primarily responsible for emergency service calls within the LOSRA, with primary backup provided by BCFD. In State Responsibility Areas outside of LOSRA, Butte County has primary financial responsibility for responding to emergency service calls.

- Local Responsibility Areas (including Thermalito Forebay, Thermalito Afterbay, and the OWA): In the unincorporated part of the Local Responsibility Area (Figure 4.9-1), Butte County is primarily responsible for fire protection and suppression and emergency service calls, with Butte County bearing the primary financial responsibility. Within Oroville, the City of Oroville has primary fire protection and emergency services and financial responsibilities.

In practice, fire protection and emergency medical services to the project area and to the Greater Oroville Area are provided jointly by CDF, BCFD, DPR, and the Oroville Fire-Rescue Department. These agencies cooperatively respond to calls within the area based on the South County Interagency Fire Protection Agreement. Under this agreement, primary responsibility for fire protection and emergency service calls in the south County area is divided among these agencies depending on the location of the incident and the availability of fire units to respond to the call, regardless of primary jurisdictional responsibilities. Calls from the project area are most likely to be rescue-related, with DPR and CHP sometimes receiving the initial call, which may then be passed along to the most appropriate responder (Butte County Office of the Chief Administrative Officer, February 2006). Within the LOSRA, including Lake Oroville, DPR rangers who have EMT or equivalent certifications are the first responders for emergency calls (pers. comm., Feazel 2006). DPR has four to five vessels at their disposal at any given time for this purpose. DPR usually transports medical emergency victims on Lake Oroville to appropriate boat ramps or marina locations, where accident victims can then be picked up by local ambulance firms or Enloe Hospital resources, such as a helicopter. The accident victims or their medical insurers are financially responsible for the ambulance and hospital costs. Additionally, CDF/BCFD fire department personnel often respond to calls for emergency services in the LOSRA and are the primary responders to emergency services calls elsewhere in unincorporated Butte County.

Additional information on the operations and responsibilities of CDF, BCFD, and the Oroville Fire-Rescue Department are provided below.

<u>California Department of Forestry and Fire Protection</u>

CDF has a mission to protect the people of California from fires, respond to emergencies, and protect and enhance forest, range, and watershed values providing social, economic, and environmental benefits to rural and urban citizens. As discussed previously, CDF has major fire-related responsibilities within State Responsibility Areas in Butte County, including lands surrounding Lake Oroville. CDF also often serves as a first responder to accidents in the area and provides assistance and mutual aid on search-and-rescue operations. CDF provides funding for the Butte Emergency

Command Center, which serves the needs of CDF, BCFD, and certain cities within the county.

State law (Public Resources Code Sections 4142, 4144, and 4145) allows CDF to enter into cooperative agreements with local governments for the purpose of providing full-service fire protection services on any lands within a jurisdiction, including Local Responsibility Areas, as it does with 35 counties and 25 cities in California. As a full-service fire department, compensated for its services by a local agency, CDF can respond to wildland fires, structure fires, floods, hazardous material spills, swift-water rescues, civil disturbances, earthquakes, and medical emergencies of all kinds depending on terms of the cooperative agreement. Pursuant to this authorization, CDF has had longstanding cooperative agreements, reinstituted annually, with Butte County and with the Cities of Biggs and Gridley, as these small municipalities do not provide city-funded separate fire protection services.

The contract between CDF and Butte County, known as the Cooperative Agreement Program Schedule A Agreement for Local Services, stipulates, among other terms, that CDF is to maintain the necessary equipment, personnel, and facilities required to provide fire protection and emergency services in the County's Local Responsibility Area during the entire year. The agreement, in some ways, consolidates the wildland fire suppression operations of CDF and Butte County throughout the unincorporated county area, with Butte County paying the State for the services in the Local Responsibility Area covered by the cooperative agreement. The contractual arrangement is designed to meet the fire protection and suppression needs of Butte County.

As a major fire protection service provider statewide and in the region, CDF has prepared a Fire Management Plan (CDF 2002) for the Butte Unit, which documents the assessment of the fire situation within the unit. The plan includes stakeholder contributions and priorities, identifies strategic areas for pre-fire planning, and fuel treatment as defined by the people who live and work with the local fire problem. The fire plan assessment system has four components, which include level of service, assets at risk, hazardous fuels, and historic fire weather. CDF bases its level of service on initial attack success rates for lands of a similar type. Generally, the goal of CDF is to attain approximately 95–98 percent success rates across planning belts (i.e., grass, brush, interior-timber, woodland, and agricultural or urban). Success rates in the Butte Unit range from 89 percent (interior timber) to 100 percent (woodland), and are generally in the mid-to-upper 90th percentile; these success rates are considered to meet established service standards (pers. comm., Hawks 2004).

