypassed reaches, whether enhancement of the supply of gravel and other native materials is needed, management of Lake Almanor 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 UNFFR Project is a resource that is important to the operation of the Feather River system as a whole, contributes to PG&E's resource diversity, and plays a part in meeting the capacity requirements of both PG&E and the state of California.

The UNFFR Project is one of the upstream-most projects in a series of water resource and hydroelectric projects in the Feather River basin. There are 11 powerhouses licensed to PG&E upstream of the California Department of Water Resource's (CDWR's) Lake Oroville Project, which includes hydroelectric generation as well as a 3.5 million acre-foot storage reservoir. Operations at the UNFFR Project not only affect generation at this project, but the reregulation of UNFFR flows influences downstream generation. Thus, project operations affect the availability of generation from the project itself as well as downstream facilities.

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. The UNFFR Project is in the California-Mexico Power Area (CA/MX) of the Western Electricity Coordinating Council (WECC) within the North American Electric Reliability Council (NERC). NERC annually forecasts electrical supply and demand nationally and regionally for a 10-year period. According to NERC's most recent forecast, hydroelectric generation will only account for 80 MW (1.1 percent), of the projected capacity growth of 7,110 MW in the region between 2003 and 2012 (table 1-1) (http://www.wecc.biz/2003_Summer_Assessment_Revised.pdf). If the project ceased generation, the area-wide diversity of the CA/MX would be reduced because the electric output of the project would not be completely replaced by other hydroelectric generation. With the project currently reducing greenhouse gas emissions by 100,000 metric tons of carbon/year compared with fossil-fuel generation, net emissions in the CA/MX would increase over the coming 10-year period if the project ceased to generate electricity.

Peak summer demand and annual energy requirements for the CA/MX are projected to grow at an average of 1.9 and 1.8 percent, respectively, from 2003 through 2012 (table 1-2). Projected resource summer capacity margins (generating capacity in excess of demand) vary over the period, but overall decrease from 24.9 to 13.4 percent of firm peak demand (http://www.wecc.biz/2003_Summer_Assessment_Revised.pdf). With available reserve in the CA/MX projected to decrease below generally accepted values of 15 to 18 percent, generation loss from this project could have a significant effect on the ability of the area to meet regional requirements for generation.

Table 1-1. Actual and projected generation resources in the California-Mexico Power Area. (Source: http://www.wecc.biz/2003_Summer_Assessment_Revised.pdf, as modified by staff.)

	Resources in 2003 (MW)	Resources in 2012 (MW)	Growth Over Period (MW)	Growth Over Period (%)	Resource Growth as a Percent of Total Growth (%)
Hydro - conventional	7,193	7,213	20	0.3%	0.3
Hydro- pumped storage	3,840	3,900	60	1.6%	0.8
Steam – coal	3,604	2,024	-1,580	-43.8%	-22.2
Steam – oil	276	0	-276	-100.0%	-3.9
Steam- gas	18,016	14,070	-3,946	-21.9%	-55.5
Nuclear	4,450	4,450	0	0.0%	0.0
Combustion turbine	6,787	6,749	-38	-0.6%	-0.5
Combined cycle	6,600	19,438	12,838	194.5%	180.6
Geothermal	2,184	2,184	0	0.0%	0.0
Internal combustion	40	48	8	20.0%	0.1
Other	1,013	1,037	24	2.4%	0.3
Total	54,003	61,113	7,110	13.2%	100%

Table 1-2. Actual and forecasted generation, demand, and reserve capability for CA/MX and WECC. (Source: http://www.wecc.biz/2003_Summer_Assessment_Revised.pdf, as modified by staff)

	2003 Actual	2012 Forecasted	Annual Percentage Change
CA/MX			
Existing/planned generation (MW)	54,003	61,113	1.4%
Summer peak demand (MW)	53,334	64,585	2.2%
Winter peak demand (MW)	42,017	50,921	2.2%
Annual energy load (GWh)	292,024	349,983	2.0%
Summer reserve as percentage of firm peak demand	24.9%	13.4%	
Winter reserve as percentage of firm peak demand	19.8%	14.3%	
WECC			
Existing/planned generation (MW)	173,440	205,763	1.9%
Summer peak demand (MW)	136,587	164,417	2.1%
Winter peak demand (MW)	125,149	148,931	2.0%
Annual energy load (GWh)	841,180	1,001,964	2.0%
Summer reserve as percentage of firm peak demand	31.6%	21.2%	
Winter reserve as percentage of firm peak demand	36.3%	27.4%	

Due to its effect on the Feather River system, the lack of projected new hydroelectric resources in the system, and the projected growth in demand and lack of reserve capability in the region, we conclude that power from the UNFFR Project would help meet both short- and long-term needs for power and ancillary services in the CA/MX.

1.3 INTERVENTIONS

On December 26, 2002, the Commission issued a notice accepting PG&E's application to relicense the UNFFR Project. This notice set a 60-day period, which ended on February 24, 2003, during which interventions could be filed. In response to that notice, the following entities filed motions to intervene:

Intervenor	Date of Letter
U.S. Department of Agriculture, Forest Service	February 19, 2003
Biggs-West Gridley Water District	February 20, 2003
Butte Water District	February 20, 2003
U.S. Department of the Interior	February 20, 2003
Richvale Irrigation District	February 20, 2003
Western Canal Water District	February 20, 2003
California Department of Fish and Game	February 21, 2003
U.S. Department of Commerce, National Marine Fisheries Service	February 21, 2003
Plumas County and Plumas County Flood Control and Water Conservation District	February 21, 2003
State Water Resources Control Board	February 21, 2003
California Trout, Trout Unlimited, and California Sportfishing Protection Alliance	February 24, 2003
California Trout and Trout Unlimited	February 24, 2003
Lassen Municipal Utility District	April 17, 2003
Maidu Cultural and Development Group	May 15, 2003
Anglers Committee Against Artificial Whitewater Flows	September 5, 2003
State Water Contractors	January 8, 2004

1.4 SCOPING PROCESS

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 25, 2003. We held one scoping meeting on May 20, 2003, in Chester, California, and one scoping meeting on May 21, 2003, in Chico, 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 oral comments received at the scoping meetings, the following agencies, representatives, individuals, and non-governmental organizations (NGOs) provided written comments.

Commenting Entity	Date of Letter
Bridget Johnston	June 7, 2003
National Park Service	June 11, 2003
Lake Almanor Fishing Association	June 14, 2003
Anglers Committee Against Artificial Whitewater Flows	June 17, 2003
California Department of Fish and Game	June 17, 2003
Plumas County Board of Supervisors	June 17, 2003
American Whitewater Affiliation, Shasta Paddlers, and Chico Paddleheads	June 18, 2003
California State Water Resources Control Board	June 19, 2003
U.S. Fish and Wildlife Service	June 19, 2003
Maidu Cultural Development Group	June 20, 2003
U.S. Department of Commerce, National Marine Fisheries Service	June 19, 2003
Plumas County Flood Control and Conservation District	June 20, 2003 and July 7, 2003

We issued the revised Scoping Document 2 on August 7, 2003, which addressed 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 Commission regulations. The

Commission issued a public notice on August 25, 2003, that the application for the UNFFR Project was ready for environmental analysis (REA Notice), and that comments should be filed by December 1, 2003. The following entities commented:

Commenting Entity	Date of Letter
Maidu Cultural and Development Group	November 24, 2003
California Department of Fish and Game	November 26, 2003
U. S. Department of Commerce, National Marine Fisheries Service	November 26, 2003
American Whitewater Affiliation, Shasta Paddlers, and Chico Paddleheads	December 1, 2003
U.S. Department of the Interior	December 1, 2003
U.S. Department of Agriculture, Forest Service	December 1, 2003

1.6 SETTLEMENT AGREEMENT

On January 24 and 25, 2001, PG&E met with several resource agencies in Sacramento to begin a series of discussions on environmental topics relating to project relicensing. Eventually, NGOs were involved in this series of discussions, which ultimately developed into a broad group of UNFFR Project relicensing stakeholders. PG&E referred to this group as the 2105 Collaborative, and it included PG&E, the FS, the California Department of Fish and Game (CDFG), the U.S. Fish and Wildlife Service (FWS), Plumas County and the local 2105 Committee, the U.S. National Park Service (NPS), the U.S. National Marine Fisheries Service (NMFS), American Whitewater (AW) and local recreation interests, the California Sportfishing Protection Alliance, the Anglers Committee, Native American interest groups, the California Hydro Reform Coalition, and the California State Water Resources Control Board (SWRCB). The 2105 Collaborative had a goal of reaching mutually acceptable protection, mitigation, and enhancement (PM&E) measures for inclusion in a new license that could be issued for the project.

On October 1, 2003, PG&E filed a letter with the Commission that provided an update on its efforts to reach agreement on behalf of the 2105 Collaborative. Attached to the letter was a flow issues settlement proposal, which included draft settlement language tentatively agreed to at a meeting on September 29, 2003, on the subjects of streamflow management, recreation flow management, reservoir operation, and water year (WY) type. At that time, PG&E anticipated that it would have a final fully, executed Settlement Agreement (SA) filed with the Commission by December 1, 2003.

NPS, the FS, and Plumas County, all filed letters with the Commission in support of the 2105 settlement process and the general settlement language submitted by PG&E. CDFG submitted a letter to PG&E expressing its agreement with the terms and conditions defined in the draft SA, and Jerry Mensch of the California Sportfishing Protection Alliance sent an email to William Zemke of PG&E supporting both the collaborative process and the draft agreement process. PG&E filed both the letter from CDFG and the email from Jerry Mensch with the Commission on October 16, 2003.

In response to the Commission's REA notice, on November 28, 2003, CDFG submitted its recommendations pursuant to Section 10(j) of the Federal Power Act (FPA). In its recommendations, CDFG indicated its support of the PM&E measures outlined in the draft SA and attached to CDFG's recommendations was a copy of the draft SA dated October 31, 2003.

On March 5, 2004, PG&E filed a letter with the Commission which included an updated version of the draft SA. PG&E stated that this version reflected the 2105 Collaborative's progress from meetings held on February 20, March 1, and March 4, during which they reviewed the draft on a line-by-line basis. In its letter, PG&E stated that the 2105 Collaborative was optimistic that a consensus could be reached on final language in the near future. PG&E also indicated that a date for all of the parties of the 2105 Collaborative to sign the final SA had not yet been set, but that it could realistically occur in early April 2004.

Also in its March 5, 2004, letter, PG&E disclosed that the issue of water temperature control was not resolved in the draft SA, but that it is recognized as an important topic by the 2105 Collaborative. PG&E also acknowledged that study results and modeling information critical to this issue have only recently been available. PG&E stated that additional studies and data synthesis would be necessary prior to any decision-making on water temperature by the 2105 Collaborative. PG&E indicated its willingness to continue discussions with the 2105 Collaborative in hopes that an addendum to the current SA addressing this issue could be completed, but chose to not estimate a date for the completion of the addendum.

On April 30, 2004, PG&E filed the final SA, with the Commission (PG&E, 2004; attached as appendix A of this EIS). In its transmittal letter, PG&E indicated that the SA represented the concerted effort of a broad-based group of resource agencies, public entities, and NGOs and that it addressed many key issues concerning the project and its operation. PG&E also acknowledged that agreement on appropriate measures for the control of water temperatures in the NFFR was not included in the settlement. PG&E stated that discussions with the Collaborative were continuing and that its goal is to reach a collaborative settlement on this issue, if possible. PG&E intends to keep the Commission informed of the status of these discussions.

The April 30, 2004, final SA includes measures pertaining to minimum streamflows, pulse flows, ramping rates, recreation flows, reservoir operations, water quality monitoring, wildlife habitat enhancement, recreation facilities development, maintenance and monitoring, adjustments to the project boundary, an interpretation and education (I&E) program, and land management and visual resources. We consider the final SA to represent the proposed measures of PG&E and the other signatory parties[8] to the agreement, superceding previous recommendations made by these respective entities.[9]

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 APPLICANT'S PROPOSAL

PG&E proposes to maintain its existing operations, with minor modifications, at the UNFFR Project. No new construction is proposed.

2.1.1 Project Description and Operation

2.1.1.1 Project Description

The existing UNFRR Project consists of three dams and reservoirs; five powerhouses; tunnels and penstocks connecting the reservoirs to the powerhouses, and associated transmission, operations and maintenance (O&M), and access facilities. The five developments include a total of eight hydroelectric generating units with a total dependable capacity of 357.3 MW. All three reservoirs provide regulated storage. The project waters continue downstream in the NFFR to the Rock Creek reservoir and the Rock Creek-Cresta Hydroelectric Project (FERC No. 1962).

The upstream-most reservoir is Lake Almanor, located on the NFFR. Lake Almanor has a usable storage capacity of 1,134,016 acre-feet, a maximum water surface area of 27,000 acres, and a maximum normal water surface elevation of 4,494 feet (PG&E datum). Lake Almanor is impounded by Canyon dam, an earth-filled structure 135 feet high and 1,400 feet wide at its base. The dam has an outlet tower and tunnel capable of releasing up to 2,100 cubic feet per second (cfs) to the NFFR through outlets with inverts at 4,420 feet and 4,465.0 feet (PG&E datum), as well as a simple overflow spillway at 4,500 feet (PG&E datum). The maximum water storage elevation, as

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[8] Signatory parties to the SA include the following: PG&E, USDA Forest Service, Plumas National Forest, California Department of Fish and Game, Plumas County Board of Supervisors, CA Sportfishing Protection Alliance, American Whitewater, Shasta Paddlers, Chico Paddleheads, and Mountain Meadows Conservancy.

[9] In section 3.1 of the SA, the parties to the settlement requested that FERC accept and incorporate, without material modification, as license articles all of the PM&E measures included in appendix A of the settlement.

authorized by the California Division of Safety of Dams, is 4,994 feet (PG&E datum). Water also leaves Lake Almanor through the Prattville intake, which has an invert located at 4,410.0 feet (PG&E datum). From the Prattville intake, flow passes through the 10,899-foot-long Prattville Tunnel No. 1A, then the 5,568-foot-long Butt Valley penstock to the Butt Valley powerhouse.

Butt Valley reservoir, located on Butt Creek, takes inflows from Butt Creek as well as the Butt Valley powerhouse. Butt Valley reservoir has a usable storage capacity of 49,897 acre-feet, a maximum water surface area of 1,600 acres, and a maximum normal water surface elevation of 4,132.1 feet (PG&E datum). Butt Valley reservoir is impounded by Butt Valley dam, an earth filled structure 1,350 feet long, 74 feet high, and 850 feet wide at its base. The dam has no low level outlet, and an ungated overflow spillway has a crest elevation of 4,132.1 feet (PG&E datum). Water also leaves Butt Valley reservoir through the Tunnel No. 2 intake, which has an invert elevation of 4,066.9 feet (PG&E datum), through the 9,776-foot-long Tunnel No. 2 and the 2,222-foot-long Caribou No. 1 penstock to the Caribou No. 1 powerhouse, and through the Tunnel No. 2A intake, which has an invert elevation of 4,093.0 feet (PG&E datum) through the 8,710-foot-long Tunnel No. 2A and the 2,322-foot-long Caribou No. 2 penstock to the Caribou No. 2 powerhouse.

Belden forebay, located on the NFFR, receives water from the Seneca bypassed reach, and the Caribou Nos. 1 and 2 powerhouses. Belden forebay has a usable storage capacity of 2,421 acre-feet, a maximum water surface area of 42 acres, and a maximum normal water surface elevation of 2,975.0 feet (PG&E datum). Belden forebay is impounded by Belden forebay dam, a rock filled structure 500 feet long, 152 feet high, and 630 feet wide. Water exiting the Belden forebay is either diverted to the Belden powerhouse via the Belden intake, which has an invert elevation of 2,930.0 feet (PG&E datum), then through the Belden tunnel and penstock, or continues down the NFFR. The dam also has a spillway with four radial gates and a siphon that activates if the reservoir exceeds 2,975.5 feet (PG&E datum).

The Butt Valley powerhouse includes a single, 55,000-hp vertical Francis turbine. The generator is a 13.8-kV, 44,400-kVA, 3-phase unit with a 0.9 power factor. The development includes a 40,000-kVA transformer bank that steps up voltage from 13.8 kV to 115 kV for transmission.

The Caribou No. 1 powerhouse includes three, 30,000-hp double overhung impulse turbines. Two of the turbines are connected to 11.5-kV, 27,777-kVA, 3-phase generators with a 0.9 power factor, and one turbine is connected to an 11.5-kV, 26,500-kVA, 3-phase generator with a 0.9 power factor. The generating units are connected to a 90,000-kVA transformer bank that steps up voltage from 13.8 kV to 115 kV for transmission, and the development's output can also be tied to Caribou No. 2 development through a 56,000-kVA autobank.

The Caribou No. 2 development has two, 76,000-hp, six-jet vertical shaft impulse turbines. One of the turbines is connected to 13.8-kV, 64,000-kVA, 3-phase generators with a 0.9 power factor, and one turbine is connected to a 13.8-kV, 67,000-kVA, 3-phase generator with a 0.9 power factor. The generating units are connected to a 137,800-kVA transformer bank that steps up voltage from 13.8 kV to 230 kV for transmission, and the development's output can also be tied to Caribou No. 1 development through a 56,000-kVA autobank.

The Oak Flat development, located at the base of Belden forebay dam, has a single 1,837-hp horizontal shaft Francis turbine. The turbine is connected to a 1,628-kVA, 3-phase generator with a 0.86 power factor. The generating unit is connected to a 2,001-kVA transformer bank which connects to a 21/2.4-kV distribution line.

The Belden powerhouse contains a single, 158,000-hp vertical shaft Francis turbine. The turbine is connected to 13.8-kV, 131,000-kVA, 3-phase generator with a 0.90 power factor. The generating unit is connected to a 131,000-kVA transformer bank that steps up voltage from 13.8 kV to 230 kV for transmission.

There are three transmission lines associated with the project. A 7.4-mile-long line from Butt Valley to the Caribou development was developed to 230 kV standards but is currently operated at 115 kV. A 12-kV tap line carries power from the Oak Flat development to a local distribution line. The third line is a 115-kV transmission circuit extending 38.2 miles from the Caribou developments to the Big Bend substation.

The applicant proposes no new facilities, but it does propose to add 33.73 acres of lands of the Plumas National Forest to the project because of historical and future project use of these lands.

2.1.1.2 Project Operation

The developments are operated in an integrated manner, and their operation is also coordinated with other facilities in the Feather River system, including the upstream unlicensed Hamilton Branch Project, and the downstream Rock Creek – Cresta (FERC No. 1962), Bucks Creek (FERC No. 619), and Poe (FERC No. 2107) projects.

Water levels in Lake Almanor are maintained below the authorized level of 4,994.0 feet (PG&E datum) by releases through the Prattville intake to the Butt Valley development, and through the low level outlet at Canyon dam, which releases flows into the NFFR. Due to the large capacity of Lake Almanor, Canyon dam is rarely operated to control water level. The water level has never exceeded the authorized level, and thus the spillway has never been used to pass flows. The minimum flow requirement downstream of Canyon dam in the UNFFR is 35 cfs. Outflow from Lake Almanor is controlled in the spring to refill the lake with snowmelt, though in drier years the reservoir will not completely fill.

Butt Valley reservoir is operated to meet power system needs. The average daily reservoir fluctuation was 0.27 foot, and daily fluctuations exceeded 1 foot about 3.5 percent of the time over the period of record. Spill at Butt Valley dam is rare due to the high hydraulic capacity of the Caribou developments.

Belden forebay can fluctuate up to 10 feet in a day due to changing upstream inflows. The minimum flow to the NFFR is 140 cfs from the last Saturday in April to Labor Day, and 60 cfs for the remainder of the year. Spill at the dam is infrequent due to upstream control of inflows and the control of flows to the Belden development.

Operation of all project developments is controlled from the Caribou No. 1 powerhouse. The maximum flow through (i.e., hydraulic capacity of) each development is as follows:

- Butt Valley: 2,118 cfs
- Caribou No. 1: 1,114 cfs
- Caribou No. 2: 1,464 cfs
- Oak Flat: 140 cfs
- Belden: 2,410 cfs

2.1.2 Proposed Environmental Measures

PG&E proposes the following PM&E measures:

(1) Use the upper-level gates in the Canyon dam intake tower for releases to the Seneca reach beginning on September 15 and continuing until at least November 1.

(2) Continue to implement the road maintenance agreement between PG&E and the Plumas National Forest.

(3) Operate and maintain the existing gages to determine river stage and minimum streamflow below Canyon dam (NF-2) and Belden forebay dam (NF-70) under the supervision of the United States Geological Survey (USGS).

(4) Prepare annual water quality report(s) that contain elements consistent with reporting requirements from five water quality programs.

(5) Develop a monitoring program to evaluate the effectiveness of seasonal switching of the Canyon dam intake tower gates used.

(6) Develop a monitoring program to determine if the elevated dissolved cadmium and specific conductance levels recorded within the UNFFR basin during 2002 and 2003 were caused by the project and potential solution(s) if they are project effects.

(7) Develop a monitoring program to document long-term water quality trends in Lake Almanor under altered project operations for the new license.

(8) Develop a monitoring program to assess potential bioaccumulation of methylmercury, silver, and PCBs in catchable-sized fish in the UNFFR Project area.

(9) Develop a bacteriological monitoring program, using a methodology appropriate to determine compliance with state water quality standards.

(10) Provide minimum streamflows to the Seneca and Belden reaches, as measured at gages NF-2 and NF-70, in accordance with tables A-1 and A-2 in the final SA. Minimum streamflows would commence within 60 days of the issuance of the new license, unless facility modifications are required.

(11) Maintain existing streamflow in lower Butt Creek. No action would be taken to reduce dam leakage, tunnel leakage, spring, or other natural flows that currently provide inflow to Butt Creek below the Butt Valley dam.

(12) Provide one pulse flow release from both Canyon dam (Seneca reach) and Belden dam (Belden reach) in each of January, February, and March if the forecasted WY type for that month indicates that the WY is anticipated to be either normal or wet. No pulse flows would be required in months where the WY type forecast for that month indicates that the WY would be either dry or critically dry.

(13) Develop a monitoring program to evaluate movement of sediment that occurs during scheduled pulse flow events and other flows of a similar magnitude as scheduled pulse flows.

(14) Implement a ramping rate of 0.5 foot per hour, in all months, at Canyon dam, measured at gage NF-2, and Belden dam, measured at gage NF-70, when ramping rate can be controlled.

(15) Block load at the Belden powerhouse at times when the Rock Creek dam is spilling water in excess of the minimum streamflow required under the license for the Rock Creek-Cresta Project but less than 3,000 cfs.

(16) Rehabilitate and maintain an existing streamflow gaging station on Lower Butt Creek designated as NF-9, and read the gage four times a year.

(17) Develop a monitoring program in lower Butt Creek to: (a) determine if the weir for gage NF-9 is acting to block upstream fish passage, and (b) evaluate habitat quality at intervals of 3 to 5 years.

(18) If determined to be necessary based on the results of the monitoring program in lower Butt Creek, provide pulse flows in lower Butt Creek via use of the Butt Valley reservoir spillway or an acceptable alternative.

(19) Develop an aquatic monitoring program in the Seneca and Belden reaches that would include monitoring of fish and benthic macroinvertebrates in at least three sites in each reach.

(20) Maintain Lake Almanor water levels as follows:

- Wet and Normal Water Years. By May 31, the water surface elevation would be at or above 4,485.0 feet[10] (908,000 acre-feet) and from June 1 through August 31, at or above 4,485.0 feet (908,000 acre-feet);

- Dry Water Years. By May 31, the water surface elevation would be at or above 4,483.0 feet (859,000 acre-feet) and from June 1 through August 31, at or above 4,480.0 feet (787,000 acre-feet);

- Critically Dry Water Years. By May 31, the water surface elevation would be at or above 4,482.0 feet (835,000 acre-feet) and from June 1 through August 31, the water surface elevation is at or above 4,480.0 feet (787,000 acre-feet); and

- Multiple Dry Water Years. In the event of multiple, sequential dry or critically dry water years, PG&E would be allowed to decrease surface water elevations below those specified above, as well as the current minimum elevations specified for the Butt Valley and Belden reservoirs.

(21) Take such reasonable actions as may be prudent to prevent the water surface elevation in Lake Almanor from exceeding elevation 4,494.0 feet unless a higher level is approved by the Commission and the California Department of Water Resources (CDWR), Division of Safety of Dams.

(22) Operate Butt Valley reservoir so that the minimum water surface elevation from June 1 through September 30 is at or above 4,120.0 feet and from October 1 through May 31 at or above 4,115.0 feet.