Butte County Fire-Rescue Department

As discussed previously, BCFD holds responsibility for responding to wildland fire incidents in the unincorporated areas of the County outside of State Responsibility Areas, and has primary financial responsibility for responding to structural fires and medical emergency calls in all unincorporated areas of Butte County, although DPR has primary responsibility for responding to emergency services calls in the LOSRA. As

described previously, Butte County contracts with CDF for full-service emergency and non-emergency response to incidents that include medical emergencies, rescues, structural fires, wildland fires, hazardous material spills, and other miscellaneous calls for service. Butte County pays CDF for staff services under the cooperative fire protection agreement, and BCFD receives supplemental staffing through a volunteer program.

In FY 2002-03, BCFD was staffed by approximately 200 career and seasonal CDF employees, 250 volunteers, and 100 staff assigned to the Butte Fire Center, according to Butte County's adopted budget. (CDF employees staff the Butte County Fire-Rescue Department through a contractual arrangement between Butte County and CDF.) Budgeted expenditures for Butte County's regular and volunteer fire protection programs, including equipment replacement, totaled $10.1 million in FY 2002-03.

According to Butte County (Butte County Office of the Chief Administrative Officer 2006), there are 22 fire stations, not including City of Oroville fire stations, with the ability to respond and provide services to a large part of Butte County that includes the project area. Butte County has stated that these fire stations have response areas that fall within the area most frequented by resident and non-resident visitors to the Oroville Facilities. This roughly 400,000-acre area, as defined by Butte County in its relicensing filings with FERC, was used by Butte County to calculate county project-related emergency response calls. This represents an area approximately ten times larger than the project area. Of these 22 stations, 9 are Butte County Volunteer Fire stations, 4 are CDF/BCFD 'Amador' stations, 8 are BCFD stations, and 1 is a CDF station.

This visitor-frequented area, which has not been verified by other service providers, is much larger than the FERC project boundary area and LOSRA, taking in areas that may be traversed by visitors on their way to Oroville Facilities recreation sites. Hence, project visitors may generate few service calls for some of these stations. These stations primarily serve Butte County residents in addition to potentially providing services to project visitors.

Butte County Volunteer Fire stations are owned and maintained by Butte County and are primarily staffed by trained volunteer staff who receive stipends. CDF/Butte County "Amador" stations are owned by the State of California. For these stations, CDF provides full staffing and operational funding for 5 months (the fire season) of the year, while for the remaining 7 months (the non-fire season), Butte County continues to pay the additional emergency response pay for CDF firefighters, who then respond to county emergencies. BCFD stations are owned and operated solely by Butte County. Firefighters assigned to BCFD stations are CDF employees paid by Butte County through the cooperative agreement contract between the County and CDF. CDF Stations are owned, operated, and funded solely by the State.

Within the project area, visitors to the Oroville Facilities generate calls primarily for emergency medical services. Other types of calls generated by visitors include water rescues on Lake Oroville, the Feather River, Thermalito Forebay, and Thermalito Afterbay. Although few fires have occurred in the LOSRA, there are occasional

responses to reports of illegal campfires. Outside of the LOSRA, visitors traveling to the Oroville Facilities generate emergency medical services calls related to traffic accidents and occasionally generate calls to respond to grass fires (pers. comm., Fowler 2003).

According to Butte County, BCFD responds to many calls for service in the project area, including emergency medical, fire, rescue, and hazardous materials calls (Butte County Office of the Chief Administrative Officer 2006). Although call data specific to the entire project area are not available, the department reportedly responded to more than 51 emergency services calls in 2004 and 47 calls in 2005 in the Lake Oroville portion of the project area (Butte County Office of the Chief Administrative Officer 2006). Countywide, BCFD responded to 10,588 incidents in 2003 and 10,368 incidents in 2004 (Butte County 2005), indicating that emergency services calls in the Lake Oroville portion of the project area accounted for less than 0.5 percent of BCFD's total calls in 2004.

DPR confirms that BCFD personnel (including contracted CDF personnel) respond to calls for emergency medical services within the LOSRA, with or without DPR's request for assistance. DPR, however, estimates that BCFD personnel respond to only 20–25 calls for service within the LOSRA each year, with most of those responses not requested by DPR (pers. comm., Feazel 2006).

Oroville Fire-Rescue Department

Within the Oroville Fire-Rescue Department's core service area (i.e., city limits of Oroville), the fire department responded to approximately 3,000 calls during FY 2001-02 (including false fire alarm responses). Emergency medical aid–related calls accounted for 1,651 calls, or about 60 percent of non–false alarm calls. Part of this workload is attributed to visitation to LOSRA and related recreational facilities as non-residents travel to and use recreation facilities. Visitation generates calls related primarily to traffic accidents, medical aid to recreationists, and swift-water rescues on the Feather River. The majority of visitor-related incidents requiring fire-rescue department response are for emergency medical services (pers. comm., Pittman 2003).

According to the City of Oroville's adopted FY 2002-03 budget, the Oroville Fire-Rescue Department's $1.5 million budget supported 18.4 positions during that year. The City of Oroville Fire Department is guided by Fire Department Standards of Cover Guidelines included in the Safety Element of the City of Oroville General Plan:

- 8.30h: Fire Department travel times should strive to place a first due unit at the scene within 5 minutes of travel time, for 90 percent of fire and medical incidents.
- 8.30i: Fire Department units should be located and staffed such that an effective response force of four units with eight personnel minimum should be available to all areas of the City of Oroville within a maximum of 10 minutes travel time, for 90 percent of all structure fires.

According to the Standard of Coverage Study conducted by the Oroville Fire-Rescue Department (2003), the City of Oroville Fire Department, through the South County Fire

and Rescue Management Agreement, meets these standards. Since that report, however, incident activity and new development has created the need for an additional staffed engine company serving the western portions of Oroville. Further, staffing has not increased since 1983 due to revenue deficiency, although there is roughly 3 times the emergency workload. Based on these considerations, there are concerns that multiple or simultaneous emergencies would exceed the City of Oroville Fire Department's ability to provide service (pers. comm., Pittman 2004).

4.9.2.3 Traffic and Road Maintenance

Traffic and road maintenance issues related to use of the Oroville Facilities area are discussed in Section 4.14, Traffic and Road Maintenance.

4.9.2.4 Utilities and Service Systems

Various utilities and service systems serve the area, and may be needed to serve proposed facility developments under the alternatives and indirect population growth generated by the project. These services include water, wastewater treatment, and solid waste disposal.

Water

Water service is provided to the Kelly Ridge portion of the project area by the South Feather Water and Power (SFWP), formerly known as the Oroville-Wyandotte Irrigation District. It primarily functions as a domestic water retailer and a hydropower generator, with the Feather River serving as its source of water. The SFWP's water rights and facilities are upstream and not part of the SWP.

The ditch system utilized for irrigation water by the SFWP today is a modification and expansion of the ditch network constructed by early miners who diverted water from the Feather River to their mining claims. In the late 19th century, as mining gave way to agriculture, the South Feather Land and Water Company acquired many of the miners' ditches.

The Del Oro Water Company was originally formed in 1965 to meet the water needs of the Paradise Pines area in Magalia, California. Since that time the company has grown throughout California. Nine hundred of its customers are located in the Lake Oroville area.

Wastewater Treatment

The 60-acre Sewerage Commission–Oroville Region (SCOR) wastewater treatment plant is designed to treat 6.5 million gallons of wastewater per day, and treats 1.2 billion gallons per year, serving 15,000 households and numerous industries in the Greater Oroville Area, including the City of Oroville and outlying rural areas. Eighty percent of the treatment plant's power is supplied by a 520-kilowatt solar panel array, which at the time of installation in 2002 was the fifth largest solar-powered system in the world, and the first predominantly solar-powered wastewater treatment plant in the country.

Public entities in the Greater Oroville Area own individual wastewater collection systems, while SCOR receives and treats collected wastewater for the region.

Solid Waste

Management of solid waste material in the area is performed by several privately owned transfer stations and one central sanitary landfill site that is owned by Butte County and leased to a private company (Waste Management) for operation and management. Solid waste produced in the area is transferred to the Neal Road Landfill, which is located in the City of Paradise and operated by the Neal Road Landfill Company, a subsidiary of Waste Management. The Neal Road Landfill provides service to all 212,800 residents of Butte County. Waste from outside Butte County is not accepted. The landfill's expected capacity would allow it to be used until 2034, with a total of 140 acres permitted for landfill.

Power

Pacific Gas and Electric Company is the primary provider of electricity and natural gas services to residents and businesses in the area. Scheduling of local and regional power generation and distribution is managed by the California Independent System Operator. Information regarding power generated by the Oroville Facilities is included in Chapter 3.0.

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4.10 ENVIRONMENTAL JUSTICE

Environmental justice refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level in the development and implementation of environmental management policies and actions. Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations" (Council on Environmental Quality 1997). Comparable policies and guidelines have been established by the State of California Resources Agency, which includes DWR, owner and operator of the Oroville Facilities.

4.10.1 Characteristics of Populations Affected by the Oroville Facilities

An important baseline effect of the Oroville Facilities is the provision of relatively affordable water to customers throughout the SWP service areas. The Oroville Facilities also provide recreation opportunities, including access to fee-based and free facilities, to visitors from throughout the State. A summary of the demographic characteristics of populations affected by the Oroville Facilities is provided in this section.

The racial characteristics of the population living in the SWP service areas vary by region of the state. Locally, the racial makeup of the population in the FRSA is more uniform than that of the state, with only American Indians/Alaska Natives representing a higher proportion of the overall population. The proportion of American Indians/Alaska Natives is even higher in the city of Oroville, which is nearly four times the state average. Based on survey data collected as part of Study Plan R-13 (SP-R13), Recreation Surveys, the ethnicity of visitors to the Oroville Facilities is predominantly White/Anglo/non-Hispanic, and Latinos/Hispanics are the second most populous ethnicity.