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[10] Lake level is defined as the water surface elevation, expressed in PG&E datum, which is 10.2 feet lower than the USGS datum.

(23) Operate Belden reservoir so that the minimum water surface elevation is 2,905.0 feet, year round.

(24) Forecast the WY type on or about January 10, notify the FS, CDFG, FWS, SWRCB, and Plumas County within 15 days, and operate for the remainder of that month and until the next forecast based on that January forecast. New forecasts would be made on or about the tenth of February, March, April, and May after snow surveys are completed, and operations would be changed as appropriate. The May forecast would be used to establish the WY type for the remaining months of the year and until the following January 10, when forecasting should begin again.

(25) Remove the Gansner Bar fish barrier on the Belden reach.

(26) Design and implement a wildlife habitat enhancement plan within 1 year of license issuance.

(27) Develop an amphibian monitoring plan for FS sensitive species for the Seneca, Butt Creek, and Belden bypassed reaches.

(28) Test bramble (Himalayan blackberry) control methods at two to four river access sites along the Belden reach, including planting alders to shade out the brambles.

(29) Continue to comply with measures protecting bald eagles according to existing nesting territory management plans.

(30) Finalize and implement a recreation resource management plan (RRMP) for the project that includes the following elements:

- A recreation facilities development program;
- A recreation operations and maintenance (O&M) program;
- An I&E program, including the development of a bathymetric map for Lake Almanor;
- A recreation monitoring program;
- A resource integration and coordination program; and
- A RRMP review and revision program.

(31) Implement recreational facility enhancement measures (part of the recreation facilities development program) at Lake Almanor, Butt Valley

reservoir, Belden forebay, and the bypassed reaches based on target completion dates and monitoring triggers (standards) included in the RRMP.

(32) Provide the FS with matching funds up to a maximum of $5,000,000 (2004 dollars) to construct recreation improvements at FS-owned recreation facilities.

(33) Assume responsibility for O&M of the following FS facilities prior to the start of the first recreation season following license issuance: the Dyer View day-use area, the Canyon dam boat launch and day-use area, and the Almanor boat launch. As each recreation facility is individually constructed, assume O&M responsibility for the southwest shoreline access zone facilities. Within 6 months of completion of construction of the recreation improvements it has planned for the FS Almanor family campground and amphitheater, the FS Almanor group campground, and the FS Almanor beach, apply to the Commission to incorporate these additional FS facilities within the project boundary, and include these facilities in the O&M program.

(34) If a decision is made to proceed with recreation river flow releases, upon FS request, provide up to a maximum of $125,000 (2005 dollars) to the FS for construction of non-project river access to the lower Belden reach.

(35) Provide up to $50,000 (2004 escalated dollars) to (1) reimburse CDFG for stocking 5,000 pounds of catchable trout per calendar year in the waters of the NFFR between its confluence with the East Branch of the North Fork Feather River (EBNFFR) and the Belden diversion dam, and (2) augment CDFG's existing Lake Almanor fisheries program.

(36) Provide up to $25,000 (2004 dollars) to the FS by March 1 of each year of the new project license to assist in funding a river ranger position to provide additional light maintenance, visitor information/assistance, user safety, and law enforcement presence in the project's bypassed river reaches.

(37) Coordinate with the FS, Plumas County, and CalTrans to develop a Memorandum of Understanding (MOU) to produce a Belden interagency recreation river flow management plan.

(38) Establish a recreation river flow technical review group (TRG) within 6 months of issuance of a new license for the purpose of consulting with PG&E in the design of recreation and resource river flow management and

monitoring plans, reviewing and evaluating recreation and resource data, and in developing possible recreation river flows in the Belden reach.

(39) Implement a recreation flow implementation plan (RFIP) as presented in the final SA.

(40) Implement the recreation river flow schedule and other provisions as presented in the final SA.

(41) Post, through a third party or other mechanism, an annual recreation flow calendar scheduling the initial recreation flow day per month.

(42) Conduct an annual planning meeting each year in March to discuss expected WY type, results of monitoring efforts, PG&E maintenance needs that may conflict with recreation flow releases, and other relevant issues.

(43) During scheduled recreation river flows, count observed boater use in number of boats per day to determine whether recreation flow release days should be added or subtracted. If the number of boats per day on the first recreation river flow day for a month exceeds 100 boats per day, one day of recreation river flow would be added to the recreation river flow schedule in that month the next year. If the number of boats per day is less than 100 boats per day for both the recreation river flow releases in one month, one day of recreation river flow would be subtracted from the recreation river flow schedule for the that month in the next year.

(44) Develop and implement a visitor survey for up to 3 years to determine if visitors would choose to return to recreate on the Belden reach based on their experience related to the number of boats encountered on the river.

(45) Apply the basic ramping rates when implementing recreation river flows.

(46) Create a calendar showing the dates of the March pulse flow in the Seneca reach and any scheduled pulse flow or recreation river flow releases in the Belden reach, and make that calendar available on the Internet through a third party or other mechanism.

(47) Meet annually with a committee appointed by the Plumas County Board of Supervisors between March 15 and May 15 to inform the committee about the water surface levels of Lake Almanor predicted to occur between May 1 and September 30. Schedule an additional meeting with the committee if forecasts show that PG&E's obligation to deliver water to the state of California and the Western Canal Water District pursuant to the January 17, 1986, agreement would require it to deviate from the Lake Almanor water elevation levels previously predicted.

(48) Modify the project boundary to include 34 additional acres of the Plumas National Forest at the Caribou development and Belden dam for the purposes of penstock maintenance and spoil management.

(49) Apply to the Commission within 1 year of license issuance to adjust the project boundary to include all recreation improvements covered by the SA at PG&E facilities as well as the following FS facilities located on the Lassen National Forest: Canyon dam boat launch and day-use area, Dyer View day-use area, and Almanor boat launch.

(50) Apply to the Commission to adjust the project boundary as needed to incorporate the Almanor family campground and amphitheater, the Almanor group campground, and the Almanor beach, 6 months after the FS has completed construction of all of the recreation improvements it has planned for each of these facilities.

(51) File a FS-approved road traffic survey plan for roads used for project purposes located on National Forest System (NFS) lands with the Commission within 1 year of license issuance which includes provisions for monitoring traffic every 6 years when monitoring recreation use in accordance with FERC Form 80 requirements.

(52) Implement aesthetic improvement measures, and develop FS-approved visual management plans within 2 years of license issuance.

(53) Implement the Lake Almanor shoreline management plan (SMP) included in the final license application as amended for the project within 30 days after license issuance.

(54) Conduct an annual meeting with the FS, CDFG, and Plumas County to coordinate ongoing project-related land management activities.

(55) Preserve the historic features and character of the old clubhouse and grounds at Camp Caribou, and consult with the FS when planning maintenance and repair activities at this facility.

(56) Finalize and implement a Cultural Resources Management Plan (CRMP).[11]

[11] To be consistent with current Commission practice, we now refer to this as a Historic Properties Management Plan (HPMP) throughout the EIS, regardless of what we or other parties may have called it in the past. We consider both naming conventions to be synonymous,

2.2 MODIFICATIONS TO APPLICANT'S PROPOSAL

2.2.1 Mandatory Conditions

2.2.1.1 Section 18 of the Federal Power Act—Authority to Require Fishways

Section 18 of the FPA, 16 USC §811, states that the Commission shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of Commerce and the Interior may prescribe. By letter dated December 1, 2003, Interior stated that it reserved its authority to prescribe the construction, operation, and maintenance of such fishways as appropriate, 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 rainbow trout, steelhead, spring run Chinook salmon, and any other fish to be managed, enhanced, protected, or restored to the Feather River basin during the term of any license.

By letter dated November 26, 2003, the National Oceanographic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) provided a fishway prescription, conditioned on the passage of anadromous fishes at one or more unspecified dams below the project area. Additionally, NOAA Fisheries stated that it reserved its authority to prescribe fishways under Section 18 of the FPA.

2.2.1.2 Section 4(e) Conditions

Because the project occupies lands of the Lassen and Plumas National Forests, the FS has authority to impose conditions under Section 4(e) of the FPA. The FS provided 50 preliminary license conditions by letter dated December 1, 2003 (letter from J. Gipsman, Attorney, USDA, Office of the General Counsel, Pacific Region, San Francisco, CA, to the Secretary of the Commission, dated December 1, 2003). The FS intends to provide final Section 4(e) conditions within 60 days of the issuance of this draft EIS, if the FS determines that it provides an adequate record to support its Section 4(e) conditions. If the FS concludes that the record is still incomplete at that time, it would file final 4(e) conditions within 60 days of the publication of the final EIS.

Conditions 1 through 26 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 O&M procedures that would enable continued project operations to be consistent with applicable provisions of the Lassen and Plumas National Forests' Land and Resource Management Plans. Conditions 35, 36, 40, 43, 44, 45, 47, 48, 49, and 50 pertain to development of plans for use of FS-managed lands (including spoil pile, habitat, recreation, traffic, visual, and cultural resource management). Conditions 27 through 30, pertain to establishing and publicizing reservoir water levels and flow regimes in project reaches. Conditions 38 and 39 pertain to project-specific

consultation with the FS regarding FS special status species and the need for emergency erosion and sedimentation control. Conditions 31 through 34 and 37, 41, 42, and 46 pertain to monitoring water quality, water temperature, plants, fish, macroinvertebrates, 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. Many of these conditions are identical to the terms that are specified in the final SA. We include the complete preliminary FS 4(e) conditions as appendix B of this EIS.

2.2.2 Staff's Alternative

After evaluating PG&E's proposal and recommendations from resource agencies and other interested parties, we considered what, if any, additional PM&E measures would be necessary or appropriate with continued operation of the project. In addition to, or in lieu of, PG&E's proposed measures, we recommend the following additional environmental measures:

(1) File with the Commission a spoil disposal plan within 6 months of issuance of a new license and at least 60 days prior to any ground-disturbing or soil producing of piling activity.

(2) Develop a water level and flow gaging plan.

(3) Develop a monitoring program to document water quality trends in Lake Almanor under a new license and project operations.

(4) Develop a bacteriological monitoring program for the first 3 years following license issuance, using a methodology appropriate to determine compliance with state water quality standards.

(5) Use existing water temperature models to predict the effects of operating the project to meet flow and lake level requirements, taking into consideration any modifications to the Prattville intake that may be proposed by the Rock Creek-Cresta Project ERC and the FS for modifying and implementing other temperature control measures.

(6) Develop a plan to monitor DO concentrations in Lake Almanor, Butt Valley reservoir, and the NFFR downstream to the Caribou No. 1 powerhouse tailrace.

(7) Revise the draft SMP, and implement the revised plan.

(8) For any recommended new recreational facilities, develop site-specific plans to control erosion and potential adverse effects on water quality. These plans would be included in the recreation facilities development program of the RRMP.

(9) Develop a notification and minimization of emergency and planned outage spill plan.

(10) Develop an aquatic resources monitoring plan for the Seneca and Belden reaches. Periodically monitor fish populations (consistent with data presented in pre-filing study reports) and benthic macroinvertebrates in Seneca and Belden reaches, as recommended in the final SA. Initiate monitoring during years four and five of the new license. After this 2-year monitoring period, the frequency of surveys could be reduced to every fifth year to evaluate long-term responses to measures implemented in the new license and any subsequent modifications that are made.

(11) Develop a woody debris management plan.

(12) Develop an adaptive management plan that addresses the results of all monitoring and special studies conducted on water temperature, water quality, flow, macroinvertebrates, gravel, woody debris, fisheries, amphibian populations and habitat, and vegetation.

(13) Develop a plan, if modifications to the Prattville intake are proposed and approved, to evaluate salmonid and wakasagi populations in Lake Almanor and Butt Valley reservoir prior to and after any modifications to the Prattville intake.

(14) Develop and implement, within 1 year of license issuance, a vegetation and noxious weed management plan that incorporates protection and management of valley elderberry longhorn beetle (VELB) habitat for all project lands.

(15) Develop a plan for the protection of threatened, endangered, proposed for listing, and sensitive species.

(16) Incorporate the determination of California red-legged frog (CRLF) habitat into the amphibian monitoring plan.

(17) Develop a peregrine falcon monitoring plan within 1 year of license issuance.

(18) Develop an IBEMP within 1 year of license issuance.

(19) Develop a fire prevention and response plan within 1 year of license issuance.

(20) Implement the measures outlined in the Programmatic Agreement (PA) and final HPMP.

(21) Consult with the FS and the Maidu community to more fully investigate the possibility of providing seed funds for a curation facility or interpretive center, and report the results of this consultation in the HPMP.

(22) Invite both Plumas County and the NPS to attend future Cultural Resources Working Group meetings.

(23) Provide Plumas County with copies of all requested cultural resources reports, including the non-confidential volume of the ethnographic study, if Plumas County agrees not to make the reports available to the public, in compliance with Section 304 of the NHPA.

(24) Include, as part of the HPMP: the details of PG&E's employee and public education and interpretive program; detailed site-specific treatment measures; site-specific treatment measures for historic archaeological sites and standing structures that the Commission, in consultation with the California State Historic Preservation Officer (SHPO), has determined are eligible for the National Register of Historic Places (National Register); protocols for PG&E to consult and work with the Greenville Rancheria, Susanville Indian Rancheria, and other interested Maidu groups.

2.3 NO-ACTION ALTERNATIVE

Under the no-action alternative, PG&E would continue to operate the project under the terms and conditions of the current license. The environmental measures proposed by PG&E and/or recommended by staff, would not be implemented.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

As part of our independent analysis, we considered several other alternatives to the relicensing proposals: (1) federal government takeover; (2) issuance of a nonpower license; and (3) project retirement. We eliminated them from detailed study, however, because they are not reasonable in the circumstances of this license for the following reasons.

2.4.1 Federal Government Takeover of the Project

We do not consider federal takeover to be a reasonable alternative. Federal takeover of the UNFFR Project would require Congressional approval. While 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 UNFFR Project.

2.4.2 Issuing a 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 governmental 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 UNFFR Project should no longer be used to produce power. Thus, we do not consider a nonpower license to be a reasonable alternative.

2.4.3 Retiring the Project[12]

Retiring the project could be accomplished with or without removing the project dams and related project works. Either retirement option would involve denial of the relicensing application and surrender or termination of the existing license with appropriate conditions. At a minimum, project retirement would have the following effects: (1) the energy currently generated by the project (about 357.3 megawatt-hours [MWh] annually) would be lost, and generation at PG&E's downstream Rock Creek-Cresta and Poe projects would be substantially negatively affected; and (2) there would be substantial costs associated with retiring the project powerhouses and appurtenant facilities. However, no agency has advocated the retirement of the project, and the project is a viable operation that supplements PG&E's power generation mix.

In the case of retiring the project with dam removal, adverse effects on the watershed likely to occur within the first 5 to 10 years following project retirement as a result of erosion include suspension of sediments in the project reservoirs, bank failure, development of debris jams and gravel bars, scour, and deposition. Removal of the UNFFR Project dams would not allow for anadromous fish to be restored to the project area unless downstream dams were also removed or passage provided. Removal of the project dams would eliminate the warmwater recreational fisheries found in Lake Almanor and Butt Valley reservoirs and habitat for common carp, which is an important forage species for bald eagle. The loss of open water habitat, with dam removal, would also reduce foraging opportunities for osprey, bald eagle, and other piscivorous birds, and for several species of bats. Project retirement would not affect habitat for the VELB but it would cause temporary noise disturbance to bald eagles during dam removal and restoration. Adverse socioeconomic impacts on Plumas County and the town of Chester would be tremendous, due to the loss of Lake Almanor.

[12] In Scoping Document 2, we indicated that we would assess project retirement to the extent that information was available to address each of the resource issues identified for analysis. Our analysis in this section concludes that retirement of the project is not a viable alternative.

With dam removal, the areas surrounding Lake Almanor and Butt Valley Reservoir would be converted from lacustrine to riverine environments. The large meadow that existed prior to the creation of Lake Almanor would likely be re-established. The removal of Canyon dam would cause water levels to drop and would likely dewater the developed recreation sites along the shoreline of Lake Almanor and Butt Valley Reservoir with the possible exception of those sites on Lake Almanor near the confluence of the NFFR. Recreational use within the project area would change to that associated with more riverine conditions. Lower water levels would change recreational uses in the Lake Almanor area from flatwater-based opportunities such as motor boating, boat fishing, and flatwater canoeing to more river-based opportunities, such as shore fishing and whitewater boating. Fishing in the Lake Almanor area would change from lake species to more riverine species. The restored NFFR may provide new shoreline angling opportunities.

Retirement of the project with the retention of dams would require a reconfiguration of Canyon dam and or the outlet tower, because of the elevation of the spillway. Failure to do so would result in unacceptable dam safety concerns and result in upstream flooding. With dams in place, all project reservoirs would remain at full pool on a year-round basis, and riparian habitat around the reservoirs would be relatively similar to current conditions.

Under either retirement scenario, the trophy trout fishery in Butt Valley reservoir would likely be lost, because wakasagi from Lake Almanor would no longer be entrained into Butt Valley reservoir. In addition, the limnology of Butt Valley reservoir would be significantly impacted by the loss of inflow from Lake Almanor through the Prattville intake.

PG&E would no longer require the project lands for project operations, thus ownership of those lands currently owned by PG&E may change. Depending on the subsequent landowner, public access to some parts of the project area and recreational opportunities may be eliminated.

If the project is retired, the protection and enhancement measures that would be specified in the HPMP would not be implemented. Abandonment of the project facilities could lead to loss or deterioration of historically important project elements due to lack of repair, maintenance, and the protection afforded by active use. Consequently, prior to abandonment, PG&E would be required to consult with the SHPO to determine what provisions would be necessary to protect those project elements that contribute to their eligibility for listing in the National Register.

For these reasons, we conclude that project retirement is not a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

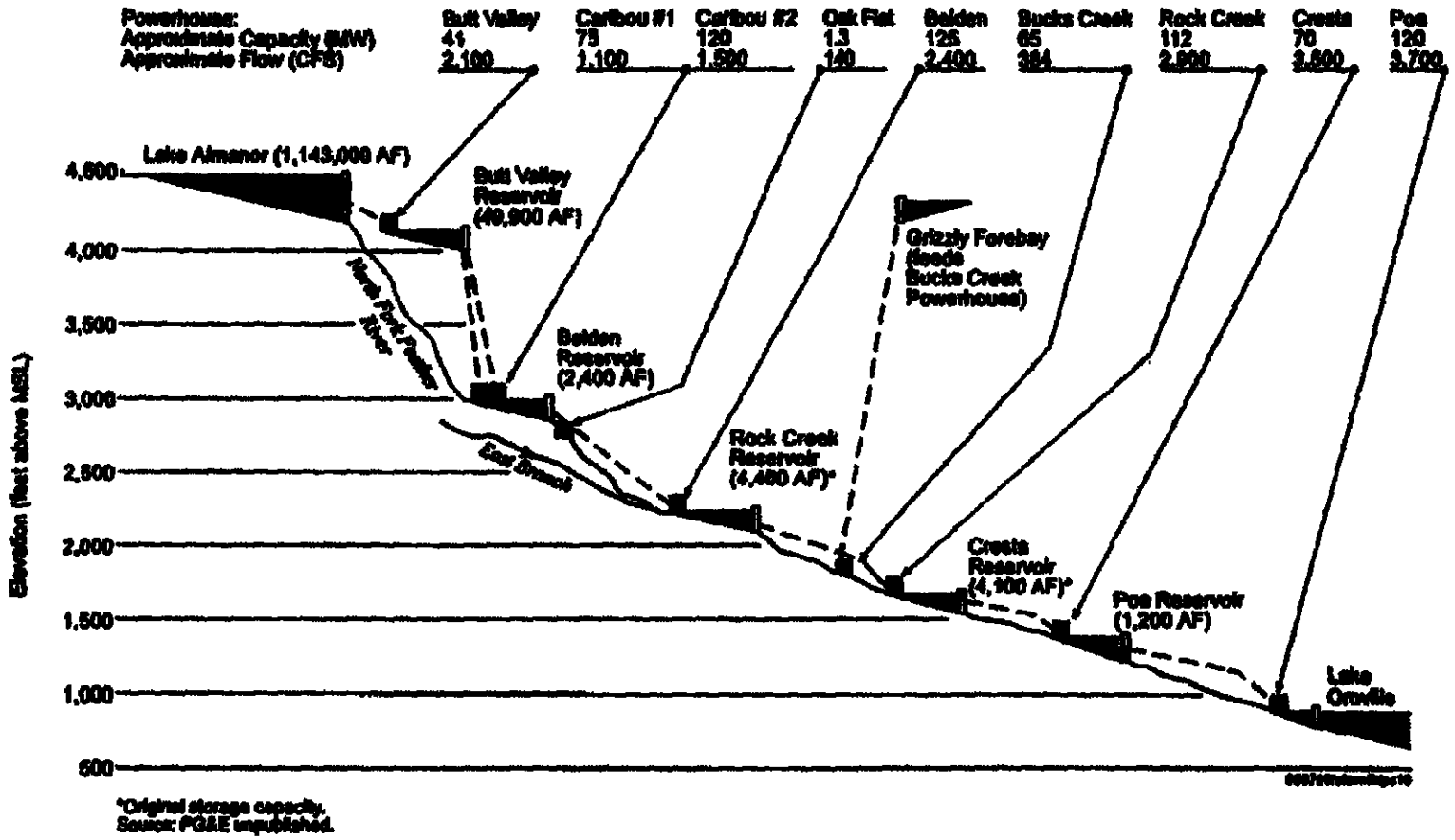
In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the UNFFR Project. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the 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 for the project (PG&E, 2002a).

3.1 GENERAL DESCRIPTION OF THE UPPER NORTH FORK FEATHER RIVER BASIN

The UNFFR Project is located on the NFFR and Butt Creek, a tributary to the NFFR. The project extends from the upper end of Lake Almanor at elevation 4,500 feet (PG&E datum),[13] approximately 3 miles north of the community of Chester, down to elevation 2,205 feet (PG&E datum), where Yellow Creek enters the NFFR. The project also makes use of Butt Creek, from approximate elevations 4,330 to 4,070 feet (PG&E datum). Figure 3-1 shows how the project is hydraulically situated with respect to other hydroelectric projects on the NNFR.

The upper end of the project is located on the western side of the crest of the Sierra Nevada Mountains at elevation 4,500 feet. Precipitation occurs primarily during the winter months, and substantial snow accumulation can occur at this elevation. Mount Lassen (elevation 10,457 feet USGS datum) is at the northwestern end of the Lake Almanor basin. Normal annual precipitation at Lake Almanor is approximately 38 inches, and summer months are typically dry and mild. Butt Valley, on Butt Creek, is located at elevation 4,140 feet. Seasonal temperatures and precipitation at Butt Valley are similar to those at Lake Almanor. Because Caribou is located at elevation 2,980 feet in the NFFR canyon, seasonal temperatures are higher at Caribou than at Butt Valley and Lake Almanor. Annual average precipitation at Caribou is 41 inches, and snow accumulation is typically rare. The Belden powerhouse is located at elevation 2,215 feet, and conditions are similar to those at Caribou.

[13] Lake level is defined as the water surface elevation, expressed in PG&E datum, which is 10.2 feet lower than the USGS datum.



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2 Figure 3-1. North Fork Feather River hydroelectric projects. (Source: PG&E, 2002a)

3

Project features range in elevation from 4,500 to 2,215 feet. Lake Almanor is in a very broad basin with surrounding peaks of generally 6,000 to 7,000 feet. Butt Valley reservoir is in a small basin with surrounding ridges around 5,500 feet in elevation. Below Lake Almanor dam (also known as Canyon dam), the NFFR enters a canyon with steep sides dropping from elevation 4,400 feet at the base of the dam to elevation 2,985 feet at Caribou, a distance of about 11 river miles. This canyon is generally inaccessible, except at Seneca, which is located approximately midway between Lake Almanor dam and Caribou. Butt Creek below Butt Valley dam is also in a steep canyon until it joins the NFFR.

The NFFR passes through a narrow notch in rock outcroppings just below the Caribou powerhouse. From Belden forebay dam to the confluence with the EBNFFR, the NFFR drops in elevation from 2,850 feet (USGS datum) to 2,290 feet (USGS datum), a distance of about 7.5 river miles. Over the remaining 1.75 miles to the Belden powerhouse, the NFFR drops to elevation 2,215 feet (USGS datum). The slopes of the NFFR canyon remain very steep between Caribou and Belden.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations of implementing the National Environmental Policy Act (NEPA) (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 quality and quantity, fisheries, and the federally listed bald eagle as potentially cumulatively affected resources. Our analysis of cumulative effects to these resources is found in the corresponding resource section.

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. However, in this instance, we conclude that the geographic scope for all identified resources is the same and would extend from the point where the NFFR enters Lake Almanor downstream to the point where the NFFR flows into Lake Oroville. Although project operations could influence flows and associated environmental resources in the NFFR downstream to Lake Oroville, the relatively large storage capacity of Lake Oroville (3.5 million acre-feet) mutes any project influences beyond this location.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in this 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 in the future, concentrating on the effects of 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

3.3.1 Water Resources

3.3.1.1 Affected Environment

Water Quantity

The UNFFR Project uses water resources of the NFFR basin to generate electricity. The river basin drains a large portion of the eastern Sierra-Cascade geomorphic area in California, and its headwaters are located on the southeastern slope of Mount Lassen. The river generally flows southwesterly and enters Lake Oroville, a primary reservoir for the California State Water Project, approximately 30 miles downstream of the Belden powerhouse.

PG&E operates one hydroelectric project upstream of the UNFFR Project. The Hamilton Branch Project uses water from the Hamilton Branch of the NFFR and some other small streams located above the UNFFR Project to produce up to 4.8 MW at its powerhouse, which is located at the mouth of Hamilton Branch along the shoreline of Lake Almanor's eastern lobe. PG&E also regulates flow in Bucks Creek, a major tributary to the lower NFFR, with its Bucks Creek Project (FERC No. 619), including the city of Santa Clara's Grizzly powerhouse which is operated in coordination with the Bucks Creek Project.

The NFFR basin has mild, dry summers and heavy winter precipitation. Mean annual precipitation in the upper NFFR basin ranges from 20 inches in eastern portions of the EBNFFR subbasin to 90 inches in the northwestern portion of the basin near Mount Lassen. Monthly average precipitation varies at Chester from less than 0.5 inch in July and August to 6.5 inches in January (table 3-1). Much of the precipitation in the headwaters of the basin comes in the form of snow during November through March. Based on monthly average snow cover, most of the snowpack at Chester is melted by April.

Table 3-1. Meteorological summary for Chester, California. (Source: Weatherbase, 2003)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Air Temperature (°F)												
30	34	38	43	50	58	64	63	57	48	38	31	46
Average Precipitation (inches)												
6.5	5.4	4.6	2.1	1.6	0.9	0.3	0.4	0.8	2.0	4.1	5.5	34.1
Average Snowfall (inches)												
39.0	27.9	22.3	7.4	1.4	0.1	---	---	---	0.8	12.5	28.2	139.7
Average Snow Cover (inches)												
16	19	11	2	---	---	---	---	---	---	1	7	5

Note: --- indicates no value reported.

Since the winter of 1952-53, PG&E has implemented the Lake Almanor Cloud Seeding Project (LACSP) to increase snowfall during November through May in the NFFR basin above Lake Almanor. PG&E's LACSP includes a network of nine, ground-based cloud seeding burners located near the south and west boundaries of the target area. The LACSP's goal is to increase snowfall during naturally occurring precipitation periods. Generally, operational seeding periods are set for 12 hours; however, PG&E's meteorological staff in San Francisco, California, determines the specific operations. LACSP includes guidelines for temporary suspension or curtailment of operations under certain conditions to avoid runoff or reservoir storage beyond manageable limits. PG&E estimates that LACSP increases precipitation in the basin above Lake Almanor by 5 percent annually.

Annual runoff patterns are characteristic of snowmelt-dominated hydrology of Sierra Nevada mountain streams that experience peak runoff during the late winter and spring and low flows during the summer. Average annual runoff for the drainage area contributing to Lake Almanor is about 27 inches per year, while runoff from the upper Butt Creek basin is about 19 inches per year. Table 3-2 shows monthly and annual flows for gaged stations in the project vicinity.

The hydrology of the upper NFFR basin is affected by diverse conditions, including regional and seasonal distribution of precipitation, influence of snow melt, differing geomorphic conditions, the impoundment and diversion of flow, and the consumptive use of surface and groundwater. Subbasins associated with the project area are generally broad plateau-like areas that are densely timbered. Large meadow areas were inundated by construction of the project. Big Meadow, the largest of these, was inundated by the creation of Lake Almanor in 1914.

Table 3-2. Summary of daily average flow discharge (cfs) data, by month and overall, for the project vicinity.[a] (Source: PG&E, 2003a, as modified by staff)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
NF59 - NFFR below Chester, WY 1970 to 1985													
Mean	324	301	340	439	684	531	308	218	194	184	246	244	334
Maximum	5,660	1,520	1,450	1,360	1,860	1,640	1,150	878	783	652	2,850	2,280	5,660
10% Exceedance	594	593	548	699	1,165	1,073	712	399	355	335	496	485	739
25% Exceedance	351	356	433	547	840	750	394	296	279	274	336	312	433
50% Exceedance (Median)	193	212	295	409	651	458	246	167	121	130	161	157	240
75% Exceedance	112	109	149	250	433	221	118	86	78	99	115	118	118
90% Exceedance	97	88	100	130	258	107	64	60	62	80	86	88	80
Minimum	42	52	53	47	60	21	16	12	24	51	67	42	12
NF46 - Hamilton Branch Creek at Red Bridge Pump, WY 1970 to 2002													
Mean	98	73	118	85	137	81	51	49	47	55	61	58	78
Maximum	3,870	1,480	2,640	2,000	4,502	1,150	693	693	660	999	1,500	1,900	4,502
10% Exceedance	146	144	266	145	414	170	81	74	74	75	68	84	123
25% Exceedance	53	62	83	78	80	61	53	54	52	52	50	51	61
50% Exceedance (Median)	42	37	46	48	43	43	43	41	33	32	32	36	42
75% Exceedance	22	21	27	26	27	27	27	25	21	22	21	22	24
90% Exceedance	8	10	15	13	19	18	18	16	11	14	14	13	16
Minimum	0	0	0	0	0	0	0	0	0	0	3	0	0
NF83 - Hamilton Branch Powerhouse, WY 1976 to 2002													
Mean	108	124	149	125	134	128	104	61	75	75	83	92	105
Maximum	242	282	233	267	242	242	232	215	222	406	218	242	406
10% Exceedance	209	210	213	214	213	212	209	176	204	204	207	208	210
25% Exceedance	194	205	208	208	209	204	173	87	107	106	117	132	196
50% Exceedance (Median)	95	109	179	106	163	115	83	43	40	45	54	60	78
75% Exceedance	42	54	95	56	48	53	45	19	31	32	33	39	40
90% Exceedance	31	36	44	41	39	38	36	0	0	0	29	32	31
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0
NF2 - NFFR near Prattville, WY 1970 to 2002													
Mean	94	92	41	47	54	75	69	65	47	51	51	36	60
Maximum	2,140	1,940	722	803	730	747	709	708	505	706	694	417	2,140
10% Exceedance	41	54	41	39	40	42	40	41	39	39	40	38	40
25% Exceedance	38	39	38	38	39	39	38	38	37	37	37	37	38
50% Exceedance	36	37	37	36	37	37	37	36	36	36	36	36	37

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
(Median)													
75% Exceedance	36	36	36	36	35	36	36	36	35	35	35	35	35
90% Exceedance	34	35	35	35	35	35	35	35	34	34	34	34	35
Minimum	18	5	14	16	15	6	15	10	9	5	5	15	5
NF47 - NFFR above Caribou Powerhouse Operation, WY 1970 to 1989													
Mean	140	130	146	133	124	196	174	96	76	76	85	103	123
Maximum	1,190	1,420	1,060	575	935	2,710	2,090	1,720	125	426	328	841	2,710
10% Exceedance	230	188	234	193	175	122	99	93	88	86	107	146	153
25% Exceedance	117	137	159	141	126	104	92	85	80	81	88	100	109
50% Exceedance	89	107	125	117	98	86	79	77	75	77	79	83	84
(Median)													
75% Exceedance	78	85	95	96	79	75	71	68	69	68	72	74	75
90% Exceedance	70	75	83	78	70	66	63	62	64	65	67	68	67
Minimum	51	67	71	53	51	49	47	45	43	42	48	30	30
NF4 - Butt Creek below Almanor-Butt Creek Tunnel, near Prattville, WY 1970 to 2002													
Mean	106	112	155	171	168	97	55	48	45	50	66	77	96
Maximum	2,660	2,830	1,460	1,020	1,480	590	152	205	95	160	800	1,220	2,830
10% Exceedance	167	171	251	294	340	199	80	62	59	64	91	118	193
25% Exceedance	95	116	175	220	228	105	65	55	54	58	65	74	103
50% Exceedance	66	79	118	140	119	69	53	48	47	50	53	59	61
(Median)													
75% Exceedance	53	58	84	102	73	48	39	35	35	40	45	48	48
90% Exceedance	45	49	67	78	54	40	35	32	30	36	39	42	38
Minimum	33	39	45	39	26	26	27	27	27	29	33	34	26
NF71 - Butt Valley Powerhouse, WY 1970 to 2002													
Mean	701	597	400	454	420	674	1,075	1,294	1,247	1,123	1,128	1,059	849
Maximum	2,620	2,240	2,250	2,250	2,260	2,200	2,520	2,290	2,300	2,460	2,520	2,520	2,620
10% Exceedance	2,060	1,909	1,560	2,010	1,790	1,770	1,817	2,150	2,067	1,880	2,191	2,118	2,010
25% Exceedance	1,481	1,229	694	727	622	1,207	1,676	1,841	1,710	1,570	1,858	1,669	1,530
50% Exceedance	215	38	0	0	0	559	1,080	1,460	1,410	1,220	1,096	1,050	839
(Median)													
75% Exceedance	0	0	0	0	0	0	609	921	904	729	455	323	0
90% Exceedance	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0
NF9 - Butt Creek near Caribou, WY 1970 to 1984													
Mean	18	18	30	19	29	59	70	36	16	16	17	17	29
Maximum	57	52	521	47	600	808	808	808	18	23	33	41	808
10% Exceedance	22	23	26	26	24	28	28	18	17	18	20	20	23
25% Exceedance	18	19	23	22	21	19	19	17	16	16	17	18	19

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
50% Exceedance (Median)	16	17	18	18	18	18	17	16	16	16	16	16	17
75% Exceedance	15	15	16	16	17	17	17	16	15	15	15	15	15
90% Exceedance	14	15	15	15	15	15	15	15	14	15	15	14	15
Minimum	14	14	14	14	14	14	14	14	14	7	14	14	7
NF63 - Caribou Powerhouse No. 1, WY 1970 to 2002													
Mean	223	249	208	223	178	232	308	393	377	321	364	314	283
Maximum	1,350	1,200	1,170	1,480	1,139	1,160	1,159	1,156	1,160	1,235	1,139	1,159	1,480
10% Exceedance	695	807	752	994	866	850	771	891	944	863	938	851	871
25% Exceedance	397	492	332	288	121	388	532	652	644	484	668	543	506
50% Exceedance (Median)	29	27	0	0	0	0	231	348	296	250	258	189	102
75% Exceedance	0	0	0	0	0	0	0	14	0	0	0	0	0
90% Exceedance	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0
NF263 - Caribou Powerhouse No. 2, WY 1970 to 2002													
Mean	590	506	374	388	380	517	732	869	880	843	833	819	645
Maximum	1,510	1,510	1,620	1,500	1,620	1,484	1,520	1,500	1,530	1,550	1,530	1,520	1,620
10% Exceedance	1,460	1,389	1,204	1,397	1,218	1,259	1,300	1,430	1,460	1,441	1,457	1,459	1,430
25% Exceedance	1,080	915	656	677	559	900	1,136	1,270	1,290	1,210	1,318	1,292	1,120
50% Exceedance (Median)	435	315	177	136	172	310	799	993	981	956	904	874	642
75% Exceedance	68	32	0	0	82	114	257	506	609	550	437	416	111
90% Exceedance	0	0	0	0	0	30	88	105	4	0	35	32	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0
NF103 - Oak Flat Powerhouse, WY 1986 to 2002													
Mean	58	58	66	79	122	120	121	121	68	61	60	57	83
Maximum	96	112	142	160	145	153	147	143	153	145	73	100	160
10% Exceedance	66	69	82	120	139	139	139	139	120	69	65	65	132
25% Exceedance	65	65	65	108	132	132	134	134	65	65	65	65	120
50% Exceedance (Median)	64	64	64	65	120	120	120	120	63	64	64	64	65
75% Exceedance	57	57	57	63	112	112	114	114	57	57	57	57	63
90% Exceedance	54	53	54	56	108	110	110	110	54	53	55	34	56
Minimum	0	0	0	0	35	0	0	0	0	0	0	0	0
NF70 - NFFR below Belden Diversion Dam, WY 1970 to 2002													
Mean	131	109	106	172	168	147	140	136	120	129	136	117	134
Maximum	2,130	2,100	1,490	2,300	1,570	1,160	615	183	2,300	2,390	2,800	2,540	2,800
10% Exceedance	91	90	153	449	157	150	149	149	145	75	72	73	149

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
25% Exceedance	67	68	72	146	146	145	144	144	88	67	65	67	142
50% Exceedance (Median)	63	64	64	68	143	142	142	142	64	63	63	63	68
75% Exceedance	61	61	62	63	140	139	140	140	61	61	61	61	62
90% Exceedance	59	60	60	60	124	134	135	107	60	59	60	60	60
Minimum	48	49	37	41	56	12	58	52	48	2	4	11	2
NF51 - East Branch of NFFR near Rich Bar, WY 1970 to 2002													
Mean	1,608	1,725	2,414	1,893	1,527	654	191	108	112	174	496	796	971
Maximum	69,276	52,099	36,617	19,700	18,729	6,170	1,270	358	593	2,210	22,400	25,789	69,276
10% Exceedance	3,463	3,560	4,824	3,704	3,795	1,733	418	199	189	278	771	1,748	2,520
25% Exceedance	1,452	1,854	2,840	2,546	1,978	776	214	128	134	215	335	668	1,090
50% Exceedance (Median)	503	956	1,670	1,517	971	315	129	92	102	145	209	288	278
75% Exceedance	255	401	875	769	392	138	79	59	66	96	149	195	131
90% Exceedance	166	214	494	379	188	84	56	46	52	71	118	140	78
Minimum	117	125	131	78	86	44	30	23	24	35	49	89	23
NF74 - Belden Powerhouse, WY 1970 to 2002													
Mean	896	852	675	602	519	766	1,045	1,252	1,234	1,146	1,178	1,135	942
Maximum	2,600	2,600	2,500	2,460	2,540	2,450	2,540	2,600	2,600	2,610	2,600	2,530	2,610
10% Exceedance	2,190	2,169	1,988	2,240	1,760	1,872	1,830	2,068	2,151	2,151	2,291	2,220	2,140
25% Exceedance	1,560	1,570	1,130	880	769	1,330	1,600	1,779	1,690	1,570	1,780	1,690	1,540
50% Exceedance (Median)	675	585	406	246	230	640	1,076	1,350	1,325	1,290	1,200	1,150	895
75% Exceedance	125	103	0	0	0	0	502	788	877	585	536	502	168
90% Exceedance	0	0	0	0	0	0	0	221	0	0	6	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0

1

The major tributaries to Lake Almanor, the reservoir for the project's uppermost development, are the upper NFFR and Hamilton Branch. Flows from Hamilton Branch into Lake Almanor include flows in the branch itself at its confluence with the lake as well as discharge from the Hamilton Branch powerhouse, which is diverted from Hamilton Branch several miles upstream. Downstream of Mountain Meadows reservoir, flows from Hamilton Branch are diverted into a 3-mile-long canal paralleling Hamilton Branch (see figure 1-1). From this canal, water passes through a penstock to the Hamilton Branch powerhouse and reenters Hamilton Branch at its confluence with Lake Almanor. The Hamilton Branch powerhouse can discharge up to 200 cfs, although mean monthly outflows are generally less than 100 cfs from August through December (table 3-2). The mean annual flows from the upper NFFR measured below Chester, Hamilton Branch at the lake, and the Hamilton Branch powerhouse are 330, 80, and 100 cfs, respectively.

The reservoir also receives surface water from minor tributaries including Benner, Last Chance, and Bailey creeks and groundwater from various submerged springs. Meinzer (1927) reported that there are many large springs in the lava-covered areas of the upper NFFR basin. These springs include Pratt Spring near the Prattville intake, Dotta Spring about 1 mile north of Canyon dam, and Big Spring located near what is now the northern shore of the eastern lobe of Lake Almanor. USGS reported outflows from Dotta Spring ranging from 50 to 122 cfs and averaging about 90 cfs for the period between September 1902 and August 1906 (Meinzer, 1927). Through the use of mass balance calculations, PG&E estimates that submerged springs contribute about 200 to 250 cfs to Lake Almanor.

PG&E diverts water from Lake Almanor to the Butt Valley powerhouse, which is located along the northwest shoreline of the Butt Valley reservoir, by drafting up to approximately 2,100 cfs through the Prattville intake located near the shoreline of the south-central portion of Lake Almanor. Based on mean annual flows for the Butt Valley powerhouse and NFFR below Canyon dam (station NF2 in table 3-2), about 93 percent of the reservoir's outflow is routed through the powerhouse, and 7 percent continues down the NFFR past Canyon dam. These proportions vary considerably through time depending on project operations.

The project generally stores water in Lake Almanor during high flow periods in winter and spring and draws down the reservoir in summer and fall. Lake Almanor's historic storage and water levels for WY 1970 through 2003 are shown in figure 3-2 and summarized in table 3-3. During the droughts of 1976-77 and the late 1980s through mid 1990s, Lake Almanor did not refill. At the normal maximum water level of 4,494 feet (PG&E datum), Lake Almanor has a usable storage capacity of approximately 1,134,000 acre-feet and a surface area of 27,000 acres. The hydraulic retention time of the reservoir averages 291 days.

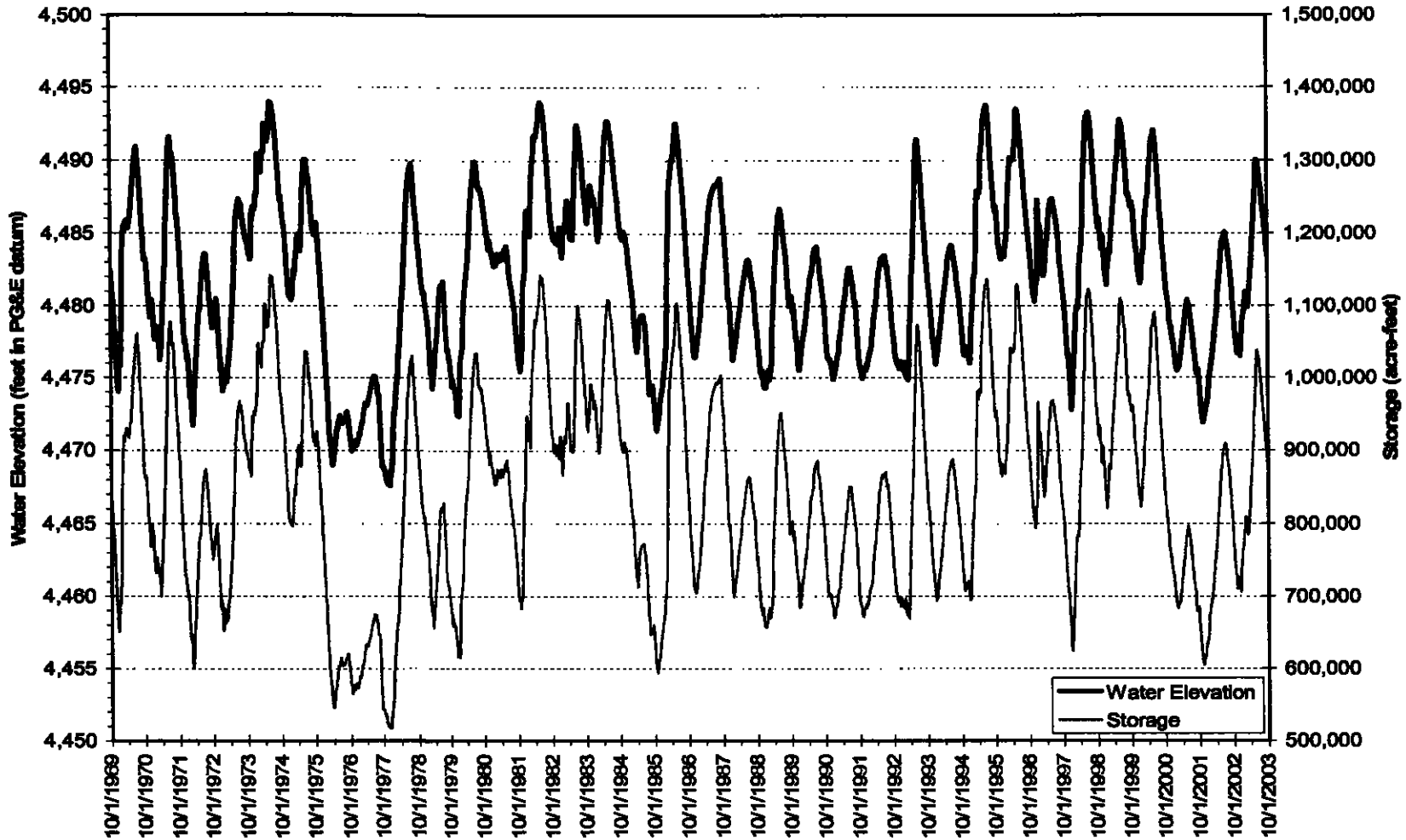

Figure 3-2. Lake Almanor (NF1) end-of-day water surface elevation and storage, WY 1970-2003. (Source: PG&E, 2003a, as modified by staff)

Table 3-3. Summary of Lake Almanor end-of-day water surface elevations, WY 1970-2003. (Source: PG&E, 2003c, as modified by staff)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	4,478.63	4,479.50	4,481.08	4,483.00	4,485.16	4,486.86	4,486.37	4,484.46	4,482.27	4,480.43	4,479.16	4,478.43	4,482.12
Maximum	4,490.43	4,490.05	4,492.03	4,492.50	4,493.71	4,494.00	4,493.78	4,492.52	4,489.35	4,487.29	4,488.29	4,487.94	4,494.00
Minimum	4,468.98	4,470.62	4,468.97	4,469.05	4,470.85	4,471.84	4,471.85	4,471.57	4,468.83	4,468.05	4,467.67	4,467.55	4,467.55
10% Exceedance	4,485.68	4,485.26	4,488.43	4,490.06	4,491.82	4,492.95	4,492.44	4,490.13	4,487.78	4,486.29	4,484.93	4,484.56	4,489.95
25% Exceedance	4,482.20	4,483.56	4,485.63	4,485.87	4,489.11	4,491.50	4,490.57	4,488.48	4,486.41	4,484.94	4,483.79	4,482.15	4,486.47
50% Exceedance (Median)	4,477.20	4,478.53	4,480.18	4,482.85	4,485.26	4,487.66	4,488.27	4,486.19	4,483.61	4,480.94	4,478.87	4,477.32	4,482.37
75% Exceedance	4,475.57	4,475.88	4,477.31	4,479.88	4,482.16	4,483.19	4,482.91	4,481.16	4,478.92	4,476.81	4,476.14	4,475.56	4,477.57
90% Exceedance	4,474.07	4,474.02	4,475.23	4,477.63	4,479.37	4,479.79	4,478.11	4,476.10	4,475.34	4,473.12	4,472.39	4,473.20	4,474.77

The Butt Valley powerhouse is typically used for peaking, which can result in discharges changing by up to about 2,000 cfs in a few minutes. As table 3-2 shows, the Butt Valley powerhouse does not discharge water on more than half the days in March, April, and May. These operations have minimal effects on water elevations of Lake Almanor, due to its large size. However, Butt Valley reservoir water levels tend to fluctuate more rapidly due to its smaller size. Butt Valley reservoir water elevations typically fluctuate between 4,132 and 4,115 feet (PG&E datum) on an annual basis, and may fluctuate about 1 foot on a daily basis. In addition to receiving water from the Butt Valley powerhouse, Butt Valley reservoir receives inflow from Butt Creek (station NF4) which has a mean annual flow of about 95 cfs (table 3-2). At an elevation of 4,132 feet (PG&E datum), the reservoir has a usable storage capacity of approximately 49,900 acre-feet and a surface area of 1,600 acres. The hydraulic retention time for the reservoir generally ranges from 14 to 32 days.