Income-related characteristics of persons living in the SWP service areas also varies considerably. The FRSA has the lowest median household income in the Oroville area with the city of Oroville (included in the FRSA) having the lowest income level. Median household income levels in both of these areas are lower than statewide figures. The highest poverty rates occur in the San Joaquin Valley, followed by the FRSA and Southern California, all of which are higher than the state average. Based on the survey data, the household income levels for Oroville recreationists are fairly evenly distributed. The majority of visitors had a total household income that was higher than median income level for Butte County in 2000.

The evaluation of environmental justice considerations focuses on the local, regional, and out-of-region effects of the Oroville Facilities on minority and low-income groups. Once the socioeconomic impacts of the Oroville Facilities are identified, along with the populations affected by those impacts, it is necessary to establish the extent to which

minority and low-income groups potentially are disproportionately affected by adverse impacts of the Proposed Project. The information and data presented below serve as the foundation for establishing the proportion of minority and low-income groups affected by the project. The information presented is organized into the following categories: (1) the core service area of the SWP, which includes regional (i.e., Butte County) and out-of-region populations, and (2) visitors to the Oroville Facilities, as derived from the recreation survey data collected as part of SP-R13, Recreation Surveys. Location-specific race and income data are considered in the context of statewide data to establish whether a particular area or group is more disposed to environmental justice impacts.

4.10.2 Minority Groups

The racial composition of population comprising the SWP service area, which includes Butte County and its local communities, is presented in Table 4.10-1. The six regions served by the SWP have different racial compositions. The Upper Feather River area is most uniform with 82.6 percent of the population being White, the next largest ethnic classification ("Other Race") representing less than 6 percent of the population, and Hispanics (of any race) comprising roughly 12 percent of the population; however, this area contains the largest proportion of American Indian/Alaska Native populations (1.9 percent) of the SWP service areas and in the State of California overall. The South Bay area has the lowest proportion of White residents (51.5 percent), and the largest proportion of Asian residents (23.2 percent). The largest proportion of Black/African Americans (11.6 percent) and people of two or more races (5.8 percent) occurs in the North Bay area. The San Joaquin Valley area has the largest Hispanic population at 39.5 percent.

The population of Butte County and its communities is predominantly White, ranging from 66.6 to 93.7 percent depending on the jurisdiction and 84.5 percent for the county overall. The population of the city of Oroville is diverse, with the highest percentage of other defined racial groups (i.e., Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Pacific Islander) in Butte County. The cities of Biggs and Gridley have relatively large populations of Hispanics, 27.6 percent and 38.6 percent, respectively, which is well above the 10.5 percent countywide average.

Table 4.10-2 identifies the racial composition of visitors to the Oroville Facilities.

4.10.3 Socioeconomic Indicators of Well-Being (Low-Income Groups)

Socioeconomic indicators are those factors that provide information on the social well-being of residents of a particular community or region. These indicators are commonly tied to economic factors, and therefore serve as proxies in identifying low-income groups for the purposes of evaluating environmental justice issues associated with the project.

Table 4.10-1. Racial composition (percent) of populations in the SWP service area.

Service Area/ Jurisdiction	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other Race	Two or More Races	Hispanic or Latino (Any Race)
Upper Feather River	**82.6**	**1.5**	**1.9**	**3.9**	**0.1**	**5.9**	**3.9**	**12.1**
Yuba City	91.8	0.6	2.5	0.5	0.1	1.8	2.6	5.7
Plumas Co.	67.0	2.8	1.7	8.9	0.3	14.4	4.9	24.6
Butte Co.	84.5	1.4	1.9	3.3	0.1	4.8	3.9	10.5
Biggs	*74.5*	*0.4*	*1.8*	*0.8*	*0.0*	*18.5*	*3.8*	*27.6*
Chico	*82.4*	*2.0*	*1.3*	*4.2*	*0.2*	*5.7*	*4.3*	*12.3*
Gridley	*66.6*	*0.3*	*1.5*	*3.5*	*0.0*	*24.1*	*4.0*	*38.6*
Oroville	*77.2*	*4.0*	*3.9*	*6.3*	*0.3*	*2.8*	*5.4*	*8.3*
Paradise	*93.7*	*0.2*	*1.1*	*1.0*	*0.1*	*1.2*	*2.6*	*4.3*
North Bay Area	**62.1**	**11.6**	**0.8**	**10.4**	**0.7**	**8.7**	**5.8**	**19.1**
Napa Co.	80.0	1.3	0.8	3.0	0.2	10.9	3.7	23.7
Solano Co.	56.4	14.9	0.8	12.7	0.8	8.0	6.4	17.6
South Bay Area	**51.5**	**8.4**	**0.7**	**23.2**	**0.4**	**10.6**	**5.1**	**21.7**
Alameda Co.	48.8	14.9	0.6	20.4	0.6	8.9	5.6	19.0
Santa Clara Co.	53.8	2.8	0.7	25.6	0.3	12.1	4.7	24.0
San Joaquin Valley	**59.9**	**5.1**	**1.5**	**5.4**	**0.2**	**23.2**	**4.7**	**39.5**
Fresno Co.	54.3	5.3	1.6	8.1	0.1	25.9	4.7	44.0
Kern Co.	61.6	6.0	1.5	3.4	0.1	23.2	4.1	38.4
Kings Co.	53.7	8.3	1.7	3.1	0.2	28.3	4.8	43.6
Stanislaus Co.	69.3	2.6	1.3	4.2	0.3	16.8	5.4	31.7
Central Coast	**77.2**	**2.2**	**1.1**	**3.6**	**0.2**	**11.8**	**4.0**	**27.4**
San Luis Obispo Co.	84.6	2.0	0.9	2.7	0.1	6.2	3.4	16.3
Santa Barbara Co.	72.7	2.3	1.2	4.1	0.2	15.2	4.3	34.2
Southern California	**56.8**	**7.3**	**0.9**	**10.2**	**0.3**	**19.8**	**4.7**	**38.3**
Los Angeles Co.	48.7	9.8	0.8	11.9	0.3	23.5	4.9	44.6
Orange Co.	64.8	1.7	0.7	13.6	0.3	14.8	4.1	30.8