Although the project diverts up to approximately 2,100 cfs from Lake Almanor to the Butt Valley powerhouse, virtually all of this water, along with flow from upper Butt Creek, is generally routed through the Caribou nos. 1 and 2 powerhouses, thereby bypassing the lower portion of Butt Creek and a 10.8-mile-long reach of the NFFR referred to as the Seneca reach. No controlled minimum flow release is made from Butt Valley dam to lower Butt Creek; however, leakage of approximately 0.07 cfs (30 gallons per minute) occurs. Lower Butt Creek also receives inflow from springs and Benner Creek. Spills at the Butt Valley dam rarely occur because of the large capacity of the Caribou nos. 1 and 2 developments. Flows in Butt Creek monitored near its mouth (station NF9) indicate that mean annual flows are about 30 cfs, and minimum flows are generally 14 cfs (table 3-2). Butt Creek contributes these flows to the Seneca reach at a point approximately 9.6 miles downstream of Canyon dam.

At Canyon dam, water is released into the upper end of the Seneca reach, which extends 10.8 miles down to the Belden forebay. The current license mandates a year-round minimum flow of 35 cfs in the channel immediately downstream of the dam, which is accomplished by using the gated intake tower near Canyon dam. Flows monitored by PG&E, in cooperation with USGS, at a permanent gaging station about 0.5 mile downstream of Canyon dam (station NF2) indicate little seasonal variation (table 3-2). Based on flow measurements reported by PG&E for June through September of 2000 and 2001, the Seneca reach gains about 6 to 31 cfs between the upper gaging station and the gaging station located above the Caribou No. 1 powerhouse (station NF47) excluding Butt Creek. During 2001, monthly mean accretion to this reach was 50 to 71 percent lower than in the wetter summer of 2000. In the upper portion of the bypassed reach (the 4.7-mile-long section from station NF2 to Seneca Bridge), the NFFR gained between 4 and 16 cfs during the summer of 2001. Average accretion was highest (13 cfs) in June and lowest (5 to 6 cfs) in August and September. Flows measured immediately upstream of the Butt Creek confluence indicate that the NFFR received little accretion in the 4.4-mile-long section between the Seneca Bridge and immediately upstream of the Butt

Creek confluence during the summer of 2001. Accretion to the lower portion of the Seneca bypassed each (Butt Creek confluence to the Caribou No. 1 powerhouse) ranged from less than 1 to 5 cfs and averaged 1 cfs or less during June, July, and August.

The Belden forebay receives water from the Seneca bypassed reach, and the Caribou Nos. 1 and 2 powerhouses. Mean annual inflow from the NFFR is about 125 cfs, while inflows from the Caribou Nos. 1 and 2 powerhouses are about 280 and 650 cfs, respectively (table 3-2). Differences between the Caribou discharges demonstrate that PG&E prefers to operate the Caribou No. 2 development. NFFR inflows are generally stable, due to minimum flow releases from the Canyon dam intake and accretion. In contrast, inflows from the Caribou powerhouses can vary considerably between days and over short periods, because of the typical peaking operations of the developments. Table 3-2 shows that the Caribou No. 1 powerhouse is operated on less than half of the days from March through June. Peaking operations may result in discharges from each of the powerhouses changing by more than 1,000 cfs in a few minutes.

Belden forebay is the smallest of all of the project's impoundments. At its normal maximum water elevation of 2,975 feet (PG&E datum), it has a usable storage capacity of 2,421 acre-feet and a surface area of 42 acres. Under normal operation, the impoundment's water elevation typically fluctuates between 2,960 and 2,973 feet (PG&E datum) with typical daily fluctuations of 5 to 10 feet when water is being released from Lake Almanor. PG&E estimates the average hydraulic retention time as 0.5 to 1 day.

Water exiting the Belden forebay is either diverted to the Belden powerhouse or continues down the NFFR. Water diverted to the Belden powerhouse bypasses a 9.3-mile-long reach of the NFFR referred to as the Belden bypassed reach. The existing license mandates minimum flows of 140 cfs below the Belden dam during the fishing season (last Saturday in April through Labor Day) and 60 cfs during the remainder of the year. Since October 1985, PG&E has typically routed its minimum flow for this reach through the Oak Flat powerhouse. The turbine has a high-flow and a low-flow runner, which are changed in the spring and fall. During change-out periods, which are a few days long, water is continuously released through the pressure release valve at the end of the outlet pipe. Monthly and annual flow summaries are presented for the Oak Flat powerhouse (station NF103) and a gaging station approximately 0.5 mile downstream of the Belden dam-Oak Flat powerhouse complex (station NF70) in table 3-2.

The Belden bypassed reach receives additional inflow from two primary tributaries. Mosquito Creek generally contributes a flow of about 2 to 10 cfs approximately 2.9 miles downstream of the Belden dam. PG&E estimated that flows averaged about 5 to 6 cfs during the summers of 2000 and 2001. The EBNFFR (station NF51) contributes a mean annual flow of nearly 1,000 cfs to the Belden bypassed reach approximately 7.5 miles downstream of the Belden dam. Flows in the EBNFFR vary considerably throughout the year. Median monthly flows are roughly 100 to 200 cfs during July through November, but exceed 1,500 cfs during March and April (table 3-2).

The Belden bypassed reach ends approximately 1.8 miles downstream of the EBNFFR confluence, where Yellow Creek joins the NFFR.

Water diverted through the Belden powerhouse is discharged into Yellow Creek immediately upstream of its confluence with the NFFR. Annual flows through the powerhouse average nearly 950 cfs. Similar to the project's upper developments, the Belden development is used for peaking, and large rapid fluctuations—more than 1,000 cfs—of its discharges are common. During June through September, Yellow Creek also contributes about 40 to 170 cfs.

Water Use

PG&E holds water rights to store, divert, and use water from the NFFR and its tributaries for the production of power, domestic water supply, industrial and fire protection water supply, and irrigation (table 3-4). Most of these water allocations are for the non-consumptive use of producing energy, although three of them are for consumptive uses.

Table 3-4. PG&E water rights for the UNFFR Project. (Source: PG&E, 2003a, as modified by staff)

No.	Priority Date	When	Description	Use(s)
SWDU No. 922	1902	Year-round	Storage of 1,142,964 acre-feet at Canyon dam[a]	Power at licensee's powerhouses in the Feather River watershed; domestic and irrigation in the Sacramento Valley
Permit No. 21151	May 20, 1993	Oct 1–Jun 30	Storage of 500,000 acre-feet at Canyon dam	Power at Butt Valley and Caribou powerhouses
SWDU No. 923	1902	Year-round	Storage of 49,897 acre-feet at Butt Valley dam[a]	Power at licensee's powerhouses in the Feather River watershed; domestic and irrigation in the Sacramento Valley
SWDU No. 933	1913	Year-round	Divert 2,000 cfs at Canyon dam	Power at Butt Valley powerhouse
Permit No. 21152	May 20, 1993	Nov 1-Jun 30	Divert 1,000 cfs at Canyon dam	Power at Butt Valley and Caribou powerhouses

No.	Priority Date	When	Description	Use(s)
Permit No. 21153	Dec. 6, 1994	Year-round	Divert 1,400 cfs at Canyon dam	Power at Butt Valley and Caribou No. 2 powerhouses
SWDU No. 931	Pre-1914 and riparian rights	Year-round	Divert 1,000 cfs at Butt Valley dam	Power at Caribou No. 1 powerhouse
SWDU No. 932	Pre-1914 and riparian rights	Year-round	Divert 1,350 cfs at Butt Valley dam	Power at Caribou No. 2 powerhouse
SWDU No. 11477	Riparian right	Year-round	Divert 2,410 cfs at Belden diversion dam	Power at Belden powerhouse
License No. 9871	Jan. 9, 1940	Year-round	Divert 2,465 cfs at Belden diversion dam, 2,896 cfs at Rock Creek diversion dam, 3,500 cfs at Cresta diversion dam, and 3,500 cfs at Poe diversion dam	Power at Belden, Rock Creek, Cresta, and Poe powerhouses, respectively.
Permit No. 20864	Apr. 7, 1981	Year-round	Divert 135 cfs at Belden diversion dam, 604 cfs at Rock Creek diversion dam, 600 cfs at Cresta diversion dam, and 800 cfs at Poe diversion dam	Power at Belden, Rock Creek, Cresta, and Poe powerhouses, respectively.
Permit No. 18962	Nov. 2, 1982	Year-round	Divert 160 cfs at Belden diversion dam	Power at Oak Flat powerhouse

No.	Priority Date	When	Description	Use(s)
License No. 637	Jan. 10, 1924	Year-round	Divert 0.5 cfs from French Creek	Domestic, industrial and fire protection at Caribou camp
License No. 809	Jan. 10, 1924	Year-round	Divert 600 gallons per day from Oak Creek	Domestic, industrial and fire protection at Howells patrol station
SWDU No. 11477	Pre-1914	Year-round	Divert 10 cfs from Butt Creek	Irrigation in Humbug Valley

[a] Western Canal Water District exercises the licensee's consumptive water rights pursuant to a 1986 contract, which stipulates that the licensee must release, from storage in its reservoirs, 145,000 acre-feet between March 1 and October 31.

Water Quality

The NFFR basin lies within the Sacramento River basin and the Fourth Edition of the Central Valley Regional Water Quality Control Board Basin Plan (Basin Plan) for the Sacramento and San Joaquin River basins (CVRWQCB, 1998) applies to waters in the area. The Basin Plan designates existing beneficial uses for waterbodies in the basin. Existing beneficial uses designated for Lake Almanor are hydropower generation, water contact recreation, warm and cold freshwater habitat, warm spawning habitat, and wildlife habitat. Existing beneficial uses designated for the NFFR are hydropower generation, municipal and domestic supply, water contact recreation, non-water contact recreation, cold freshwater habitat, cold spawning habitat, and wildlife habitat.

Water quality standards applicable to surface waters in the project area are defined in three primary documents: the Basin Plan (CVRWQCB, 1998); CFR 40 Part 131, commonly referred to as The California Toxics Rule (EPA, 2000); and drinking water standards set in California Code of Regulations Title 22 (CDHS, 2002), which are applicable to surface waters of the NFFR designated for municipal water supply.

Table 3-5 summarizes selected applicable criteria. The California SWRCB (2003) did not include any waterbodies in the project area on its 2002 303(d) list of water-quality-limited waterbodies.

1 Table 3-5. Water quality criteria for the UNFFR Project.

Constituent	Objectives of Basin Plan for the Sacramento and San Joaquin River Basins (Source: CVRWQCB, 1998)	California Toxics Rule (EPA, 2000)	CA Drinking Water Standards[a] (CDHS, 2002)
Temperature	Natural water temperatures shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration does not adversely affect beneficial uses. At no time or place shall the temperature be increased more than 5°F above the natural receiving water.	---	---
Dissolved oxygen (DO)	Monthly median of the mean daily DO concentration shall not fall below 85% of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75% of saturation. DO concentrations shall not be reduced below 7.0 mg/L.	---	---
pH	The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 units.	---	---
Fecal coliform	Based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200/100 ml, nor shall more than 10% of the total number of samples taken during any 30-day period exceed 400/100 ml.	---	---
Oil and grease	Waters shall not contain oils, greases, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.	---	---
Turbidity	Shall be free of changes in turbidity that cause	---	---

Constituent	Objectives of Basin Plan for the Sacramento and San Joaquin River Basins (Source: CVRWQCB, 1998)	California Toxics Rule (EPA, 2000)			CA Drinking Water Standards[a] (CDHS, 2002)
	nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following: increases of 1 nephelometric turbidity units (NTU) where natural turbidity is 0-5 NTU, increases of 20% where natural turbidity is 5-50 NTU, increases of 10 NTU where natural turbidity is 50-100 NTU, and increases of 10% where natural turbidity is >100 NTU.				
Tastes and Odors	Shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affects beneficial uses.	---			Secondary maximum contaminant level (MCL) 3 Odor units
Methyl-*tert*-butyl ether (MTBE)	---	---			Primary MCL 0.013 mg/L; Secondary MCL 0.005 mg/L
		Dissolved Concentrations (mg/l)			
Trace Metals		**4-day Avg.**	**1-hr Avg.**	**Ins. Max.**	
Aluminum	---	0.087	0.750	---	Primary MCL 1.0 mg/L; Secondary MCL 0.2 mg/L
Arsenic	---	0.15	0.34	---	Primary MCL 0.05 mg/L

Constituent	Objectives of Basin Plan for the Sacramento and San Joaquin River Basins (Source: CVRWQCB, 1998)	California Toxics Rule (EPA, 2000)			CA Drinking Water Standards[a] (CDHS, 2002)
Barium	---	---	---	---	Primary MCL 1.0 mg/L
Cadmium[b]	---	0.0013	0.0020	---	Primary MCL 0.005 mg/L
Chromium (total)	---	---	---	---	Primary MCL 0.05 mg/L
Copper[b]	---	0.0050	0.0070	---	Primary MCL 1.3 mg/L Action level; Secondary MCL 1.0 mg/L
Iron	---	---	---	1.0	Secondary MCL 0.3 mg/L
Lead[b]	≤0.015 in waters designated as domestic or municipal supply	0.0012	0.030	---	Primary MCL 0.015 mg/L Action level
Manganese	---	---	---	---	Secondary MCL 0.05 mg/L
Mercury (inorganic)	---	0.00077	0.0014	---	Primary MCL 0.0020 mg/L
Nickel[b]	---	0.026	0.23	---	Primary MCL 0.1 mg/L
Selenium	---	0.005	0.02	---	Primary MCL 0.05 mg/L
Silver[b]	---	---	---	0.00105	Secondary MCL 0.1 mg/L
Zinc[b]	---	0.066	0.065	---	Secondary MCL 5.0 mg/L

[a] Applicable only to the NFFR.

[b] Hardness-dependent criteria. The listed criteria are for a hardness of 50 mg/l.

Action level based on concentration of 90th percentile exceedance of samples

General Water Quality

General water quality is largely dependent on the geologic and hydrologic characteristics of a basin. Table 3-6 summarizes PG&E's seasonal measurements of various water quality parameters that PG&E monitored in 2000. These measurements indicate that project waters are soft to moderately hard, generally have low to moderate total suspended solids and turbidities, and do not have excessively high nutrient (phosphorous or nitrogen) concentrations. Seasonal near surface chlorophyll-*a* concentrations for 2000 were typically 3 µg/l or less in both Lake Almanor and Butt Valley reservoirs (PG&E, 2003a). These concentrations indicate that the reservoirs have relatively low productivity (lower mesotrophic) based on Carlson's (1977) trophic state index. Secchi depth was measured in Lake Almanor during 2000 (May through December) and 2001 (March through September). Secchi depth averaged 5.0 meters (range 2.3 – 8.4 meters) during 2000 and 4.9 meters in 2001 (range 2.9 – 7.4 meters) in 2001. The primary cation and anion are calcium and bicarbonate, respectively.

Table 3-6. Range of general water quality parameters measured in project waters by PG&E in 2000. (Source: PG&E, 2003a)

Parameter (units)	Lake Almanor	Butt Valley Reservoir[a]	NFFR[b]	Butt Creek[c]	Tributaries[d]
pH (standard units)	6.9-8.3	6.8-8.0	7.1-8.4	7.4-8.2	7.1-8.8
Total alkalinity (mg $CaCO_3$/l)	48-50	48-60	49-90	87-150	26-100
Total hardness (mg $CaCO_3$/l)	10-46	36-50	41-89	76-99	17-97
Specific conductance (µS/cm)	85-99	85-119	89-185	159-200	44-323
Calcium (mg/l)	<0.1-9.4	8.6-10	8.9-21	20-24	4.7-23
Magnesium (mg/l)	0.1-4.8	4.2-5.2	4.2-8.4	6.7-8.0	2.0-8.6
Potassium (mg/l)	<0.1-2.6	1.2-2.6	<0.1-2.7	<0.1-0.9	0.3-2.3
Sodium (mg/l)	2.7-4.4	3.2-7.8	3.4-27	4.9-6.1	2.8-14
Bicarbonate (mg/l)	48-50	48-60	<10-90	87-150	<10-100
Chloride (mg/l)	<0.2-1.6	<0.2-3.3	0.6-3.3	0.2-2.0	<0.2-4.5
Sulfate (mg/l)	<0.2-9.3	<0.2-2.0	<0.2-6.0	2.8-3.4	<0.2-7.4
Silica (mg/l)	8.1-20	8.1-23	8.6-22	13-26	9.0-35
Total suspended solids (mg/l)	<1-23	<1-9	<1-140	<1-1	<1-10
Turbidity (NTU)	0.4-11	0.7-15	0-17	0.5-2.3	0.2-19

Parameter (units)	Lake Almanor	Butt Valley Reservoir[a]	NFFR[b]	Butt Creek[c]	Tributaries[d]
Total phosphorous (mg/l)	<0.01-0.12	<0.01-0.08	<0.01-0.13	0.02-0.11	<0.01-0.07
Orthophosphate (mg/l)	<0.01-0.01	<0.01-0.04	<0.01-0.07	<0.01-0.03	<0.01-0.13
Ammonia (mg/l)	<0.1	<0.1	<0.1-0.3	<0.1	<0.1-0.3
Total organic nitrogen (mg/l)	<0.2-1.7	<0.2-7.7	<0.2-0.2	<0.2	<0.2
Nitrate (mg NO_3/l)	<0.1-0.9	<0.1-2.7	<0.1-16	<0.1-8.0	<0.1-14
Chlorophyll-*a* (mg/l)	<0.001-0.021	<0.001-0.013	<0.001-0.013	<0.001-0.003	<0.001-0.018

[a] Butt Valley reservoir and Butt Valley powerhouse tailrace.
[b] Project-affected reaches of the NFFR including the Seneca and Belden bypassed reaches; Belden forebay; and Caribou No.1, Caribou No. 2, and Belden powerhouse tailraces.
[c] Project-affected reach of Butt Creek (i.e., reach between the Butt Valley dam and confluence with the NFFR).
[d] Inflows to Lake Almanor, Butt Valley reservoir, and the project-affected reaches of the NFFR.

Total alkalinity measurements indicate that Lake Almanor, Butt Valley reservoir, and the NFFR generally have low to moderate buffering capacity to resist changes in pH. The data indicate that Butt Creek downstream of Butt Valley dam, which is highly influenced by ground water, has a higher buffering capacity than other project-affected waters.

PG&E's reported pH values for 2000 indicate that relatively consistent pH levels occur throughout the upper NFFR basin. Overall, reported pH values ranged from 6.8 to 8.8 units (table 3-6). The Hamilton Branch powerhouse and EBNFFR were the only stations to have a reported pH value outside the criteria ranging from 6.5 to 8.5. These stations are not influenced by project operations. Values reported for NFFR project-affected stream reaches ranged from 7.1 to 8.4 units with station averages of 7.4 to 8.1 units.

Temperature

As part of relicensing the Rock Creek-Cresta Project (FERC N0. 1962), a SA (PG&E, 2000b) was developed and signed by PG&E, resource agencies (FS, USFWS, CDFG, SWRCB, Plumas County), and NGOs (Natural Heritage Institute, Friends of the River, California Outdoors, California Trout, AW, Chico Paddleheads, and Shasta Paddlers). One of the principal goals of this agreement was to improve cold freshwater

habitat in the Rock Creek and Cresta bypassed reaches. To accomplish this goal, a daily mean water temperature of 20°C was set as a standard, and a process was established for ensuring that PG&E implemented all reasonably practicable control measures to accomplish this goal. The SA requires PG&E to develop and implement a water temperature management plan, conduct modeling to evaluate the anticipated effectiveness of Prattville intake modification measures, and implement Prattville intake modifications determined by representatives of the parties signing the agreement to be reasonable and practicable measures to maintain daily mean temperatures of 20°C or less in the Rock Creek and Cresta bypassed reaches.

On October 23, 2002, PG&E filed its water temperature monitoring plan for the Rock Creek-Cresta Project with the Commission (PG&E, 2002b). The Commission approved this plan with modifications on February 28, 2003 (FERC, 2003). The objectives of this plan include:

- documenting continuous summer temperature and flow monitoring in the Rock Creek-Cresta reaches and upstream areas;

- determining if mean daily water temperatures of 20°C or less can be met in the Rock Creek and Cresta reaches through implementation of reasonable control measures, including modification of the Prattville intake by PG&E; and

- developing and verifying a temperature model that predicts, with reasonable accuracy, the temperature profile of the NFFR.

Adoption of the plan formalized water temperature and flow monitoring along with water temperature modeling to be conducted by PG&E for the Rock Creek-Cresta Project. However, PG&E had monitored flow and water temperatures throughout the NFFR basin in a similar manner as proposed in the plan during the years of 2000 through 2002. It did this by continuously monitoring water temperatures at 26 stations in the upper NFFR basin from June 1 to September 30 (table 3-7), and monitoring vertical profiles of temperature in Lake Almanor and Butt Valley reservoir during 2000, 2001, and 2002; and in the Belden forebay during 2000. Table 3-7 presents the range of daily average temperatures reported, along with an evaluation of the frequency and timing that daily average temperatures exceeded 20.0°C at each station.

In the following discussion of water temperatures, we generally progress from an upstream to downstream direction and intermix the results of the two sources of monitoring data.

Table 3-7. Monitoring locations for Commission-approved Rock Creek-Cresta water temperature monitoring plan and summary of daily average water temperatures for continuous monitoring in June through September of 2000, 2001, and 2002. (Sources: PG&E, 2002a, b; 2003b, as modified by staff)

Station	Monitoring Parameters	Range (°C)	Greater than 20.0°C	
			Months[a]	Percent[b]
NFFR at Chester (NF1A)	TR, FT	9.1-16.8	None	0%
Hamilton Branch Creek at Hwy A13 bridge (HB1)	TR, F	9.0-14.2	None	0%
Hamilton Branch powerhouse (HB2)	TR,F	9.2-20.3	June-July	2%
Lake Almanor at Canyon dam near surface (LA1-S)	TR	16.1-25.4	June-Sept.	72%
Lake Almanor at Canyon dam near bottom (LA1-B)	TR	8.2-16.1	None	0%
Butt Valley powerhouse (BV1)	TR, F	14.0-22.2	July-Sept.	38%
Butt Valley reservoir at Caribou intake near surface (BV2-S)	TR	17.0-24.4	June-Sept.	74%
Butt Valley reservoir at Caribou intake near bottom (BV2-B)	TR	9.4-20.8	Aug.-Sept.	6%
Butt Creek above Butt Valley reservoir (BC1)	TR, F	9.4-16.0	None	0%
Butt Creek below Butt Valley reservoir (BC2)	TR	10.2-13.1	None	0%
Butt Creek at mouth (BC3)	TR, FT	10.5-12.9	None	0%
NFFR below Canyon dam (NF2)	TR, F	9.4-15.8	None	0%
NFFR at Seneca Bridge (NF3A)	TR, S	10.8-16.2	None	0%
NFFR above Butt Creek (NF3B)[c]	---	12.8-17.2	None	0%
NFFR above Caribou powerhouse (NF4)	TR, FT	11.4-16.8	None	0%
Caribou No. 1 powerhouse (CARB1)	TR, F	12.3-21.9	July-Sept.	35%
Caribou No. 2 powerhouse (CARB2)	TR, F	16.6-24.0	June-Sept.	68%
Belden forebay at intake (BD1)	TR	15.5-22.8	June-Sept.	55%
NFFR below Belden dam (NF5)	TR, F	13.9-21.3	July-Sept.	29%
Mosquito Creek at mouth (MC1)	TR, S	10.7-15.6	None	0%

Station	Monitoring Parameters	Range (°C)	Greater than 20.0°C	
			Months[a]	Percent[b]
NFFR near Queen Lily campground (NF6)	TR	14.0-21.1	July-Sept.	20%
NFFR near Gansner Bar (NF7)	TR	14.9-21.3	July-Sept.	19%
EBNFFR at mouth (EB1)	TR, F	15.4-25.5	June-Sept.	63%
NFFR at Belden Town Bridge (NF8)	TR	15.6-22.9	June-Sept.	50%
Belden powerhouse (BD2)	TR, F	15.4-22.8	July-Sept.	48%
Yellow Creek near mouth (YC1)	TR, FT	10.9-18.6	None	0%

Key to monitoring parameters: F = flow gaging station or powerhouse records, FT = temporary flow gaging station, TR = temperature recorder, P = reservoir profile, S = staff gage, and --- = not included.

[a] Months that had at least 1 day with an average temperature of greater than 20.0°C.

[b] Percent of monitored days that had daily average temperature of greater than 20.0°C.

[c] No temperatures reported for June through September of 2000 or 2002.

The primary surface inflows to Lake Almanor (NFFR, Hamilton Branch, and Hamilton Branch powerhouse) had daily average temperatures that ranged from 9.0 to 20.3°C. The warmest daily average temperatures for the NFFR and Hamilton Branch were 16.8 and 14.2°C, respectively. In contrast, discharge from the Hamilton Branch powerhouse reached as high as 20.3°C in June and July 2000. Temperatures were cooler at the Hamilton Branch powerhouse in 2001 and 2002 when the maximum daily average temperature was 18.0 and 19.1°C, respectively. Daily average temperatures exceeded 20.0°C at the Hamilton Branch powerhouse on 2 percent of the days with measurements.