Table 4.10-1. Racial composition (percent) of populations in the SWP service area.

Service Area/ Jurisdiction	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other Race	Two or More Races	Hispanic or Latino (Any Race)
Riverside Co.	65.6	6.2	1.2	3.7	0.3	18.7	4.4	36.2
San Bernardino Co.	58.9	9.1	1.2	4.7	0.3	20.8	5.0	39.2
San Diego Co.	66.5	5.7	0.9	8.9	0.5	12.8	4.7	26.7
Ventura Co.	69.9	1.9	0.9	5.3	0.2	17.7	3.9	33.4
STATE OF CALIFORNIA	**59.5**	**6.7**	**1.0**	**10.9**	**0.3**	**16.8**	**4.7**	**32.4**

[1] *Percentages for each area total to greater than 100 percent because persons of Hispanic/Latino heritage may be considered members of other racial classifications.*

Source: U.S. Census Bureau 2000

Table 4.10-2. Racial composition of visitors to the Oroville Facilities.

Ethnicity	Percent at Each Survey Site						
	Lake Oroville	Thermalito Diversion Pool	Low Flow Channel	Thermalito Forebay	Thermalito Afterbay	Oroville Wildlife Area	All Facilities
White/Anglo/Non-Hispanic	**84.8**	**86.2**	**76.1**	**72.8**	**80.4**	**74.8**	**81.0**
Latino/Hispanic	5.1	3.4	7.7	16.3	10.7	10.0	7.9
Asian	3.3	0.0	2.8	2.8	0.4	4.8	3.0
African American/Black	1.1	0.0	0.7	2.8	0.4	0.3	1.1
American Indian/Alaskan Native	2.3	8.6	7.0	2.8	4.4	4.5	3.3
Pacific Islander	1.0	0.0	1.4	1.1	0.7	2.8	1.2
Other	2.5	1.7	4.2	1.4	3.0	2.8	2.5

Source: DWR 2004c

As derivatives of total income, per-capita personal income and poverty rates are established indicators of social well-being (Table 4.10-3). In terms of SWP service areas, only the North Bay ($22,848) and South Bay ($29,971) areas have per-capita income levels that are higher than the statewide average ($22,711); all other service areas fall below the statewide average, with the lowest per-capita income level occurring in the San Joaquin Valley area ($15,915). Double-digit poverty rates occur in the Upper Feather River, San Joaquin Valley, and Southern California areas.

Average per-capita income of residents of Butte County is significantly below regional, state, and national averages. In 2000, average per-capita income in Butte County was $17,517, which was 77 percent of the per-capita income level for the State of California ($22,711) (U.S. Census Bureau 2000). Among the incorporated jurisdictions, per-capita income levels are relatively higher (compared to Butte County) in Paradise ($19,267) and Chico ($16,970) and relatively lower in Biggs ($12,386), Gridley ($12,267), and Oroville ($12,345). In addition, Oroville has the highest proportion (33.1 percent) of residents below the poverty level; this figure is substantially higher than the countywide average of 19.8 percent.

4.10.4 Identification of Minority and Low-Income Groups for Potentially Analyzing Environmental Justice Impacts

Users of the Oroville Facilities are a population group that could potentially experience environmental justice effects. Recreation fees are paid by users of certain Oroville Facilities, including fees for camping, boat and personal watercraft launching, and day-use areas. Information on the economic characteristics of recreation users of the Oroville Facilities was collected as part of SP-R13, Recreation Surveys, including household income levels. The distribution of respondents' income was fairly evenly distributed, with the highest number of responses in the $40,000-to-$59,999 range, which corresponds to the median household income for the state of California ($47,493). Further, approximately 33 percent of users of the Oroville Facilities had household incomes of less than $40,000, while roughly 37 percent of statewide residents had household income levels of less than $35,000 (note that survey data and census data used different income brackets). Based on these figures, household income levels of recreationists using the Oroville Facilities and the general (statewide) population are comparable, with users of the Oroville Facilities having slightly higher income levels compared to the state. Because there are no meaningful differences between these two populations, it can be concluded that the recreation user group is not a disproportionately low-income population.

The majority of users of the Oroville Facilities are Butte County residents, and therefore it is important to note the income levels and ethnicity of recreationists from Butte County compared to Butte County residents as a whole, as well as Butte County compared to the state averages.

Table 4.10-3. Personal income measures of social well-being in the SWP service area. [1]

Jurisdiction	Income		Percent Below Poverty Level	
	Median (Family)	Per-Capita	All Ages	Families
Upper Feather River	**$41,188**	**$17,443**	**19.0**	**12.3**
Plumas County	$39,381	$15,928	18.1	14.5
Yuba City	$46,119	$19,391	13.1	9.0
Butte County	$41,010	$17,517	19.8	12.2
Biggs	$39,063	$12,386	17.5	11.7
Chico	$43,077	$16,970	26.6	12.7
Gridley	$29,957	$12,267	23.3	19.5
Oroville	$27,666	$12,345	33.1	26.2
Paradise	$41,228	$19,267	12.4	9.7
North Bay Area	**$60,792**	**$22,848**	**8.3**	**6.0**
Napa County	$61,410	$26,395	8.3	5.6
Solano County	$60,597	$21,731	8.3	6.1
South Bay Area	**$74,393**	**$29,971**	**9.1**	**6.2**
Alameda County	$65,857	$26,680	11	7.7
Santa Clara County	$81,717	$32,795	7.5	4.9
San Joaquin Valley	**$40,112**	**$15,915**	**20.5**	**16.1**
Fresno County	$38,455	$15,495	22.9	17.6
Kern County	$39,403	$15,760	20.8	16.8
Kings County	$38,111	$15,848	19.5	15.8
Stanislaus County	$44,703	$16,913	16.0	12.3
Central Coast	**$53,433**	**$22,603**	**13.7**	**7.9**
San Luis Obispo County	$52,447	$21,864	12.8	6.8
Santa Barbara County	$54,042	$23,059	14.3	8.5
Southern California	**$51,078**	**$21,427**	**15.1**	**11.7**
Los Angeles County	$46,452	$20,683	17.9	14.4
Orange County	$64,611	$25,826	10.3	7.0
Riverside County	$48,409	$18,689	14.2	10.7
San Bernardino County	$46,574	$16,856	15.8	12.6
San Diego County	$53,438	$22,926	12.4	8.9
Ventura County	$65,285	$24,600	9.2	6.4
STATE OF CALIFORNIA	**$53,025**	**$22,711**	**14.2**	**10.6**

[1] *Represents 1999 data reported in the 2000 census.*

Source: U.S. Census Bureau 2000

Table 4.10-4. Total household income of visitors to the Oroville Facilities.

Income [1]	Percent at Each Survey Site						
	Lake Oroville	Thermalito Diversion Pool	Low Flow Channel	Thermalito Forebay	Thermalito Afterbay	Oroville Wildlife Area	All Facilities
Less than $20,000	8.3	10.7	20.3	26.7	14.8	12.5	12.7
$20,000-39,999	16.6	17.9	**29.3**	**36.4**	22.0	21.4	19.9
$40,000-59,999	**22.7**	25.0	24.8	23.1	**24.8**	**25.7**	**23.6**
$60,000-79,999	17.5	16.1	9.8	12.8	16.0	16.8	16.1
$80,000-100,000	15.6	3.6	9.0	6.6	10.8	8.9	12.4
Over $100,000	19.3	**26.8**	6.8	4.4	11.6	14.6	15.4

[1] *Total household income before taxes.*

Source: DWR 2004c

In general, income levels for recreationists from Butte County are comparable to income levels for Butte County residents as a whole. Household income for recreationists from Butte County generally fall between $20,000 and $60,000, with slightly more responses in the $20,000-to-$39,999 range, which corresponds to the median household income for Butte County ($31,924). Roughly 18 percent of Butte County recreationists had household incomes of less than $20,000, while roughly 22 percent of Butte County residents had household income levels of less than $15,000. Based on these figures, there is a slightly smaller low-income population in the Butte County user group compared to Butte County as a whole. Because there are no meaningful differences between these two populations, it can be concluded that recreation users of the Oroville Facilities from Butte County are not a disproportionately low-income population group.

Income levels in Butte County and the City of Oroville fall below statewide figures. Median household income in Butte County is $31,924 versus $47,493 for the state of California, a 49 percent difference. In Oroville, the median household income ($21,911) is less than half of that for the state. In terms of poverty rates, Butte County (12.2 percent) and the city of Oroville (26.2 percent) are also higher than the statewide average (10.6 percent). Based on these figures, it is reasonable to state that low-income families in the affected area are “meaningfully greater” than in the general population (i.e., state of California), and therefore a low-income population exists in the Oroville Facilities project area.