Vertical profiling of water temperatures in Lake Almanor indicate that thermal gradients typically begin to develop in April and May, are well established during June to mid-September, and the lake turns over (mixing of water throughout the entire profile) in late September to November. From June through mid-September, a warm upper layer (epilimnion) exists and generally extends to a depth of 30 to 40 feet, while a much cooler layer (hypolimnion) resides below a depth of about 50 feet (figure 3-3).

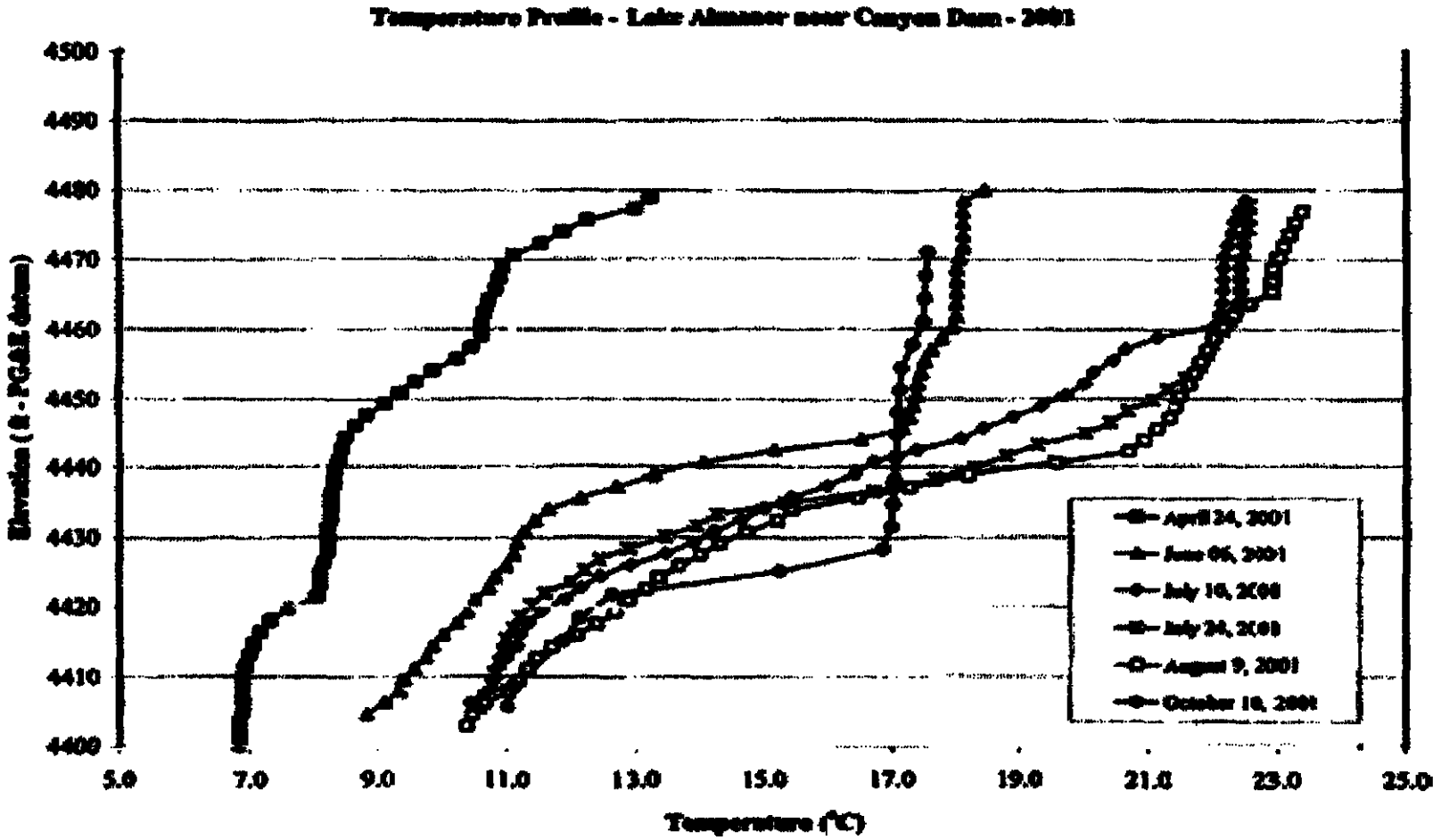

Figure E2.5-7. Comparison of Monthly Profiles from Lake Almanor near Canyon Dam (LA1) - 2001.

Figure 3-3. Vertical profiles of water temperature for Lake Almanor near Canyon dam, 2001. (Source: PG&E, 2002a)

Daily average Lake Almanor near surface water temperature based on continuous seasonal monitoring ranged from 16.1 to 25.4°C, while temperatures near the bottom were much cooler ranging from 8.2 to 16.1°C. Surface temperatures tended to be highest during July and August, although near bottom temperatures increased as summer progressed (table 3-7). During the drought of 2001, Lake Almanor's water level was considerably lower than normal and likely was one of the principal causes of early summer temperatures being about 2 to 4°C warmer near the bottom than in 2000 and 2002. Daily average temperatures of near surface waters exceeded 20.0°C on 72 percent of days monitored. Near surface (3 feet below the surface) temperatures of greater than 20.0°C were reported for the months of June, July, and August 2000, 2001, and 2002; and September 2001 and 2002.

Daily average temperatures of discharges from the Butt Valley powerhouse were about 2 to 3°C cooler than the near surface waters of Lake Almanor (table 3-7). They ranged from 14.0 to 22.2°C and exceeded 20.0°C on 38 percent of the days monitored. Daily average temperatures of greater than 20.0°C were reported for July 2001 and 2002; August 2000, 2001, and 2002; and September 2002.

The thermal regime of the Butt Valley reservoir is largely dependent on discharges from Butt Valley powerhouse, due to its high proportion of the total inflow to the reservoir, along with the relatively short transit time through the impoundment (14 to 32 days) relative to Lake Almanor. Vertical profiles of temperatures in the reservoir indicate that a moderate thermal gradient exists during late spring and early summer. However, little stratification was evident during mid- to late summer 2000, 2001, or 2002. The relatively small amount of cold-water storage, short retention time, and withdrawal of cooler water through the deeper Caribou No. 1 intake probably all contribute to the thermal characteristics of Butt Valley reservoir.

Daily average temperatures, based on seasonal sampling, for near surface waters of Butt Valley reservoir ranged from 17.0 to 24.4°C, while near bottom temperatures ranged from 9.4 to 20.8°C. The seasonal pattern of surface and bottom temperatures was similar to that observed in Lake Almanor. Surface waters tended to be warmest in July and August, and bottom waters warmed throughout the summer. Near surface daily average temperatures of greater than 20.0°C were reported for June, July, and August 2000, 2001, and 2002; and in September 2001 and 2002. Seventy four percent of the days monitored had a daily average temperature for the surface of Butt Valley reservoir of greater than 20.0°C.

Daily average temperatures reported for Butt Creek ranged from 9.4 to 16.0°C. Both the lowest and highest values were reported for the monitoring station upstream of Butt Valley reservoir. Daily average temperatures reported for the two sites downstream of Butt Valley reservoir ranged from 10.2 to 13.1°C.

Daily average water temperatures in the Seneca reach ranged from as low as 9.4°C a short distance downstream of Canyon dam to as high as 17.2°C immediately upstream of the Butt Creek confluence. Water temperatures tended to increase between the upper end of the reach (station NF2) and immediately upstream of the Butt Creek confluence (station NF3B), and decrease below the Butt Creek confluence. We suspect that the cooler conditions monitored at the lower end of the reach (station NF4) are largely due to cool inflow from Butt Creek (station BC3). None of the daily average temperatures reported for the Seneca reach exceeded 20.0°C.

The temperature of discharges from the two Caribou powerhouses differed substantially from one another. Discharges from Caribou No. 1 powerhouse ranged from 12.3 to 21.9°C, while discharges from Caribou No. 2 powerhouse ranged from 16.6 to 24.0°C. This is probably due to the shallower intake depth of Caribou No. 2 (elevation of 4,093 feet for Caribou No. 2 versus approximately 4,067 feet for Caribou No. 1). Caribou No. 1 daily average temperatures of greater than 20.0°C were reported for August 2000, 2001, and 2002; July 2001 and 2002; and September 2002. Caribou No. 2 daily average temperatures of greater than 20.0°C were reported for June, July, and August 2000, 2001, and 2002; and September 2001 and 2002. Daily average temperatures exceeded 20.0°C for 35 percent of the days monitored at the Caribou No. 1 powerhouse and 68 percent of the days monitored at the Caribou No. 2 powerhouse.

Results of vertical temperature profile monitoring in Belden forebay during 2000 indicate that little thermal stratification occurs. Temperatures within each of the vertical profiles reported varied by less than 3°C. Many factors, including the impoundment's small capacity, short (1 day or less) retention time, deep-water fish releases, and large daily changes in the impoundment's storage level during the summer, likely cause these relatively uniform temperatures throughout the water column.

Daily average temperatures reported for the Belden forebay at the intake range from 15.5 to 22.8°C, with 55 percent of the days monitored having temperatures of greater than 20.0°C. Daily average temperatures of greater than 20.0°C were reported for July and August 2000, 2001, and 2002; and for June and September 2001 and 2002. During the summer, inflow to the Belden forebay predominantly comes from the Caribou Nos. 1 and 2 powerhouses. Their warm discharges have considerable effect on temperatures at the intake in comparison to inflows from the Seneca reach of the NFFR.

Daily average temperatures reported for the Belden reach ranged from 13.9 to 22.9°C, and tended to increase in a downstream direction (table 3-7). At the three stations located upstream of the confluence with the EBNFFR, daily average temperatures were generally similar and exceeded 20.0°C on about 20 to 30 percent of the days monitored. Nearly all of the days with daily average temperatures of greater than 20.0°C in the upper portion of the Belden reach occurred in July or August. In contrast, daily average temperatures in the lower Belden reach (NF8) were generally about 1 to 2°C warmer and temperatures of greater than 20.0°C occurred in all of the

months of June-September 2001 and 2002, and June-August 2000. Daily average temperatures exceeded 20.0°C on 50 percent of the days monitored. These warmer conditions are at least partially caused by warm inflows from the EBNFFR, which ranged from 15.4 to 25.5°C during the study period.

The temperature of Belden powerhouse discharges is similar to ambient conditions in the lower Belden reach. Daily average temperatures range from 15.4 to 22.8°C, and exceed 20.0°C on nearly 50 percent of the days monitored. Temperatures of greater than 20.0°C were reported for July and August 2000, 2001, and 2002; and June and September 2000.

Dissolved Oxygen

PG&E monitored DO concentrations at 24 stations during 2000. Monitoring was conducted in April, June, July, August, September, and November. Table 3-8 presents the results of this monitoring program.

Table 3-8. Summary of dissolved oxygen concentrations monitored by PG&E during 2000. (Source: PG&E, 2002a)

	Concentration (mg/l)			Percent of Saturation		
Location	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
NFFR at Chester (NF1)	8.0	10.1	12.2	86	100	111
Hamilton Branch Creek at Hwy A13 bridge (HB1)	8.6	9.7	11.0	89	98	106
Hamilton Branch powerhouse (HB2)	7.5	9.8	12.3	94	108	126
Lake Almanor at Canyon dam near surface (LA1-S)	5.8	7.7	9.6	77	92	102
Lake Almanor at Canyon dam near bottom (LA1-B)	0.7	5.5	9.8	8	58	99
Lake Almanor near Prattville intake near surface (LA2-S)	6.8	8.1	10.6	92	99	107
Lake Almanor near Prattville intake near bottom (LA2-B)	3.0	6.4	10.3	34	73	100
Butt Valley powerhouse (BV1)	6.3	8.0	10.2	80	90	101
Butt Valley reservoir at Caribou No. 1 intake near surface (BV2-S)	6.0	8.3	10.6	76	97	108
Butt Valley reservoir at Caribou No. 1 intake near bottom (BV2-B)	0.4	4.1	10.3	5	42	100
Butt Creek above Butt Valley reservoir (BC1)	9.3	10.0	11.2	89	98	104

Location	Concentration (mg/l)			Percent of Saturation		
	Min	Avg	Max	Min	Avg	Max
Butt Creek at mouth (BC3)	8.4	9.4	10.3	86	94	99
NFFR below Canyon dam (NF2)	7.3	9.2	10.7	78	96	117
NFFR above Caribou powerhouse (NF4)	8.6	9.4	11.2	89	94	103
Caribou No. 1 powerhouse (CARB1)	6.8	7.7	9.3	78	86	90
Caribou No. 2 powerhouse (CARB2)	6.5	7.8	10.1	76	92	102
Belden forebay at powerhouse intake near surface (BD1S)	7.4	8.1	8.8	93	99	105
Belden forebay at powerhouse intake near bottom (BD1B)	6.2	7.0	8.1	73	84	99
NFFR below Belden dam (NF5)	7.2	8.5	10.5	87	94	100
NFFR near Gansner Bar (NF7)	7.4	9.0	11.4	88	96	105
EBNFFR at mouth (EB1)	6.6	8.9	12.5	83	95	106
NFFR at Belden Town bridge (NF8)	7.4	8.9	11.4	84	94	98
Belden powerhouse (BD2)	6.7	8.0	10.7	77	88	99
Yellow Creek near mouth (YC1)	8.7	10.1	12.2	90	96	107

All of the DO concentrations reported by PG&E for the inflow to Lake Almanor were greater than 7.0 mg/l (table 3-8).

DO concentrations in Lake Almanor follow the typical clinograde pattern for large, thermally stratified reservoirs. Surface waters generally remain well aerated, while DO concentrations of near-bottom waters are progressively reduced during the summer and early fall, prior to turnover. Measurements of DO in the reservoir's epilimnion ranged from 5.8 to 10.6 mg/l, while concentrations measured in the hypolimnion ranged from 0.7 to 10.3 mg/l. The lowest DO concentrations monitored in the reservoir occurred near the bottom at the Canyon dam intake, which is deeper and receives substantially less flow than near the Prattville intake. Near-bottom DO concentrations at this station were 7.0 mg/l or higher during April, September, and November; 2 to 3 mg/l in June and July; and less than 1 mg/l in August. Further up the reservoir near the Prattville intake, DO concentrations of slightly less than 7.0 mg/l occurred near the surface in June, and DO concentrations of approximately 3 mg/l occurred near the bottom in June and July.

During July through November 2001, PG&E monitored DO and other water quality in Lake Almanor near the Canyon dam intake as part of a study to evaluate the

effects of late summer releases from Canyon dam. Near-surface DO levels monitored for the 2001 study ranged from 6.5 to 7.2 mg/l and 73 to 99 percent of saturation. In contrast, near-bottom DO levels ranged from 0.2 to 4.8 mg/l and 2 to 50 percent of saturation. Anoxic (DO of <0.5 mg/l) conditions occurred near the bottom during each of the monitoring visits from early August through mid-October. Since no measurements were reported prior to the August 8 value of 0.2 mg/l, it is not evident when anoxic conditions began to occur. By mid-November, turn-over had begun to occur, and the near-bottom DO concentration was 4.8 mg/l.

DO levels in 2000 for the Butt Valley powerhouse ranged from 6.3 to 10.2 mg/l, and are quite similar to conditions in the Lake Almanor epilimnion from which the water is drafted. DO concentrations of less than 7.0 mg/l occurred in July and August.

DO levels measured in Butt Valley reservoir ranged from 0.4 to 10.6 mg/l. DO concentrations in the epilimnion ranged from 6.0 to 10.6 mg/l, while they ranged from 0.4 to 10.3 mg/l at depths of greater than 46 feet. Values of less than 7.0 mg/l were reported for a depth of 3 feet in July and near the bottom during the months of June through September. Measurements near the bottom indicate that anoxic conditions occurred in August and hypoxic (<2.0 mg/l) conditions occurred in June and July.

DO levels were somewhat depressed in discharges from the Caribou developments, bottom of Belden forebay, and Belden powerhouse. DO concentrations of less than 7.0 mg/l were reported for both of the Caribou powerhouses in September, near the bottom of Belden forebay in June and July, and for the Belden powerhouse in July and September. Results of PG&E's 2000 study indicate that low-DO water drafted from the hypolimnion of Butt Valley reservoir via the Caribou No. 1 facility is generally re-aerated to 7 to 8 mg/l by the time it reaches the powerhouse tailrace.

All of PG&E's seasonal measurements of DO concentrations for project-affected stream reaches (i.e., the Seneca, Belden, and lower Butt Creek bypassed reaches) were greater than 7.0 mg/l.

Coliform Bacteria

Four principal sources of coliform data are available to describe bacteriological water quality conditions in the project area. Fecal coliform densities reported for a study conducted between 1993 and 1996 by Henrici Labs that sampled 12 locations along the margin of Lake Almanor for 3 months a year (typically, May, August, and October) ranged from less than 2 MPN/100 ml to greater than 1,600 MPN/100 ml (PG&E, 2003a). With the exception of four of the 134 samples analyzed, all samples had fecal coliform densities of less than 200 MPN/100 ml.

Fecal coliform densities reported for CDWR's study conducted between 1995 and 1999 at 22 stations in Lake Almanor and Hamilton Branch of the NFFR ranged

from zero to 1,710 MPN/100 ml. Of the total 428 samples, all but five had values of less than 200 MPN/100 ml.

PG&E reported fecal coliform densities ranging from less than 2 to 80 MPN/100 ml for a total of 118 samples collected at 20 locations during April, June, July, August, September, and November 2000 (table 3-9).

PG&E monitored fecal coliform densities in Lake Almanor at the Canyon dam picnic area by sampling five times within 30 days (as specified in the Basin Plan) between June 29 and July 24, 2001. Samples were collected prior to and following the July 4 holiday in an effort to monitor worst-case conditions. This location receives considerable day use by swimmers and recreational watercraft, and has pit toilets located upgradient from the sample site. Fecal coliform densities reported for each of the five days monitored were less than 2 MPN/100 ml; therefore the geometric mean for the 30-day period also was less than 2 MPN/100 ml.

Between August 29 and September 23, 2002 (which included the Labor Day holiday weekend), PG&E monitored fecal coliform densities in Butt Valley at the Ponderosa campground using the methodology specified in the Basin Plan. Reported fecal coliform densities for this period ranged from less than 2 to 80 MPN/100 ml, and had a geometric mean of less than 5.5 MPN/100 ml.

Study results suggest that the state criteria for fecal coliform are nearly always satisfied within waters in the project area, although fecal coliform concentrations of >200 MPN/100 ml sometimes occur along the southern part of Lake Almanor (see sampling results of Henrici Labs and CDWR discussed earlier).

Metals and Polychlorinated Biphenyls

The project may influence the concentrations of metals and polychlorinated biphenyls (PCBs) in water through its current and past operations. There are three primary pathways for this potential influence: (1) PG&E's LACSP, which vaporizes a silver iodide/acetone solution, (2) potential PCB contamination resulting from the 1984 Caribou rockslide and subsequent storage of contaminated soils, and (3) sorption/desorption of metals in sediments deposited in project impoundments as a function of cyclical redox functions.

As described earlier, PG&E implements the LACSP to increase snowfall in the upper part of the basin. It uses nine cloud seeding burners, which vaporize a silver iodide/acetone solution and form microscopic-sized crystals. During the 12 winter seasons of 1989-90 through 2000-01, the cumulative operation of cloud-seeding burners ranged from 44 hours in 1996-97 to 3,808 hours in 2000-01. PG&E estimates that these operations released an average of 102 pounds of silver iodide into the atmosphere per year during winter storm periods. Annual estimates ranged from 2 pounds of silver iodide in 1996-97 to 176 pounds of silver iodide in 2000-01.

Table 3-9. Summary of total coliform and fecal coliform densities monitored by PG&E during 2000 to 2002.[a] (Source: PG&E, 2002a)

Station	Total Coliform Range (MPN/100 ml)	Fecal Coliform Range (MPN/100 ml)
NFFR at Chester (NF1)	11-300	2-26
Hamilton Branch Creek at Hwy A13 bridge (HB1)	4-30	<2-23
Hamilton Branch powerhouse (HB2)	13-130	<2-4
Lake Almanor at Canyon dam near surface (LA1-S)	<2-2	<2
Lake Almanor at Canyon dam near bottom (LA1-B)	<2-70	<2
Lake Almanor at the Canyon dam picnic area[b]	23-900	<2
Butt Valley powerhouse (BV1)	2-50	<2-17
Butt Valley reservoir at Caribou intake near surface (BV2-S)	<2-13	<2
Butt Valley reservoir at Caribou intake near bottom (BV2-B)	<2-12	<2
Butt Valley reservoir at Ponderosa campground[c]	50-300	<2-80
Butt Creek above Butt Valley reservoir (BC1)	8-500	2-80
Butt Creek at mouth (BC3)	4-50	<2-2
NFFR below Canyon dam (NF2)	4-30	<2-2
NFFR above Caribou powerhouse (NF4)	2-80	<2-8
Caribou No. 1 powerhouse (CARB1)	2-13	<2-2
Caribou No. 2 powerhouse (CARB2)	2-23	<2-2
NFFR below Belden dam (NF5)	8-240	<2-4
NFFR near Gansner Bar (NF7)	23-300	<2-4
EBNFFR at mouth (EB1)	11-500	<2-9
NFFR at Belden Town Bridge (NF8)	17-900	<2-50
Belden powerhouse (BD2)	11-110	<2-2
Yellow Creek near mouth (YC1)	8-70	<2-4

[a] All rows with the exception of footnoted rows are based on samples collected in April, June, July, August, September, and November 2000.

[b] Five samples taken between June 29 and July 24, 2001; fecal coliform geometric mean is <2 MPN/100 ml.

[c] Five samples taken between August 29 and September 23, 2002; fecal coliform geometric mean is <5.5 MPN/100 ml.

On February 24, 1984, a large rockslide severely damaged the Caribou No. 1 penstock and Caribou No. 2 powerhouse. The slide completely destroyed the Caribou No. 2 switchyard and damage to the Caribou No. 1 penstock resulted in flooding of the switchyard, which included transformers and oil circuit breaker switches that contained PCB-contaminated mineral oil (letter from W.M. Gallavan, Vice President, PG&E, to W.F. Kopfler, II, Regional Engineer, FERC, San Francisco, CA, dated July 19, 1984). The slide ruptured some of this equipment, resulting in PCB-contaminated mineral oil leaking onto the slide area and into the water. PG&E (1984) reported that most of the mineral oil at these facilities contained less than 50 ppm PCBs, although a small amount of the oil contained greater than 50 ppm PCBs.

This leakage resulted in PCB contamination of some of the soil, slide spoil, and Belden forebay sediments. By mid-July 1984, PG&E had cleaned up and/or removed all PCB contamination with the exception of concentrations of less than 0.4 ppm in the Belden forebay sediments and less than 7 ppm in the Oak Flat spoil pile. SWRCB and CDFG continued to be concerned with the potential for residual PCBs to adversely affect the fishery and wildlife resources, and required further cleanup of all detectable PCBs. PG&E continued to clean up the PCB contamination as mandated by SWRCB (letter from W.M. Gallavan, Vice President, PG&E, to W.F. Kopfler, II, Regional Engineer, FERC, San Francisco, CA, dated July 19, 1984).

PG&E sampled waters for trace metals at 20 stations in the upper NFFR basin during 2000. This sampling effort consisted of collecting samples during April, June, July, August, September, and November and analyzing the samples for total concentrations of 12 metals (arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, and zinc) and hardness. Unfortunately, method detection limits for cadmium, lead, mercury, and silver were too high to ensure that samples with non-detectable levels did not actually exceed applicable criteria. Because arsenic, cadmium, copper, lead, mercury, silver, and zinc have criteria based on concentrations of their dissolved fractions, PG&E used standard acceptable protocols for estimating their dissolved fractions (EPA, 1996a) and then compared these estimated values to the appropriate criteria.

Following the 2000 sampling effort, PG&E consulted with resource agencies and modified the monitoring program to focus on obtaining information appropriate for further evaluating selected trace metals. Between July and November 2001, PG&E sampled eight stations for dissolved concentrations of iron, manganese, and silver at method detection limits of 0.050, 0.001, and 0.001 mg/l, respectively. Sampling stations were in Lake Almanor near Canyon dam intake, in the Seneca reach, and in the springs in the upper end of the Seneca reach.

PG&E developed a supplemental monitoring program that used trace metal clean methodology and had low detection limits necessary for comparison to applicable criteria. This program included sampling for cadmium, lead, mercury, and silver during

2002 and 2003. The results of this monitoring program have not yet been filed with the Commission.