For ethnicity, the population of Butte County and the city of Oroville are predominantly White, 84.5 percent and 77.2 percent, respectively, which is higher than in the state of California (59.5 percent). As such, the proportion of minority groups is generally lower in the county and city than in the state as a whole. However, the proportion of American

Indians/Alaska Natives in Butte County (1.9 percent) and the city of Oroville (3.9 percent) is “meaningfully greater” than in the state (1.0 percent). As a result, the American Indian population is considered a minority population in the Oroville Facilities project area for the purposes of the environmental justice analysis.

4.11 AESTHETIC RESOURCES

The aesthetic environment encompasses visual resources, noise, and odor. The scoping process did not reveal any concerns with noise or odors associated with the Oroville Facilities, but did identify issues related to visual resources. Noise and odor issues were not discussed by the Collaborative, and they were not detected during field reconnaissance, but noise and odor are included in this DEIR to comply with CEQA. Hence, the description of the affected aesthetic environment focuses on visual resources.

4.11.1 Visual Resources

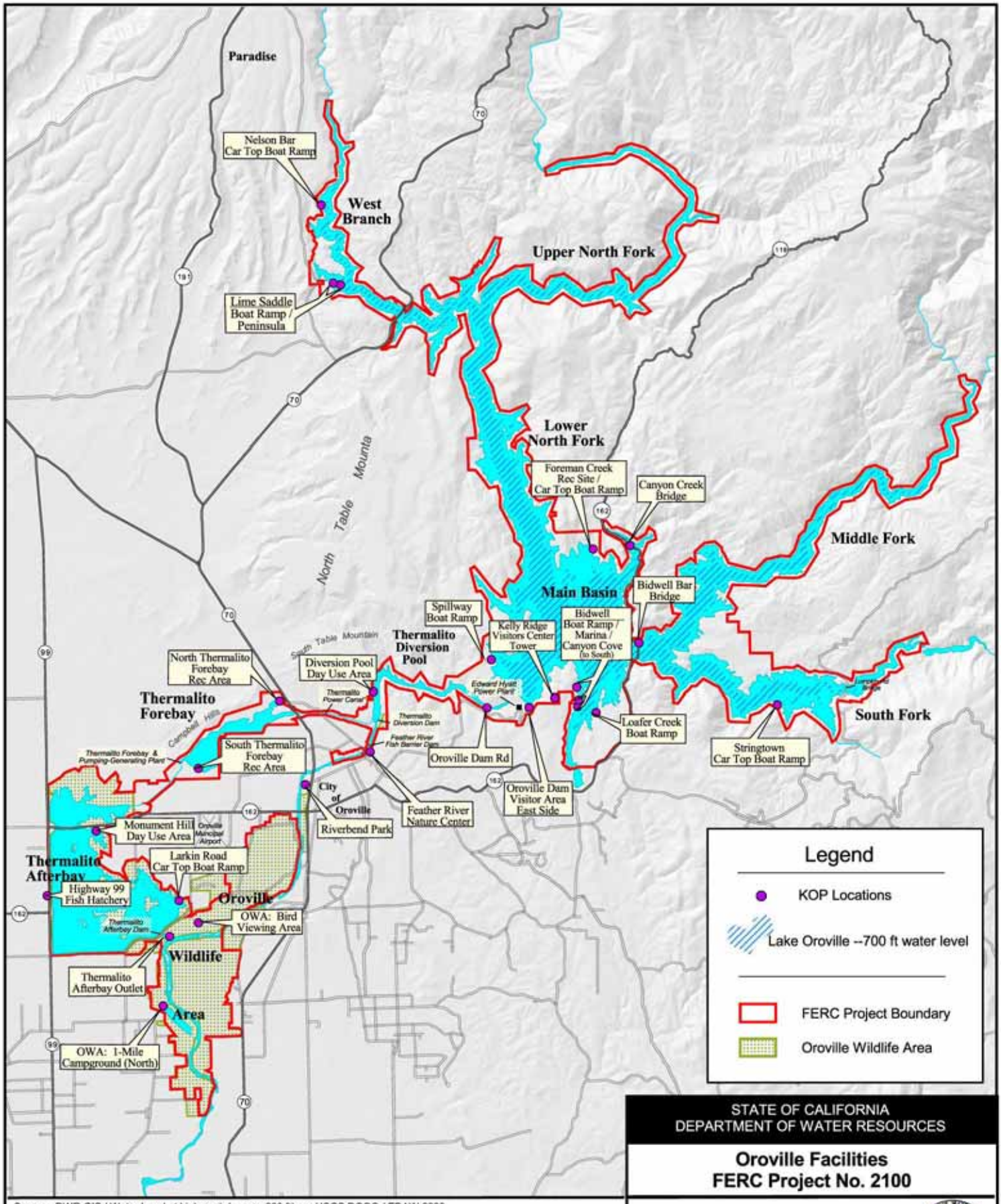
This section describes the existing aesthetic environment of the Oroville Facilities. The Oroville Facilities have been divided into five aesthetically distinct geographic areas (Lake Oroville, the Diversion Pool and Thermalito Forebay, the Thermalito Afterbay, the Low Flow Channel (LFC), and the Oroville Wildlife Area [OWA]). The review of each of the five areas includes a brief description of the area's location, topography, vegetation patterns, types of views available from within the area, land uses, major aesthetic features, and types of viewers. The description of each area also includes a brief discussion of the key observation points (KOPs) that were used in Study Plan L-4 (SP-L4), Aesthetics. KOPs are locations within and near the FERC Project boundary chosen to represent views of the aesthetic environment of the Oroville Facilities (see Figure 4.11-1). Descriptions of and photographs from each KOP are included in Appendix A of SP-L4.