We discuss the results of the 2000 and 2001 sampling programs below with a focus on exceedance of applicable criteria. We only discuss reported levels greater than the method detection limits. As discussed above, we note that method detection limits for the 2000 study were too high to be adequate for comparison of water samples with non-detectable levels to criteria applicable to cadmium, lead, mercury, and silver.

Copper was the only metal that was found to possibly exceed the applicable dissolved criterion. This occurred in the Caribou No. 1 powerhouse tailrace in July 2000, where the laboratory reported a total recoverable concentration of 0.0063 mg/l and a hardness of 49 mg/l as $CaCO_3$. Using the metals translator (EPA, 1996a), PG&E estimated a dissolved copper concentration of approximately 0.00605 mg/l, which exceeds the California Toxics Rule, Freshwater Aquatic Life Protection (CTR-FALP) hardness-dependent 4-day average criterion of 0.0049 mg/l. However, observed concentration was from a single sample, and was not a 4-day average and thus is not directly comparable to the criterion. Also, the estimated dissolved fraction was less than all of the other CTR and drinking water criteria. None of the other four samples analyzed for this station had a detectable total copper concentration of 0.00040 mg/l or greater, which converts to a dissolved concentration of less than 0.00038 mg/l. Each of these four estimated concentrations of the dissolved fraction of copper is below the applicable hardness-dependent criteria for the dates sampled.

Total iron concentrations sampled in 2000 exceeded the Title 22 Secondary MCL of 0.3 mg/l at three stations in the NFFR. These stations included the upper and lower ends of the Seneca reach (NF2 and NF4), and the lower end of the Belden reach (NF8). One of the samples analyzed (NFFR below Canyon dam [NF2] during September) had a total iron concentration of 1.7 mg/l. While this concentration is higher than the CTR-FALP instantaneous maximum criterion for dissolved iron (1.0 mg/l), it is unknown whether the concentration of dissolved iron exceeded the applicable criterion.

Dissolved iron concentrations reported for the 2001 sampling program ranged from less than the method detection limit of 0.050 mg/l to 4.02 mg/l. Concentrations of more than the allowable instantaneous maximum of 1.0 mg/l were reported for Lake Almanor at the Canyon dam intake near the bottom (LA1-B) during September to mid-October, and a mineral spring located adjacent to the Canyon dam release structure (MS) during July to November. The highest dissolved iron concentration reported for any of the NFFR stations was 0.273 mg/l, which occurred in the NFFR below Canyon dam (NF2) on October 10.

Total recoverable manganese was detected above the detection limit of 0.00046 mg/l at 17 stations during 2000. Manganese concentrations exceeded the Title 22 Secondary MCL of 0.05 mg/l at the upper and lower ends of the Seneca reach (NF2 and

NF4), Caribou No. 1 and No. 2 powerhouse tailraces (CARB1 and CARB2, respectively), the upper end of the Belden reach (NF5), and the Belden powerhouse tailrace (BD2).

Dissolved manganese concentrations reported for the 2001 sampling program ranged from less than the method detection limit of 0.001 mg/l to 3.23 mg/l. Reported values for the NFFR were compared to the Title 22 secondary criterion of 0.05 mg/l. Concentrations of greater than 0.05 mg/l were reported for three stations in the upper 0.6 mile of the Seneca reach in mid-September to mid-October. On both of the days with concentrations of greater than 0.05 mg/l in the Seneca reach, concentrations were reduced substantially between the Canyon dam release (NF2) and Skinner Flat (SF), which is approximately 0.6 mile downstream of the dam. For example, on September 11, the dissolved manganese concentration was 0.755 mg/l at the Canyon dam release and 0.057 mg/l at Skinner Flat.

PG&E analysis of total mercury concentrations in 2000 are of limited value because the detection levels (0.0002 mg/l) were not adequate for comparison to CTR Human Health Criteria for water and organisms (0.000050 mg/l) and organisms only (0.000051 mg/l), and the July samples were contaminated in the laboratory by a broken thermometer (personal communication from D. Mayugba, QA Director, ChromaLab Inc., Pleasanton, CA, to B. Mattax, Louis Berger Group, Seattle, WA, August 2, 2000). All of the valid total mercury concentrations reported for 2000 satisfied the CTR-FALP 4-day average criterion of 0.00077 mg/l. To provide data sufficient to evaluate compliance with applicable standards, PG&E included total mercury in its supplemental monitoring program for 2002-2003 (PG&E, 2003a). The results of these studies have not been filed with the Commission as of the date of this EIS; therefore, we could not include them in this analysis.

PG&E also evaluated bioaccumulation of mercury, silver, and PCBs in fishes and crayfish during 2001, 2002, and 2003. In 2001, fish and crayfish were collected from the Belden forebay and Belden reach in mid-August. Table 3-10 presents the results of the 2001 study along with various sample action, allowable, and screening levels. At the May 21, 2003, Chico, CA, scoping meeting, PG&E stated that it provided the Rancho Cordova Laboratory of CDFG with the fish and crayfish samples collected in 2002 and 2003. However, the results of these studies had not been filed with the Commission as of the date of this EIS.

Table 3-10. Fish and crayfish tissue analysis results for silver, mercury, and PCBs in Belden forebay and Belden reach, and various sample action, allowable, and screening levels, August 2001.[a] (Source: PG&E, 2002a)

Species	Length (mm)	Silver (µg/kg)	Methyl Mercury (µg/kg)	Hg (II) (µg/kg)	Total Mercury (µg/kg)	Total PCBs (µg/kg)
Belden forebay						
Rainbow trout	229	14	53.5	1.1	54.5	2.60
Brown trout	280	10	68.1	1.4	70.6	9.70
Sacramento sucker	358	5	53.2	1.4	54.7	11.00
Sacramento sucker	333	6	91.1	1.8	92.8	14.60
Sacramento sucker	340	5	89.0	1.9	90.8	13.10
Smallmouth bass	180	4	111.0	3.3	114.0	5.70
Smallmouth bass	175	2	55.6	1.0	56.7	14.90
Crayfish[b]	Various	23	31.5	1.8	33.3	0.80
NFFR downstream of dredge disposal pile						
Rainbow trout	202	---	---	---	---	5.50
Rainbow trout	203	---	---	---	---	5.20
Rainbow trout	172	---	---	---	---	5.10
Rainbow trout	295	---	---	---	---	6.70
Sacramento sucker	365	---	---	---	---	7.30
Sacramento sucker	360	---	---	---	---	6.40
Sacramento sucker	425	---	---	---	---	4.70
Sacramento sucker	418	---	---	---	---	2.30
Crayfish[c]	Various	---	---	---	---	0.20
Sample action, advisory, and screening levels						
FDA action level		---	100	---	---	NA

Species	Length (mm)	Silver (µg/kg)	Methyl Mercury (µg/kg)	Hg (II) (µg/kg)	Total Mercury (µg/kg)	Total PCBs (µg/kg)
FDA allowable level		---	---	---	---	2,000
EPA/ODH advisory		---	350	---	---	---
EPA screening level		---	---	---	---	10
SFEI screening level		---	300	---	---	20
SFEI median-largemouth bass		---	350	---	---	6.1
SFEI range-largemouth bass		---	84-670	---	---	2-112

--- indicates not reported; NA indicates not applicable.

[a] Tissue analyses were conducted on whole specimens (i.e., entire fish and crayfish were homogenized).

[b] Composite sample of about 12 crayfish.

[c] Composite sample of about 6 crayfish.

FDA Food and Drug Administration
EPA U.S. Environmental Protection Agency
SFEI San Francisco Estuary Institute

The concentration of silver in all of the fish and crayfish sampled during 2001 ranged from 0.002 ppm in smallmouth bass to 0.023 ppm in the composite sample of crayfish in Belden forebay. These results indicate that body burdens of silver in fish and crayfish are generally low in the Belden forebay.

Methyl mercury levels ranged from 31.5 µg/kg for the composite crayfish sample to 111 µg/kg in a smallmouth bass in the Belden forebay. The one smallmouth bass sample with the highest level was the only fish/crayfish sample that exceeded the FDA's action level of 100 µg/kg. None of the other action and screening levels for methyl mercury were exceeded in any of the 2001 samples.

Total PCB levels (a summation of the 209 separate cogeners for each sampled organism) ranged from 0.8 µg/kg in the composite crayfish sample to 14.9 µg/kg in a smallmouth bass in the Belden forebay and from 0.2 µg/kg in the composite crayfish sample to 7.3 µg/kg in a Sacramento sucker in the Belden reach below the dredge disposal pile. Four samples (three Sacramento suckers and one smallmouth bass) from the Belden forebay exceeded the EPA screening level of 10 µg/kg for PCBs; however, all of these tissue levels were below the FDA allowable level of 2,000 µg/kg.

Odors and Sulfide

PG&E reported that hydrogen sulfide odors were evident at the NFFR release from Canyon dam in both 2000 and 2001. During summer 2001, PG&E included an evaluation of conditions that could lead to odor problems in its investigation of the water quality of late summer releases from Canyon dam. Odor and sulfide levels were sampled during four events between July 10 and October 10 during typical operations of releasing 35 cfs into the upper end of the Seneca reach through the lower gates of the Canyon dam intake tower.

Odors monitored during these four days ranged from less than 2 to 4 odor units reported as Threshold Odor Number (TON).[14] Values of greater than the 3 Odor unit (reported as TON) Drinking Water Secondary MCL were reported for two of the 32 samples taken. These high values (4 TON) were reported for October 10 near the bottom of Lake Almanor near the Canyon dam intake (LA1-B) and the NFFR at the Canyon dam release (NF2).

Sulfide concentrations measured during these four days ranged from less than 0.0017 to 0.504 mg/l. The highest values were reported for near the bottom of Lake Almanor (LA1-B) between September and mid-October. Sulfide concentrations at this station increased rapidly from less than 0.0017 mg/l in August to 0.504 mg/l in September and then declined to 0.221 mg/l on October 10. Measured sulfide concentrations exceeded 0.005 mg/l at two of the other stations monitored during 2001. At the mineral spring located adjacent to the Canyon dam release structure (MS), sulfide concentrations of 0.0102, 0.0081, and 0.0059 were reported for July 10, August 8, and October 10, respectively. At the Canyon dam release into the NFFR (NF2), a sulfide concentration of 0.0086 mg/l was reported for October 10.

MTBE

MTBE, an additive to gasoline, which makes it burn more efficiently, could enter the project's reservoirs as a result of power boating. On August 17, 2000, PG&E collected near-surface and near-bottom waters of Lake Almanor and Butt Valley reservoir (LA1-S, LA1-B, BV2-S, and BV2-B) for MTBE analysis. Each of the four samples collected had a non-detectable MTBE level at a method detection limit of 0.005 mg/l. These limited data do not suggest any exceedances of the primary or secondary drinking water MCLs for MTBE.

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[14] Odors are measured by having individuals evaluate whether samples diluted with odor-free water have a perceptible odor, and are reported as the ratio of the greatest dilution sample with a definitely perceptible odor (e.g., a sample reported as 3 TON had a perceptible odor when diluted 2 odor-free water to 1 sample water).

Lake Almanor Shoreline Erosion

In 1957, PG&E executed a legal agreement, referred to as the Clifford Deed, with Edward A. Clifford and Josephine Clifford, landowners of property adjoining the project boundary at 4,500 feet (PG&E datum). The Clifford Deed grants PG&E the right to flood or erode lands owned or acquired by the Cliffords by wave action, seepage, or other actions of the water (Clifford et al., 1957) up to elevation 4,510.2 feet (PG&E datum). This agreement perpetuates with land sales, and PG&E reports that it is thereby effective on 733 of the approximate 1,000 residential lots adjoining the project boundary around Lake Almanor at an elevation of 4,500 feet (PG&E datum).

Under PG&E's existing shoreline management program, adjacent property owners can obtain permits for installing erosion control structures on PG&E lands below the 4,500-foot contour (PG&E datum). PG&E reports that 70 riprap permits have been issued to private parties under this program. In addition, PG&E has placed riprap on its lands adjoining 267 properties that are not under the Clifford Deed in order to prevent erosion from extending above an elevation of 4,500 feet.

Two years before increasing the normal maximum operating level of Lake Almanor to elevation 4,494 feet (PG&E datum) in 1976, Dames and Moore assessed the potential for shoreline erosion. PG&E reports that, because the original Dames and Moore report is no longer available, it used the 1975 Environmental Data Report as the source of information for the results from the study. The study concluded that the potential for erosion below elevation 4,490 feet (PG&E datum) was minimal because of low-gradient shoreline slopes. Above elevation 4,490 feet (PG&E datum), erosion was categorized by its severity and mapped. This study concluded that:

- 23 percent of the shoreline had significant erosion as determined by noticeable slope scars on the shoreline and sloughing of material into water;
- 55 percent of the shoreline had slight erosion determined by slight slope scars resulting from small wave cutting action; and
- 22 percent of the shoreline had no detectable erosion.

In 2000 (nearly 24 years after implementing the increased maximum lake level), PG&E again surveyed shoreline erosion. This survey included mapping shoreline erosion by boat with emphasis on the eastern lobe of Lake Almanor where the banks are steeper and potential for erosion is higher. Bank slopes were determined between elevation 4,490 and 4,494 feet (PG&E datum), and erosion was categorized using the same criteria as the 1974 Dames and Moore survey. Results of the 2000 survey indicate that substantial localized erosion occurs along the eastern shore of the eastern lobe and the western shore of the Almanor peninsula. Overall, approximately 4.2 miles (7 percent) of the 58-mile-long shoreline has noticeable slope scars.

3.3.1.2 Environmental Effects

Water Quantity

Reservoir Water Levels and Flows in the Bypassed Reaches

Although reservoir water level management, minimum flows in the bypassed reaches, block loading of the Belden powerhouse, winter pulse flows, summer recreational flows, and ramping rates associated with controlled releases are hydrological functions, their consequences primarily influence habitat for aquatic and riparian organisms and recreational resources. Therefore, we discuss these measures in sections 3.3.2, *Aquatic Resources*, 3.3.3, *Terrestrial Resources*, and 3.3.5, *Recreational Resources.*

Flow and Water Level Monitoring

In the final SA (PG&E, 2004), PG&E proposes to continue monitoring flows in the Seneca and Belden reaches at its NF-2 (USGS gage No. 11399500), and NF-70 (USGS No. 11401112) stream gages under the general supervision of the USGS, and to rehabilitate the NF-9 gage (Butt Creek near Caribou) to enable flow measurement in lower Butt Creek. PG&E would complete any necessary modifications to the NF-2 and NF-70 gages for the purpose of measuring the new minimum instream flow (MIF) within 3 years of license issuance. For compliance purposes, the final SA dictates that all daily mean flows should be at least as high as the monthly MIF, and the 15-minute streamflows at the compliance gages should be at least 90 percent of the applicable MIF. PG&E also would develop a stage vs. discharge rating curve for the NF-9 gage that would not be required to meet USGS standards, and would read the staff gage at this station on or about April 1, June 1, August 1, and October 1. In addition, PG&E would make daily midnight storage and water surface elevation (rounded to the nearest 100 acre-feet and 0.1 foot, respectively) of Lake Almanor available on the Internet within 7 to 10 days.

In its December 1, 2003, letter to the Commission, the FS recommends, as Items E and H of preliminary Section 4(e) condition 27, that PG&E operate and maintain the existing gages at NF-2, NF-70, and NF-9; and the FS recommends, as Item K of preliminary Section 4(e) condition 29, that PG&E make Lake Almanor water level and storage information available as described above for the final SA.

Our Analysis

The purpose of flow and water level monitoring in the context of this analysis is to allow the Commission to be able to verify compliance with flow and water surface elevation requirements that are included in a new license issued for a project. To verify compliance with MIF and specific water surface elevation requirements discussed in section 3.3.2, *Aquatic Resources*, it is necessary to monitor flows in the Seneca and

Belden reaches, as well as water surface elevations in Lake Almanor, Butt Valley reservoir, and Belden forebay.

PG&E gages NF-2 and NF-70 currently monitor flows in Seneca reach and Belden reach, respectively. PG&E also currently monitors water surface elevations in Lake Almanor (NF-1), Butt Valley reservoir (NF-8), and Belden forebay (NF-67). Continued operation of the above gages would allow evaluation of compliance with required MIF and water surface elevations.

As discussed in section 3.3.2, *Aquatic Resources,* PG&E is also required to ensure that it takes no action that would reduce inflow to lower Butt Creek. Although no measure proposed for this license explicitly alters flows below the Butt Valley dam, it is possible that the change in reservoir operations after relicensing may affect groundwater recharge and leakage, which would correspondingly affect inflows to lower Butt Creek. However, as shown in section 3.3.2, the elevation in Butt Valley reservoir is likely to be the same or higher than currently observed. Since increased reservoir elevation would cause an increase in the hydraulic pressure pushing leakage through dam facilities, and would also result in an increase to the groundwater available for inflow to lower Butt Creek through exfiltration from the reservoir, the flows in lower Butt Creek are likely to be unchanged or increase slightly due to operational changes required in this license.

As part of the licensing of PG&E's downstream Rock Creek-Cresta Project, the Commission included a requirement to develop a flow and water temperature monitoring plan in the recently issued (October 24, 2001) license order for that project. PG&E filed this plan with the Commission on October 23, 2002, and the Commission approved the plan on February 28, 2003. Under the approved plan, PG&E would monitor flow at 10 USGS gaging stations and 6 ungaged stations in the UNFFR Project area from June 1 through September 30 for 15 years, including gaging stations NF-2, NF-70, and NF-9. As part of the plan, gaging stations that historically have contributed greater than 10 percent of the flow in the main stem, including NF-9, are to be gaged with continuous stage recorders.

Although PG&E currently operates gaging sufficient to ensure compliance with MIF and water surface elevation requirements as discussed above, PG&E's coordination of the collection and reporting of this data would ensure that compliance is continually checked and confirmed, and the Commission can easily verify compliance as warranted.

Water Quality

Water Quality Monitoring Program

The final SA (PG&E, 2004) includes a multi-faceted WQMP that would provide data to evaluate a reasonable protection of beneficial uses of the project waters and identify project-related changes in water quality that may occur over time.

According to the final SA, within 3 months of issuance of a new license for the project, PG&E would develop monitoring plans that provide specific details, analytical methods, sampling protocols, and QA/QC procedures to be used in the initial monitoring studies for the five facets of the WQMP, in consultation with SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP. The WQMP would be adaptive and may be modified to more effectively focus on specific project-related water quality conditions identified in project waters, if agreed to by PG&E, SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP. PG&E would also develop, in consultation with these same parties, any future modification of the initial water quality monitoring plans. The initial water quality monitoring plans and any subsequent revisions would be filed with the Commission for approval.

PG&E would analyze the water quality data collected and prepare an annual water quality report containing elements consistent with reporting requirements from all of the plans under the WQMP, and provide the report to the Commission, SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP by no later than March 15 of the following year. If an adverse trend in water quality is determined to be a result of O&M of the project, PG&E would develop and implement measures to mitigate project-related effects on water quality. PG&E would convene a discussion group meeting between April 15 and 28 once annually at least 30 days following distribution of the annual water quality monitoring report.

As described in the final SA, the WQMP would include the following five components:

- *Canyon Dam Mitigation Measures Evaluation* – The objective of this sampling program is to evaluate the adequacy and efficacy of mitigating elevated odor and dissolved metal levels in the Seneca reach through seasonal gate switching at the Canyon dam intake. PG&E would: (1) conduct *in situ* monitoring of temperature, DO, pH, specific conductance, and turbidity throughout one vertical profile in Lake Almanor near the Canyon dam intake tower at 1-meter intervals during June, July, August, September, and October; (2) sample hydrogen sulfide, iron, manganese, and arsenic at the surface and bottom of Lake Almanor and at three locations in the Seneca reach during the September and October sampling events; and (3) collect a sediment sample from Lake Almanor near Canyon dam during the October sampling event and analyze it for hydrogen sulfide, sulfate,

iron, manganese, and arsenic. Sample timing would be coordinated with switching the release flow path from the lower gate to the upper gate at the Canyon dam intake tower. September sampling would be done prior to the gate switch, and October sampling would be done after the gate switch. Monitoring would begin in the first year after issuance of a new license for the project, and would be conducted in a minimum of 6 water years with various hydrologic conditions. After sampling has been conducted in 2 wet water years, 2 normal water years, and 2 dry/critically dry water years after issuance of a new license for the project, PG&E would make a determination of the effectiveness of the mitigation measure and need (if any) for additional monitoring or development and implementation of alternative measures in consultation with SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP.

- *Selected Water Quality Monitoring* – PG&E would conduct a special study to identify the cause of high dissolved cadmium and specific conductance levels in waters of the upper NFFR that were measured in 2002-2003. Monitoring would be conducted seasonally (spring, summer, and fall) at 20 specified locations within the upper basin, and would include analysis of dissolved cadmium, total hardness, temperature, DO, pH, specific conductance, and turbidity. At a minimum, this sampling program would be conducted in years 1 and 2 after issuance of a new license.
- *Lake Almanor Water Quality Monitoring Program* – The objectives of this monitoring program are to monitor long-term water quality trends in Lake Almanor; and determine if the water quality protects the designated beneficial uses for Lake Almanor and meets water quality objectives outlined in the Basin Plan (CVRWQCB, 1998), California Toxics Rule criteria (EPA, 2000), and National Recommended Ambient Water Quality criteria (EPA, 2002). PG&E would monitor the water quality of Lake Almanor at three representative locations: (1) in the channel near the Canyon dam intake structure, (2) in the western lobe, and (3) in the eastern lobe. Sampling would include:
    1. monitoring in situ parameters (including temperature, DO, pH, specific conductance and turbidity), at 1-meter intervals;
    2. measuring Secchi depths; and
    3. collecting and analyzing surface and near-bottom samples for general analytes (hardness, sulfate, total alkalinity, and total suspended solids), minerals (calcium, chloride, magnesium, potassium, and sodium), metals (total concentrations[15] of aluminum, arsenic, cadmium, copper, iron, manganese, mercury, nickel, silver, and zinc), nutrients (nitrate+nitrite, total ammonia, orthophosphate, total phosphorous, total organic nitrogen,

[15] Dissolved concentrations would be calculated for cadmium, copper, nickel, silver, and zinc as outlined in EPA (1996a).

total Kjeldahl nitrogen, total organic carbon, and chlorophyll-*a*), and petroleum products (MTBE, TPHG,[16] and BTEX[17]).

PG&E would monitor once per season (spring, summer, and fall) every 5 years beginning in year 3 after issuance of a new license, and continue for the term of the new license. During the new license term, monitoring and reporting requirements may be modified to more appropriately monitor for changes in project operations, regulatory mandates, or focus study needs, or terminated if agreed to by PG&E, SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP. A modification that could be implemented is increasing the sampling frequency for specific parameters to once every 3 years if results exhibit a substantial increasing trend over time or if a parameter that has historically had low levels approaches or exceeds applicable federal or state water quality standards.

- *Fish Tissue Bioaccumulation Screening* – PG&E would monitor the potential bioaccumulation of silver, total mercury, and PCBs in tissue samples collected from resident catchable-sized (minimum total length of 8 inches) fish in waters of the project. The sampling strategy would be consistent with the field methods developed in the relicensing process in coordination with SWRCB's Toxic Substances Monitoring Program (table 3-11). Sampling would target fish with a total length of at least 10 to 12 inches. Silver and mercury analyses would be conducted for fish collected from Lake Almanor, Butt Valley reservoir, and the Belden forebay; and PCB analyses would be conducted for fish collected from Belden forebay. Fish tissue bioaccumulation screening samples would be collected once every 5 years beginning with the first year after issuance of a new license, and continue through the term of the new license. During the term of the license, monitoring and reporting requirements may be reduced or terminated after it is demonstrated to the satisfaction of SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP that the given requirement is no longer necessary.

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[16] Total petroleum hydrocarbons as gasoline.

[17] Benzene, toluene, ethlybenzene, and xylenes sampled only at the surface.

Table 3-11. Fish tissue bioaccumulation screening-sampling protocols. (Source: PG&E, 2004)

Sample Species	Analysis	Sample Description	Alternative Sample Description[a]
Lake Almanor			
Smallmouth bass	Silver and mercury	18 individuals	---
Brown trout[b]	Silver and mercury	9 individuals	---
Brown bullhead	Silver and mercury	2 composites of 3 individuals[c]	---
Butt Valley reservoir			
Smallmouth bass	Silver and mercury	9 individuals	---
Brown trout	Silver and mercury	6 individuals	---
Rainbow trout	Silver and mercury	6 individuals	---
Belden forebay			
Smallmouth bass	Silver, mercury, and PCB	6 individuals	3 composites of 3 individuals[c]
Rainbow trout	Silver, mercury, and PCB	6 individuals	3 composites of 3 individuals[c]
Sacramento sucker	Silver, mercury, and PCB	2 composites of 3 individuals[c]	2 composites of 3 individuals[c]

[a] This sample set may be prepared and analyzed rather than the one listed in the column to the left.

[b] Sacramento pikeminnow may be substituted, if brown trout can not be reasonably obtained.

[c] The total length of all individuals included in each composite sample must fall within a 25 percent range of one another.

- *Bacteriological Sampling* – PG&E would conduct bacteriological monitoring consistent with the Basin Plan objectives for protection of the water contact recreation beneficial uses at 10 locations in the project boundaries. Sampling would include five annually rotating stations (stations would be selected on an annual basis and may differ by year) at PG&E-owned or managed recreation sites around Lake Almanor, three rotating stations at PG&E-owned or -managed recreation sites around Butt Valley reservoir, and two stations at recreation sites on the upper NFFR. PG&E would select sampling locations by April 30 for each upcoming field season by consulting SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP. Five samples would be collected at each of the 10 selected sampling locations during the 30-day period that spans either the Independence Day holiday or the Labor Day holiday. Bacteriological monitoring would be conducted annually for the first 5 years after license issuance and once every other year for the remaining

term of the new license. This monitoring program may be modified or terminated if agreed to by PG&E, SWRCB, CVRWQCB, Plumas County, FS, CDFG, FWS, and other parties who request involvement in the WQMP.

In its December 1, 2003, filing with the Commission, the FS makes a preliminary Section 10(a) recommendation for PG&E to develop and implement plans to monitor water quality that is consistent with PG&E's proposal.

In its comments on Scoping Document 1 letter filed with the Commission on July 7, 2003, Plumas County recommends that PG&E be required to augment the water quality monitoring plan if it is insufficient to ensure that water quality problems would be detected.

Our Analysis

We agree with the need to document that water quality conditions under any new license issued meet applicable federal and state water quality standards and meet the objectives of applicable management plans. These standards are set to protect the designated beneficial uses of surface waters. Any new license issued for the project is expected to include measures that would alter water quality in project impoundments and stream reaches. Although PG&E conducted studies to evaluate the effects that implementing various measures would have on water quality, it has not determined with reasonable certainty the effects of some measures. For instance, its test of using the upper-level Canyon dam intake gates during the fall was done under lower than normal Lake Almanor water levels, which may have resulted in substantially different results than would occur under a higher reservoir level.

Our review of available water quality information (section 3.3.1.1, *Water Quality*) indicates that project waters typically comply with the applicable federal and state standards for most water quality parameters. However, the available information indicates that the applicable criteria for water temperature and DO are frequently not satisfied in some areas, and it is questionable whether other water quality standards including some trace metals are typically satisfied throughout project waters. We discuss these in the following section.

Our review of temperature data reported by PG&E indicates that daily mean water temperatures of greater than 20°C generally occur more than 20 percent of the time from June through September throughout the Belden reach; in near-surface waters of Lake Almanor and Butt Valley reservoir; and in discharges from the Butt Valley, Caribou No. 1, Caribou No. 2, and Belden powerhouses (see table 3-7). PG&E is required under the terms of the Rock Creek-Cresta SA (PG&E, 2000a-SA) to evaluate and potentially modify the Prattville intake and implement other options for using the coldwater supply in Lake Almanor and Butt Valley reservoir to attain cooler temperatures in the NFFR downstream of the Caribou developments. Implementation of these measures for the Rock Creek-Cresta Project along with altering operations of this project under any new license could substantially alter the thermal regimes of Lake

Almanor, Butt Valley reservoir, and the NFFR downstream of the Caribou developments. We evaluate the effects of these measures below in our discussion of *Water Temperature and Dissolved Oxygen Management.*

DO concentrations of less than 7.0 mg/l are common near the bottom of Lake Almanor, Butt Valley reservoir, and Belden forebay; and occur occasionally in the surface waters of Lake Almanor and Butt Valley reservoir along with the Butt Valley, Caribou No. 1, Caribou No. 2, and Belden powerhouse tailraces (see table 3-8). Data collected by PG&E in 2000 indicate DO levels generally satisfy the applicable standard in the Seneca, Belden, and lower Butt Creek bypassed reaches. Implementation of various options to use coldwater supply from Lake Almanor and/or Butt Valley reservoir could have marked effects on the limnology including DO concentrations of these reservoirs. In addition, DO levels could be altered in Lake Almanor and the Seneca reach if the Commission adopts PG&E's proposal to shift its typical use of the lower gate at the Canyon dam intake tower to the upper gate from September 15 to at least November 1. We address the effects of modifying the Prattville intake and other temperature control options being considered below in our discussion of *Water Temperature and Dissolved Oxygen Management*, and discuss the need for monitoring effects of switching the Canyon dam intake tower gate used and implementation of coldwater supply options in our discussion of *Odors and Metals in the Seneca Reach.*

During relicensing studies for this project, PG&E conducted evaluations of the concentration of metals in water; however, not all of these studies analyzed the dissolved metal fraction, where appropriate, or had method detection limits sufficient to verify compliance with applicable criteria. PG&E modified its monitoring protocol for trace metals to address these concerns; however, as of the preparation of this draft EIS, it had not filed the complete results of the 2002 and 2003 sampling program with the Commission. The FS (letter from J. Gipsman, Attorney for the National Forest Service, Pacific Region, USDA Office of the General Counsel, San Francisco, CA, to M.R. Salas, FERC, Washington, DC, dated December 1, 2003) states that PG&E's 2002 to 2003 measurements of dissolved cadmium exceeded the respective criteria at the NFFR near Chester (NF1), Lake Almanor near Canyon dam surface (LA1-S), and Butt Valley powerhouse tailrace (BV1); and that measurements of specific conductance exceeded the Basin Plan criterion of 150 µS/cm at several stations in the NFFR. Data obtained during implementation of a monitoring program consistent with the selected water quality monitoring described in the final SA would provide information on both spatial and seasonal differences in these parameters. We anticipate that seasonal monitoring for a period of 1 to 3 years along with the results of PG&E's 2002 and 2003 studies, should be sufficient to determine the extent and cause(s) of elevated dissolved cadmium and specific conductance levels and identify potential measures to remedy the situation, if the cause(s) is due to the project. We note that implementation of this monitoring program along with the 2002 and 2003 data could provide sufficient information to determine the cause(s) and potential remedies in less than 3 years; review of the results of the study annually by PG&E and the appropriate agencies could determine if the

cause(s) and potential remedies, if necessary, and determine if monitoring should be reduced or terminated.

Lake Almanor's limnology could be highly influenced by operational changes incorporated into a new license for this project, as well as the potential modification of the Prattville intake agreed to under the Rock Creek-Cresta SA. We conclude that it would be appropriate to monitor water quality conditions in Lake Almanor for the first wet, normal, and dry/critically dry year of any new license period to assess the effects of changing project operations under any new license for this project. In this manner, the effects of the new operations could be readily evaluated and corrective actions, if necessary, could be made within a few years of implementing the new license terms.

We concur with the final SA that monitoring in situ parameters; measuring Secchi depths; and analyzing general analytes, minerals, metals, nutrients, and petroleum products seasonally at the three indicated locations would be appropriate to document conditions in the reservoir. Data collected could be used to determine compliance with applicable federal and state water quality standards for trace metals and other water quality parameters. Implementing the schedules for monitoring Lake Almanor once every 5 years for the term of any new license would unnecessarily prolong determination of any adverse effects that may occur and could delay implementation of corrective actions, if necessary. Interannual variability in meteorological, hydrological, and limnological conditions would limit the value of data collected every fifth year, and would reduce the usefulness of using the data to determine long-term trends in limnologic conditions. We acknowledge that modifying the Prattville intake also could substantially affect Lake Almanor's limnology. However, it is not currently clear if, when, or how the modification would be implemented, and until it is we cannot evaluate its effects.

Natural, project-related, and other human-related activities lead to the concentration of metals in the sediments of Lake Almanor, some of which are subsequently mineralized and dissolve into water when DO levels are low at the water/substrate interface. The anoxic conditions and generally neutral pH near the bottom of Lake Almanor, along with the long hydraulic residence time (average of about 290 days), result in methylation of mercury and a buildup of mercury in the reservoir's deep water. Methylmercury levels may increase substantially upon fall turnover of the reservoir, be drafted through the Prattville intake and discharged into the Butt Valley reservoir, and then on to the Belden forebay and the Belden reach. PG&E's cloud seeding operations, which vaporize a silver iodide/acetone solution, increase the potential for elevating silver concentrations in precipitation and surface waters. The results of PG&E's 2001 study do not enable determination of whether silver concentrations in water exceed applicable criteria; however, the LACSP does increase the potential for silver to be introduced to Lake Almanor and consequently other project water bodies. Concentrations of PCBs in water and biota in the project area are largely a result of the 1984 Caribou landslide.

Trace metals and PCBs can bioaccumulate and present a hazard to the health of both biota and humans. To evaluate bioaccumulation, PG&E sampled silver, mercury, and PCB levels in various fish species and crayfish. The results of PG&E's 2001 study, which evaluated levels in whole organisms, are summarized in table 3-10. These results indicate that some silver, mercury, and PCBs are accumulating in fish and crayfish tissues. We conclude that biomagnification (higher concentrations of contaminants in successive levels of the food chain) of methylmercury and PCB could lead to elevated concentrations of these contaminants in these organisms' predators, including birds of prey and humans. However, biomagnification of silver is unlikely (Howe and Dobson, 2002).

After reviewing the results of the 2001 bioaccumulation study, SWRCB and CDFG became concerned that the concentrations reported could represent a risk to human health, and requested that PG&E evaluate that risk through further sampling. Subsequently PG&E sampled fish fillets for these contaminants in 2002 and 2003. At the scoping meeting on May 21, 2003, PG&E staff informed us that the fish tissue samples collected in 2002 had been provided to CDFG laboratory in Rancho Cordova, and the results had not yet been provided to PG&E (Ace-Federal Reporters, 2003). PG&E planned to provide the 2003 fish tissue samples to the same laboratory in June 2003. As of the preparation of this draft EIS, results of PG&E's 2002 and 2003 fish tissue studies had not yet been provided to the Commission. Without these or similar data we cannot determine the level of risk that bioaccumulation of mercury or PCBs in fish may present to human health and the health of other predators, including bald eagles.

Implementation of the fish tissue bioaccumulation screening identified in the final SA would provide information on the levels of mercury, PCBs, and silver in fishes in project impoundments. We question the value of analyzing fish samples for silver, however; since silver does not typically biomagnify and we are not aware of an established action or screening level that represents the risk to human health. We conclude that it would be appropriate to monitor for bioaccumulation of mercury and PCBs by sampling and analyzing fishes in a standardized fashion at intervals of 5 years for the term of any new license. We anticipate that conducting these studies would provide adequate information to document changes in body burdens of these contaminants that may occur over the term of a new license and to assess risk to human health.

The results of historical monitoring conducted by CDWR and Henrici along with PG&E's screening-level and Basin-Plan-level investigations of fecal coliform densities suggest that fecal coliform standards set in the Basin Plan are generally satisfied in project waters. However, maintaining Lake Almanor at a higher level as PG&E proposes or project or non-project sources may result in increased contamination of Lake Almanor waters and could result in exceedance of the criteria for water contact recreation. Results of monitoring fecal coliform levels using a method that is consistent with the Basin Plan criterion and targets high recreational use periods such as the

Independence Day or Labor Day holidays would ensure that project waters comply with the standard.

We concur with CDFG and the FS that it would be appropriate to select sampling stations prior to each season of monitoring based on the presence of water contact recreation and sources of potential introduction of pathogens to the water column in the immediate area. However, we conclude that by monitoring coliform levels for the first 3 years following implementation of any new license PG&E would sufficiently document coliform levels and identify non-compliance with the standard, should it occur. As recreational use of the area increases and additional recreational facilities are developed and used there could be increased contamination of surface waters. The recreation management plan discussed in section 3.3.5, *Recreational Resources*, would address appropriate actions to minimize contamination from new recreational developments and any monitoring of the effects of these developments on water quality.

Water Temperature and Dissolved Oxygen Management

Daily mean water temperatures in the Belden reach frequently exceed 20°C during June through September (see table 3-7), and as such, become suboptimal for trout. In addition, the daily mean temperature of water discharged from the Belden powerhouse frequently exceeds 20°C during July through September. As water flows downstream, temperatures tend to further increase. In years when Lake Almanor summer water surface levels are substantially below full pool, water temperatures in the Rock Creek and Cresta reaches can exceed 20°C by as much as 1 to 3°C (PG&E, 2000b, as cited in FERC and Plumas National Forest, 2001; PG&E, 2003b).

As part of the SA for the Rock Creek-Cresta Project, PG&E agreed to conduct a modeling study to predict the effectiveness of modifying the Prattville intake to maintain daily mean water temperatures of 20°C or less in the Rock Creek and Cresta reaches and implement all reasonable practicable control measures (PG&E, 2000a). PG&E is currently conducting these feasibility studies, including modeling the water temperature effects of potential Prattville intake modifications, re-operation of the Canyon dam intake gates, and modification of Caribou No. 2 intake. Results of ongoing water temperature modeling are expected to be available in 2004. The new license for the Rock Creek-Cresta Project, and the approved SA, limit PG&E's financial responsibility for water temperature measures (other than monitoring and forgone power generation) to approximately $7,000,000.

The final SA for the UNFFR Project does not include any measures that specifically address water temperature.

In its December 1, 2003, filing with the Commission, the FS recommends, as preliminary Section 4(e) condition 32, that PG&E prepare a water temperature management plan, along with a schedule for implementation, in consultation with the FS, CDFG, and SWRCB within 90 days of license issuance. Following approval of the

water temperature management plan, it would be filed with the Commission. The water temperature management plan would include:

- A feasibility, cost, and effectiveness analysis of the following project modifications (at a minimum) that could be adopted to meet the stream temperature objective desired by SWRCB:
  - Selective temperature withdrawal from Lake Almanor through a modified Prattville intake structure with optimization in operation.
  - Modification of facilities associated with the configuration of Butt Valley reservoir, including any potential device to minimize mixing of inflow to the reservoir, and selective withdrawal through a modified Caribou No. 2 intake structure in combination with the Caribou No. 1 intake.
  - Seasonal re-operation of the Canyon dam intake tower to draw water through the low-level intake only during the summer months.
  - Proper timing of use of a Prattville intake modification device to help conserve the cold water.
  - Operation of the "fence" concept to draft near-surface water from Lake Almanor and conserve cold water in the reservoir during summer months when water temperatures in the Rock Creek and Cresta reaches satisfy the 20°C criteria.
  - Alternative combinations of these potential measures.

- A water temperature monitoring plan that is coordinated with the Rock Creek-Cresta Project water temperature monitoring plan and that specifies sampling locations, frequency, duration and methodology to measure stream temperature in project reaches. PG&E would maintain best available technology for predicting water temperature and DO concentrations in parallel to the monitoring program.
- A plan of additional reasonable control measures to be adopted as a substitute for potential measures listed above.

In its December 1, 2003, filing with the Commission, Interior makes a Section 10(j) recommendation that PG&E develop a water temperature management plan, fund and construct a modified Prattville intake, and fund other structure(s) to satisfy appropriate water temperature criteria beyond that provided by the Coldwater Habitat and Fishery Mitigation and Enhancement Fund under the relicensing SA for the Rock Creek-Cresta Project. Interior recommends that it be included among the consulted entities during plan development and that the plan be developed within 6 months of license issuance. In addition, Interior specifies that PG&E should develop appropriate additional temperature criteria by season, reach, and outlet location to avoid unintended adverse effects of sublethal temperature stress on aquatic biota as a result of structures or operations that involve planned surface water release discharge. These criteria would

be included in the water temperature management plan. The plan would include a schedule for construction of structure(s) demonstrated to reasonably meet temperature targets. PG&E would complete construction within 5 years of license issuance.

Our Analysis

The water temperature modeling results provided to the Commission by PG&E assume constant instream flow releases for each of the project's bypassed reaches (PG&E, 2002a, c). We do not consider these model results to be adequate to evaluate conditions proposed in the final SA, since proposed MIFs would vary considerably for the model period (March 1 to September 30). Therefore, we conclude that modeling additional scenarios, including incorporation of the proposed and recommended flow regimes would provide the information needed to assess the effects that implementing the potential control measures identified in the Rock Creek-Cresta SA and the Interior and FS filings with the Commission dated December 1, 2003, would have on the thermal regime of Lake Almanor, Butt Valley reservoir, and the NFFR.

Drafting deeper water from Lake Almanor via a modified Prattville intake, providing substantially higher flows to the Seneca reach, and using the upper-level gates instead of the lower-level gates at the Canyon dam intake tower would alter hydrodynamics within Lake Almanor and could substantially alter DO levels within Lake Almanor. Consequently, discharges from the Butt Valley powerhouse would be modified, which could affect DO levels within Butt Valley reservoir and the NFFR downstream of the Caribou powerhouses. Development and use of a model to predict these effects would be beneficial to management of Lake Almanor and the receiving waterbodies. However, it would be more efficient to monitor DO after implementation of any new coldwater supply measures for the Rock Creek-Cresta Project. Monitoring of DO at that time would confirm compliance with state water quality standards for DO.

We conclude that modifying the Prattville intake and/or other options for supplying cooler water to the Belden, Rock Creek, and Cresta reaches could substantially reduce water temperatures in the NFFR and thereby enhance the coldwater fishery. However, available information is not sufficient to determine the effects that modifying the Prattville intake in conjunction with PG&E proposed and agency recommended water level and flow regime restrictions for the project would have on the thermal regime of Lake Almanor, Butt Valley reservoir, and the NFFR. Furthermore, altered operations (particularly with a modified Prattville intake) would change the hydrodynamics of Lake Almanor and consequently alter DO profiles in the reservoir.

The combination of alteration of the thermal and DO conditions in Lake Almanor could substantially shift the ability of the reservoir to support its existing coldwater and warmwater fisheries. Using the coldwater supply in Lake Almanor and/or shifting operations of the Caribou developments could also affect the thermal regime and DO levels in Butt Valley reservoir and could adversely affect the existing trophy rainbow

and brown trout fishery of the reservoir. We agree with the FS and Interior that additional temperature and DO modeling is needed prior to implementing any structural modifications. PG&E is currently conducting this modeling effort as part of the Rock Creek-Cresta Project settlement.

Modification and implementation of the Prattville intake and/or implementation of other water temperature control measures is expected to substantially alter the thermal and DO regimes of Lake Almanor, Butt Valley reservoir, and the NFFR. By continuing to implement its water temperature monitoring plan for the Rock Creek-Cresta Project, PG&E would continuously monitor summer water temperatures at 25 stations within the UNFFR Project area, and monitor summer vertical profiles in Lake Almanor and Butt Valley reservoir. We conclude that continued implementation of the water temperature monitoring plan (PG&E, 2002b) would provide a thorough assessment of the thermal conditions in project-affected reaches; therefore, we conclude that there is currently no justification for requiring PG&E to monitor water temperatures at additional stations. However, we note that the Rock Creek-Cresta water temperature monitoring plan does not address monitoring DO concentrations in project-affected waters. We conclude that monitoring DO concentrations in Lake Almanor, Butt Valley reservoir, and portions of the NFFR would allow documentation of conditions resulting from modifying the Prattville intake and implementing other control measures to attain daily mean water temperatures of 20°C or less in NFFR reaches.

Odors and Metals in the Seneca Reach

PG&E typically uses the Canyon dam outlet tower low-level gates to supply the Seneca reach with cool water; however, these operations have resulted in elevated odors and trace metal concentrations in the NFFR downstream of Canyon dam, particularly in the fall prior to turnover of Lake Almanor.

PG&E proposes to switch Canyon dam releases from the low-level gate to the upper-level gate on September 15, and continue using the upper-level gate until at least November 1. On or after November 1, PG&E would switch releases back to the low-level gate. PG&E also proposes, in its final SA, to increase the MIF in the Seneca reach from 35 cfs year-round to flows ranging from 60 to 150 cfs, depending on month and hydrologic water year type. Under the terms of the final SA, the MIF would be increased to 60 cfs during September, October, and November of all water year types.

The final SA (PG&E, 2004) includes a multifaceted WQMP that includes a Canyon dam mitigation measures evaluation. This measure would examine the adequacy and efficacy of using the upper-level gates to alleviate the strong odors and elevated trace metal concentrations in the upper end of the Seneca reach. The Canyon dam mitigation measures evaluation would include a sampling program focused on odors and trace metals in waters of Lake Almanor and the Seneca reach during June to October for a minimum of 6 years following issuance of a new license. For a full

discussion of the recommended Canyon dam mitigation measures evaluation, refer to our discussion of the WQMP above.

Our Analysis

Trace metal and sulfide concentrations in reservoirs such as Lake Almanor can be affected by stagnation of water in the hypolimnion for long periods of time. In large reservoirs such as Lake Almanor, near-bottom DO levels typically become progressively reduced during the summer to early fall (Wetzel, 1975), and PG&E's water quality measurements confirm that this condition occurs in Lake Almanor (see our discussion of DO in section 3.3.1.1). During 2001, anoxic (DO of <0.5 mg/l) conditions occurred near the bottom of Lake Almanor at the Canyon dam intake from early August through mid-October. Fall turnover increased the near-bottom DO concentration to 4.8 mg/l by mid-November.

Low DO concentrations at the water/sediment interface allow reductive chemical processes to occur. Iron and manganese are converted into soluble forms and released from the sediments under anoxic conditions with pH levels of 7.5 units or less (Wetzel, 1975). In addition, these conditions lead to sulfate being reduced to sulfide, which can lead to offensive odors from the release of hydrogen sulfide to the atmosphere (Wetzel, 1975).

From mid-summer through early November 2001, PG&E conducted a study to evaluate the timing of the onset of odor problems and to determine the effects of changing operations from the typical condition of providing a 35-cfs MIF via the low-level gate to using the upper-level gates and increasing the flow release. Results of this study showed that concentrations of sulfide, dissolved iron, and dissolved manganese were elevated near the bottom of Lake Almanor at the Canyon dam intake during September and October (table 3-12). The highest measured sulfide concentration (0.504 mg/l) occurred on September 11, and October measurements were all at or above 0.186 mg/l. Dissolved iron concentrations measured in September and October ranged from 1.99 to 4.02 mg/l, with the highest level measured on October 10. Dissolved manganese concentrations measured in September and October ranged from 0.841 to 1.98 mg/l, with the highest level being recorded on October 18.

Table 3-12. Sulfide and dissolved iron and manganese concentrations in Lake Almanor and the Seneca reach, August to November, 2001. (Source: PG&E, 2002a, as modified by staff)

Location	August 8 35 cfs release via lower gate	September 11 35 cfs release via lower gate	October 10 35 cfs release via lower gate	October 17 35 cfs release via upper gate	October 18 200 cfs release via upper gate	November 14 35 cfs release via lower gate
			Sulfide (mg/l)			
LA1-S	<0.0017	0.0033	0.0018	0.0023	<0.0017	0.0017
LA1-B	<0.0017	0.504	0.221	0.265	0.186	0.0031
NF2	<0.0017	<0.0017	0.0086	0.0017	<0.0017	<0.0017
NF2A	<0.0017	<0.0017	0.0034	0.0020	<0.0017	<0.0017
SF	<0.0017	<0.0017	0.0015	0.0017	<0.0017	<0.0017
NF3	<0.0017	<0.0017	0.0007	<0.0017	<0.0017	<0.0017
NF4	0.0028	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
			Dissolved Iron (mg/l)			
LA1-S	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
LA1-B	<0.050	1.99	4.02	3.84	2.12	0.055
NF2	<0.050	0.122	0.273	<0.050	<0.050	0.068
NF2A	<0.050	0.157	0.198	<0.050	<0.050	0.057
SF	<0.050	0.140	0.105	<0.050	<0.050	<0.050
NF3	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
NF4	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
			Dissolved Manganese (mg/l)			
LA1-S	0.001	<0.001	0.004	0.002	0.004	0.006
LA1-B	0.184	0.841	1.160	1.610	1.980	0.008
NF2	0.036	0.755	0.524	0.007	0.008	0.016
NF2A	0.044	0.663	0.316	0.016	0.023	0.010
SF	0.005	0.057	0.073	0.002	0.014	0.003
NF3	0.003	0.002	0.002	0.002	0.012	0.002
NF4	0.005	0.002	0.003	0.003	0.009	0.004

Typical operation of the project includes using the low-level gates to supply the required 35 cfs to the NFFR downstream of Canyon dam. PG&E's evaluation of hydraulics in the vicinity of the Canyon dam intake indicates that, when 35 cfs is routed through the low-level gate, it draws water from a 9-foot-high band that extends above and below the gate's invert elevation of 4,467 feet (PG&E datum). PG&E concludes and we agree that during wet and normal years this results in drafting water from the hypolimnion; however, the drought conditions of 2001 led to lower than normal Lake Almanor water surface elevations and resulted in drafting water primarily from the metalimnion through the low-level gate. We conclude that conditions in Lake Almanor during 2001 led to drafting through the low-level gates of water with higher DO levels and lower concentrations of sulfide and dissolved iron and manganese than contained in normal-year hypolimnetic releases.

PG&E concludes and we agree that results of this study suggest that switching the intake gate of the 35-cfs release to the upper level gate, which is approximately 45 feet higher (invert elevation of 4,422 feet, PG&E datum), decreases sulfide, dissolved iron, and dissolved manganese concentrations at the Canyon dam release outlet, station NF2 (see October 10 and 17 in table 3-12). We conclude that there was little additional benefit associated with increasing the flow release from 35 cfs to 200 cfs on October 18; however, this may be partially due to concentrations of sulfide and dissolved iron decreasing in Lake Almanor's metalimnion and hypolimnion prior to the 200-cfs release.

PG&E reported that hydrogen sulfide odors were noticeable from the road above Canyon dam in October 2000. During 2001, hydrogen sulfide odors were present downslope of Canyon dam, although they were not as strong as during 2000. An odor of 4 TON occurred at the Canyon dam release to the NFFR on October 10, 2001. Shifting to the upper-level gate on October 17 coincided with a decrease in odor to less than 2 TON, which continued through the period of the 200-cfs release via the upper-level gate.

PG&E concludes and we agree that results of this study suggest that levels of odor, sulfide, dissolved iron, and dissolved manganese are reduced by using the upper-level gate of the Canyon dam intake tower in the fall. However, the lower than normal Lake Almanor water levels during the 2001 study period altered water quality in the reservoir and, consequently, conditions of water drafted from the reservoir. In addition, the upper level gate was only used for 2 days during the 2001 study, and prolonged usage of the gate could have a much larger effect on water quality in the hypolimnion of Lake Almanor. Therefore, we conclude that the 2001 study does not adequately demonstrate the effects that prolonged usage of the upper-level gate would have on water quality in Lake Almanor and the Seneca reach. We further conclude that conducting a study such as the Canyon dam mitigation measures evaluation that is recommended in the final SA would document the effects of prolonged usage of the

upper-level gate during wet, normal, and dry years; and could provide information to adaptively manage the gate usage.

Erosion

Lake Almanor Shoreline Erosion

Wind-generated waves and wakes from boats on Lake Almanor erode banks and may result in local degradation of water quality from turbidity and sedimentation, and endanger cultural (known and unknown), recreational, and other sites along the shoreline of the reservoir. Recreationists who drive off-road vehicles along the shoreline of Lake Almanor also contribute to ongoing localized erosion in some areas.

PG&E (2002c) developed a draft SMP for Lake Almanor, which includes an erosion control plan as one of its components. The goals of this erosion control plan are to identify and provide information on where erosion is taking place, identify where PG&E has the legal right to erode the shoreline, to guide PG&E on when and where it should implement erosion control measures, and provide information on how adjacent property owners can undertake erosion control measures on PG&E lands, while at the same time preserving and sustaining the natural environmental qualities of the reservoir.

Plumas County expresses its expectation that PG&E will amend its draft SMP to address inconsistencies of the plan with land use designations within the project boundary. The county also comments that it would like results of PG&E's investigation of a few moderate to severe erosion sites, identified by the county in a June 13, 2003, meeting with PG&E, to be incorporated into the SMP.

In its draft SMP, PG&E commits to conducting annual surveys to evaluate shoreline erosion around Lake Almanor. PG&E also plans to continue issuing cost-free permits to adjacent landowners who desire to implement erosion control work on PG&E property. In addition, PG&E plans to implement erosion control measures, as necessary, to limit erosion associated with cultural resource sites, threatened or endangered species sites, PG&E-owned facilities or sites of high value such as developed recreation sites. These measures may include riprap revetments, hardening of trails, or construction of stairways to keep recreationists off fragile slopes in popular dispersed recreation areas.

In addition, PG&E proposes to inform the recreating public of vehicular access restrictions, federal laws regarding the protection of cultural resources, and potential penalties for violation. PG&E also proposes increased monitoring and/or patrolling during periods of reservoir drawdown in fall and winter.

In its final SA, PG&E indicated that agreement has not been reached with Plumas County on shoreline erosion. In the final SA, which provides limited guidance for shoreline erosion, PG&E commits to:

- provide erosion control measures to protect the Lake Almanor shoreline from wind-caused wave action at the Westwood Beach and Stumpy Beach day-use areas;

- close and rehabilitate user-created vehicular and off-road vehicle (ORV) access routes along Lake Almanor's southwestern shoreline, in consultation with the FS; and

- determine the need to update the SMP based on discussions with the FS, Plumas County, and other interested parties at annual land use meetings and meetings held once every 10 years, at a minimum, specifically for that purpose.

In its July 7, 2003 comments on Scoping Document 1, Plumas County recommends that PG&E be responsible for controlling any shoreline erosion caused by project operations that adversely affect water quality, aquatic resources, cultural resources, recreation, or aesthetics. It also recommends that, at a minimum, PG&E develop in consultation with Plumas County and resource agencies, a comprehensive site-specific erosion protection plan for shoreline areas with significant erosion.

Our Analysis

Shoreline erosion is noticeable along portions of the perimeter of Lake Almanor, as it is on many reservoirs. PG&E's shoreline erosion survey conducted in 2000 indicates that about 7 percent of the reservoir's shoreline has substantial erosion, as identified by slope scars on the shoreline and sloughing of material into water. This survey also indicated that erosion is generally most extensive along the southeastern shoreline near Canyon dam and the western shoreline of the Almanor peninsula. Since Lake Almanor's normal maximum water level is at elevation 4,494 feet (PG&E datum) and much of the shoreline is gently sloped, erosion above the 4,500-foot contour (PG&E datum) project boundary is relatively uncommon. However, wind and wave action has eroded steep bank areas to near the 4,500-foot contour in a few locations, which has raised concerns regarding the potential for contamination of Lake Almanor from nearby septic leach fields.

In June 2003, Plumas County informed PG&E of some locations that it viewed as having moderate to severe erosion which were not included in PG&E's draft SMP. Plumas County also noted that the draft SMP is inconsistent with county land use designations in some areas. We conclude that PG&E could improve the draft SMP by revising it to include the erosion sites identified by the county in June 2003 and making it consistent with current county land use designations.

We conclude that implementation of the erosion control measures proposed by PG&E would reduce erosion, particularly in areas where erosion could result in loss of cultural resources, threatened and endangered species, and project facilities including developed recreation sites; however, localized shoreline erosion could continue to occur particularly on properties not owned by PG&E that are along the 4,500-foot contour (PG&E datum). Should Plumas County adopt an ordinance that limits the use of motorized vehicles at elevations of less than 4,500 feet (PG&E datum), informing the recreating public of these regulations and enforcing them would reduce localized erosion associated with these uses.

Monitoring shoreline erosion annually as proposed by PG&E would document changes in erosion around the reservoir. It would also be beneficial for PG&E to implement a plan developed in consultation with SWRCB, CVRWQCB, CDFG, the FS, Plumas County, and the Maidu community to evaluate any adverse effects of shoreline erosion on water quality, aquatic resources, cultural resources, recreation, and aesthetics on a regular basis. The results of the annual shoreline erosion surveys and evaluation of shoreline erosion on other resources would facilitate identification of the need for further erosion control measures in the future.

Erosion of Upland Areas

PG&E's ground-disturbing activities, and its use and management of a roadway system that is necessary to maintain and operate the project, may result in erosion and subsequent degradation of water quality. In addition, as part of the cleanup of the 1984 Caribou landslide, PG&E created a spoil pile containing PCB-laden materials at a location referred to as the Oak Flat spoil pile.

In 1998, PG&E and the Plumas National Forest (1998) entered into a road maintenance agreement. This agreement applies to all roads where PG&E and the FS have joint use of Plumas NFS roads. The intent of the agreement is to ensure maintenance of the roads in a condition that provides for their intended use, prevent and correct erosion to the roads and adjacent lands, and ensure safe and efficient use of the roads. The agreement states that PG&E and the FS shall meet annually to develop an annual maintenance plan that addresses all anticipated road maintenance work needed on the roads covered by the road maintenance agreement.

The final SA provides limited guidance for controlling erosion of upland areas. As a component of the recreation facility development program, the final SA would require PG&E to implement erosion control measures on the slope between the parking lot and the upper picnic area at the Belden rest stop (SR 70) and for construction of a trail down to the Lake Almanor shoreline at the East Shore group camp area. PG&E also would revegetate or harden areas with substantial erosion caused by pedestrian or vehicle traffic at Rocky Point campground and day use area. The final SA also would require PG&E to re-grade the Oak Flat spoil piles along Caribou Road to create a more

natural rolling topography along the roadside, and establish native plantings where possible between the road and the spoil piles. Additionally, PG&E would stabilize and revegetate all native material that is left on NFS lands following ground-disturbing activities.

In its December 1, 2003, filing with the Commission, the FS recommends, as preliminary Section 4(e) conditions 22, 24, 50, three measures to control erosion of upland areas. These measures recommend that PG&E:

- Take appropriate measures to rehabilitate existing erosion damage and minimize further erosion of the non-public project access roads on the NFS lands.
- Develop a plan for the control of erosion, stream sedimentation, dust, and soil mass movement for any new ground-disturbing construction or non-routine maintenance not addressed in an existing plan that may affect NFS lands. Following approval of the plan by the FS, PG&E would file the FS-approved plan with the Commission.
- File a FS-approved spoil disposal plan with the Commission within 2 years of license issuance and at least 60 days prior to any ground-disturbing or soil-producing or piling activity. The plan would address removal, revegetation, and noxious-weed management of all road spoil piles on NFS lands that are not currently located in approved areas; removal of visible non-native materials from NFS lands; and development of a plan for all native material allowed to be left on NFS lands addressing erosion control, slope stability, revegetation, and compliance with visual quality objectives.

In its December 1, 2003, filing with the Commission, Interior makes a Section 10(j) recommendation that PG&E develop an erosion control plan for all project facilities, roads, reservoirs, and bypassed reaches in consultation with the FWS, FS, CDFG, and SWRCB.

Our Analysis

To control erosion and limit adverse effects on water quality associated with the roadway system, it is important for PG&E to prioritize maintenance efforts and implement BMPs for ground-disturbing activities. We conclude that implementation of PG&E's road maintenance agreement with the Plumas National Forest would ensure that PG&E and Plumas National Forest regularly reevaluate the need for maintenance, prioritize efforts to address these needs, and implement maintenance accordingly.

The final SA identifies numerous activities such as development of recreation sites that would necessitate ground-disturbing activities. We consider it appropriate to address erosion control in site-specific design for any recommended new recreational facilities, which could be included in a recreation management plan (discussed in section 3.3.5, *Recreational Resources*). PG&E would benefit by consulting with the appropriate resource agencies along with the Maidu community during development of

the plan and upon discovery of previously unidentified cultural materials to ensure that their concerns are adequately addressed.

Similarly, implementation of a spoil disposal plan, as recommended by the FS, would limit the potential for existing and new spoil piles to erode, aid in controlling noxious weeds, and improve the aesthetics of the spoil piles. Appropriate testing of sediments in the existing spoils piles, prior to disturbing them, and after consultation with appropriate resource agencies, would maintain or improve the environmental quality around any spoil piles that contain hazardous materials (such as the potentially PCB-laden materials in the Oak Flat spoil pile).

Hazardous Substances Plan

In its December 1, 2003, filing with the Commission, the FS recommends preliminary Section 4(e) condition 6 to limit the potential for PG&E to introduce hazardous pollutants to waters in the project area. Under this condition, PG&E would be required to file an FS-approved hazardous substances plan (HSP) with the Commission for oil and hazardous substances storage and spill prevention and cleanup. The FS recommends that, at a minimum, PG&E 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;
- maintains in the project area, a cache of spill cleanup equipment suitable to contain any spill from the project;
- semi-annually informs the FS of the location of the spill cleanup equipment on NFS lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and
- informs the FS immediately of the nature, time, date, location and action taken for any spill affecting NFS lands and PG&E adjoining fee title property.

Our Analysis

In accordance with 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 that has a maximum oil storage capacity of greater than 1,320 gallons above ground or in greater than 660 gallons in a single container. Drawings in Exhibit F of the license application do not provide sufficient information to determine which facilities are required to have an HSP under 40 CFR §112.1. In addition to the onsite storage of lubricants and other oil products, transformers on site are likely oil-cooled; due to the total size of all transformers at each development, we also assume that the total oil capacity of the transformers cumulatively is greater than 1,320 gallons per development, and each development is therefore required to have a HSP. We also note that any other project facility, including mechanical works, maintenance and warehousing areas, and

other locations that store a single 660 gallon container or a cumulative 1,320 gallons of petroleum products is required to have an HSP.

PG&E is required to develop and implement an HSP for petroleum products independent of relicensing. This plan would provide a quick reference to procedures and notifications in the case of oil spills with the goal of reducing the effects of spills on the local area including the upper NFFR and Yellow Creek if a spill occurs. Extending the plan to include other hazardous materials stored, used, or disposed of in the project area would reduce the likelihood for contamination by these products and would reduce the extent of contamination should a spill occur.

3.3.1.3 Cumulative Effects on Water Resources

Since construction of the project, its facilities and operations have affected water temperatures throughout much of the NFFR, lower Butt Creek, and project impoundments. Increasing summer flows in the Seneca and Belden reaches would cool water within these reaches. Modifying the Prattville intake to supply cold water from Lake Almanor to downstream reaches, pursuant to the Rock Creek-Cresta SA, would result in cooler water in the Butt Valley reservoir and in the NFFR between the Caribou development and Lake Oroville, although it would also result in a deeper thermocline in Lake Almanor. Implementation of other coldwater supply options is also expected to cool water in the NFFR downstream of the Caribou development and may warm water in the Butt Valley reservoir. Routing a portion of the flow around the Rock Creek, Cresta, and Poe bypassed reaches warms water in these reaches. The cumulative effects of the project and nonproject facilities and operations would be cooling of water in the NFFR between the Caribou development and Lake Oroville, deepening of the thermocline in Lake Almanor, and cooling or warming of Butt Valley reservoir, depending on which coldwater supply option(s) are implemented.

Several project and non-project actions affect trace metals concentrations within NFFR basin waters. Since 1952, PG&E's LACSP has increased silver concentrations in the atmosphere of the watershed that contributes to Lake Almanor, and consequently has increased the likelihood of elevated silver concentrations in precipitation and runoff. Project facilities and operations have historically resulted in accumulation of sediments in the reservoir and low DO levels in water at the water/substrate interface. The naturally high levels of metals in the sediments in combination with the anoxic conditions in the reservoir's hypolimnion have historically resulted in mineralization of trace metals in the reservoir, elevated trace metal concentrations in Lake Almanor's hypolimnion and the Seneca reach. Modifying the Prattville intake to draft deeper water from Lake Almanor is expected to seasonally increase oxygen levels in deeper waters of Lake Almanor and consequently reduce mineralization of metals contained in the sediments deposited in the reservoir. PG&E's use of the upper gates instead of the lower gates at the Canyon dam intake tower during periods with elevated hypolimnetic metal concentrations would reduce the conveyance of water with high metal concentrations to the Seneca reach. Non-project related mining is expected to continue

in the Seneca and Belden reaches and other streams within the basin. Mining activity is expected to continue to cause the suspension of sediments with high trace metal concentrations. However, the cumulative effect of anticipated project and non-project actions would be a reduction in trace metal concentrations in Lake Almanor's hypolimnion and the Seneca reach.

Continued operation of the project may result in the Lake Almanor shoreline bank receding into or near septic leach fields that were constructed prior to raising the normal Lake Almanor water level to 4,494 feet (PG&E datum) in 1974. This could result in introduction of fecal coliform bacteria and human pathogens from the leach fields into Lake Almanor waters. The expected increase in water-oriented recreational use throughout the NFFR basin would increase the potential for fecal coliform bacteria and human pathogens to be introduced to surface waters in the basin. The cumulative effects of these actions would be additive and likely result in localized increases in concentrations of fecal coliform bacteria and human pathogens in surface waters of the NFFR basin.

3.3.1.4 Unavoidable Adverse Effects. None.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

The project area currently supports a diverse assemblage of native and non-native fish species (table 3-13) many of which provide a forage base for game fish in the project waters as well as avian predators (bald eagle and osprey). The reservoirs support both coldwater and warmwater fisheries, while the bypassed reaches and riverine stretches support a coldwater fishery dominated by wild rainbow trout. The wild rainbow trout populations depend upon adequate year-round instream flows, the existence of water temperatures below 20°C, continued presence of suitable spawning substrates within reaches and tributaries, and access to tributaries that provide quality spawning areas and juvenile rearing habitat.

Table 3-13. Fish species identified in recent surveys (1996-2002) of waters in the UNFFR Project. (Source: PG&E 2003a, as modified by staff)

	Lake Almanor[a]	Butt Valley Reservoir	Belden Reservoir	Upper Butt Creek	Lower Butt Creek	Seneca Reach (UNFFR)	Belden Reach (UNFFR)
Native Species							
Rainbow trout (game fish) *Oncorhynchus mykiss*	X	X	X	X	X	X	X
Sacramento sucker *Catostomus occidentalis*	X	X	X	X		X	X
Sacramento pikeminnow *Ptychocheilus grandis*	X	X	X				X
Hardhead *Mylopharodon conocephalus*							X
Prickly sculpin *Cottus asper*	X	X				X	X
Riffle sculpin *Cottus gulosus*		X		X	X	X	X
Tui chub *Gila bicolor*		X					
Introduced Species							
Brown trout (game fish) *Salmo trutta*	X	X		X		X	X

	Lake Almanor[a]	Butt Valley Reservoir	Belden Reservoir	Upper Butt Creek	Lower Butt Creek	Seneca Reach (UNFFR)	Belden Reach (UNFFR)
Chinook salmon (game fish)[b] *Oncorhynchus tshawytscha*	X						
Smallmouth bass (game fish) *Micropterus dolomieui*	X	X	X				
Largemouth bass (game fish) *Micropterus salmoides*	X	X					
Brown bullhead *Ameiurus nebulosus*	X						
Wakasagi (Japanese pond smelt) *Hypomesus nipponensis*	X	X	X				
Common carp *Cyprinus carpio*	X	X					
Sacramento perch *Archoplites interruptus*	X	X					

[a] Tahoe sucker, tui chub, hitch, brook trout, kokanee salmon, silver salmon, chum salmon, bluegill, green sunfish, and channel catfish have been noted to occur in Lake Almanor but were not collected in PG&E's recent (1996 through 2002) surveys

[b] Stocked in Lake Almanor by CDFG.

The historical fish community of the UNFFR included Central Valley spring-run Chinook salmon and Central Valley steelhead as well as the Pacific lamprey. Salmon and steelhead ascended up the entire length of the NFFR through the area now inundated by Lake Almanor and into surrounding tributary streams (Yoshiyama et al., 2001). These species utilized the UNFFR and its associated tributaries for spawning and juvenile rearing habitat. The construction of Canyon dam in 1914, and a second dam replacing it (built between 1925 and 1927), blocked these migratory fish from accessing the upstream waters in the NFFR and its associated tributaries. The construction downstream of the Rock Creek dam (1950), Cresta dam (1950), Poe dam (1958), and Oroville dam (1963) created additional migratory barriers that blocked salmon, steelhead, and lamprey runs from entering the upper Feather River, prohibiting them from using historic spawning and juvenile rearing areas located there. After the creation of reservoirs, introduced fish species such as smallmouth bass, largemouth bass, wakasagi (Japanese pond smelt, an introduced species), and brown trout exploited the new lentic environment, establishing self-sustaining populations.

Lake Almanor and Upstream Waters

Lake Almanor is the largest, most upstream project reservoir, approximately 10 miles long and 1 to 4 miles wide, with a surface area of 27,000 acres (figure 1-1). Average depth of the reservoir is 60 feet, with the deepest location occurring near Canyon dam where depths reach to about 100 feet. During the summer months, the lake is thermally stratified with the warm upper layer (epilimnion) extending to a depth of about 30 to 40 feet, and the colder bottom layer (hypolimnion) existing below a depth of 40 feet. The near-surface layer is typically more than 22°C in summer, and bottom temperatures are in the range of 10 to 14°C. Lake Almanor is also stratified with respect to the concentration of DO in the water column, with values near saturation in the surface layers and depressed values in the hypolimnion during the summer stratification. Inflow into the lake comes from the Hamilton Branch powerhouse; the NFFR; Hamilton Branch of the Feather River; and a number of smaller tributaries including Benner, Last Chance, and Bailey creeks. Additionally, various submerged springs contribute substantial flows, in the range of 200 to 250 cfs, to Lake Almanor. Seasonally, elevation of the lake can vary from a low of 4,466.7 feet (PG&E datum) to a high of 4,494 feet (PG&E datum), with the target level at or above 4,474 feet (PG&E datum) prior to September 15 to support recreation needs. As the lake levels lower during the late summer and fall, the shallower northwest portion of the lake dewaters more rapidly than the rest of the nearshore aquatic habitat elsewhere in the lake.

Lake Almanor supports both coldwater and warmwater fish species (table 3-13). Primary game fish occurring in the reservoir include: rainbow trout, brown trout, Chinook salmon, smallmouth bass, and largemouth bass. Since 1933, CDFG has stocked a variety of game and panfish in the reservoir to supplement the sport fishery. Recent CDFG stocking efforts have focused on rainbow trout, brown trout, and Chinook salmon.

A creel survey conducted by PG&E in 2000 (EA, 2001) revealed that angler catch is dominated by rainbow trout and smallmouth bass, collectively comprising 93 percent of the total recorded catch of participating anglers.

Wakasagi provide an important forage base for fish inhabiting Lake Almanor. Hydroacoustic surveys performed in 2001 indicated that wakasagi tend to be aggregated at the thermocline (HTI, 2002). From the entrainment studies conducted by PG&E in 2001 (ECORP, 2002a), wakasagi accounted for 99.9 percent of all fish entrained at the Butt Valley powerhouse, which has its intake located in Lake Almanor, with a total of 91,616 individuals collected during 10 days of sampling from June through October. These entrainment results suggest that an abundant population of wakasagi inhabit Lake Almanor. Entrainment of wakasagi inhabiting Lake Almanor transports them to downstream reservoirs and riverine reaches providing an important forage base for piscivorous fishes and avian predators (bald eagle and osprey). Fish population studies conducted by PG&E in support of the license application do not provide a thorough understanding of the population size of wakasagi within Lake Almanor, due to the collection techniques used and locations sampled.

Mollusc species inhabiting Lake Almanor include two native gastropods, rock fossaria (*Fossaria modicella*) and Artemesian rams-horn (*Vorticifex effuses*); two introduced gastropods, big-ear radix (*Radix auricularia*) and mimic lymnaea (*Pseudosuccinea columella*); one native bivalve, striated fingernail clam (*Sphaerium striatinum*); and one introduced bivalve, Asian clam (*Corbicula fluminea*). The Asian clam is the most dominant mollusc in the reservoir.

Butt Valley Reservoir

Butt Valley reservoir is long (4.75 miles) and narrow (0.75 mile) and has a maximum depth of about 50 feet (see figure 1-1). The surface area of the reservoir is 1,600 acres. The primary source of flow entering the reservoir is from Butt Valley powerhouse, which draws its water from Lake Almanor at the Prattville intake.

Butt Creek is the only major tributary entering the reservoir. Average monthly flows in the creek range from 40 to 188 cfs, averaging 99 cfs for the WY period 1970-1999. Butt Creek is an unregulated stream, flowing approximately 21 miles from its headwaters to Butt Valley reservoir, and is dominated by boulder and cobble substrate with areas of gravel, providing spawning, rearing, and foraging habitat for rainbow and brown trout inhabiting the creek and Butt Valley reservoir. Rainbow and brown trout are the only game fish present in the creek; riffle sculpin and Sacramento sucker also are present (table 3-14). Angler harvest data revealed that 64 percent of all trout caught in the creek were 14 inches or longer (table 3-15). Rainbow trout from Butt Valley Reservoir enter the creek during early spring (March through April) to spawn while brown trout enter the creek during fall (October through November) for spawning. Juvenile rainbow and brown trout have both been documented within the creek during