Major issues related to aesthetic resources identified during the scoping process included:

- Effects of project operations, features, and land uses on the aesthetic quality of project lands; and
- Assessment of appropriate landscaping, restoration, and facilities management programs for aesthetic enhancement of project lands.

4.11.1.1 Regional Setting

The Oroville Facilities are located in Butte County. The western half of Butte County is situated along the eastern edge of the Central Valley. This part of the county is primarily flat, and land use is largely agricultural with scattered areas of development ranging in intensity from scattered rural residential, to suburban, to urban. The aesthetic environment of this part of the county is dominated and largely influenced by human development activities and generally has a rural character. The agricultural areas in this part of the county generally include irrigated row crops and orchards in the flatter areas and grazing in the foothills. Thermalito Forebay and Thermalito Afterbay are located in this area.



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Source: DWR GIS / Water Level at high pool (approx 880 ft) per USGS DOQQ / EDAW 2003

1 0 1 2 3 4 5 Miles

Original Scale 1 : 190,080
1" = 3.0 miles

Figure 4.11-1

Location of Key Observation Points (KOPs)

Prepared by: PJ -- EDAW, Inc. Date 11/16/04 P:\2000\0s016.gis\arcview\apr\kop.apr

The eastern half of the county begins near the foothills of the Sierra Nevada and continues east to the range's upper slopes. This part of the county is largely undeveloped and retains much of its natural character. Scattered rural residences and small communities are located throughout this area. Vegetative cover in the foothills area includes chaparral, oak woodland, and coniferous forest. Lake Oroville is located is this area.

4.11.1.2 Project Aesthetic Environment

Lake Oroville

Lake Oroville is impounded by Oroville Dam, an earthfill structure that rises 770 feet (ft) above the floor of the Feather River Canyon and is approximately 1.3 miles in length. Oroville Dam is a major visible feature in the Oroville area. Its scale, shape, texture, and color contrast with the surrounding landscape. The dam's ancillary facilities (substation, equipment yards, roads, etc.) are somewhat visible and have a moderate degree of contrast with the landscape.

Three 230-kilovolt (kV) overhead transmission lines extend approximately 9 miles from the Hyatt Pumping-Generating Plant switchyard to Pacific Gas and Electric Company's (PG&E's) Table Mountain Substation and in some locations introduce contrasting shape, form, and color into the viewed landscape (particularly where they are silhouetted against the sky). It must be noted that there are many other non-project transmission lines that are visible in the vicinity of the project.

Lake Oroville is a major regional aesthetic resource. At maximum operating storage capacity, the reservoir's surface area at full pool is approximately 15,800 acres in size with approximately 167 miles of shoreline. The straight-line distance between Oroville Dam and the farthest reaches of both the West Branch and the Middle Fork is approximately 12 miles. Lake Oroville is composed of five main "arms" or "branches" and the large, centrally located main basin. The five arms are known as the West Branch, the Upper North Fork Branch, the Lower North Fork Branch, the Middle Fork, and the South Fork. These arms range in width from as much as 1 mile in the lower portions of the Lower North Fork, to less than 100 ft in their upper reaches. The terrain adjacent to the arms is typically steep, and the arms become narrow and canyon-like toward their upper reaches. Views along the straight parts of the arms can be extensive (approximately 7 miles in the Lower North Fork), but are restricted in most areas by twisting terrain. In contrast, the main body of the reservoir affords wide open views of the surrounding landscape.

Due to steep topography and limited road access, much of Lake Oroville is not easily accessible to the public by land. The greatest number of people who view the reservoir up close are recreating on the reservoir or at its major recreational facilities. Another large group of people who view Lake Oroville are the motorists who observe it when they drive over the bridges on State Route (SR) 162 (the Bidwell Bar Bridge), SR 70, and Lumpkin Road. A third group of people who view the reservoir are the people who live near the Oroville Facilities. Most of these residents live near Kelly Ridge and have

views of the Loafer Creek area, the main body of the reservoir, and the Bidwell Bar Bridge area. Other areas with residential viewers are scattered along the South Fork (primarily near Enterprise), in the main basin near Canyon Creek, and along the west side of the upper reaches of the West Branch.

KOPs were selected to represent existing aesthetic conditions and the types of views available from around Lake Oroville. The KOPs represent a variety of locations around the reservoir and different types of viewing areas such as developed marinas, developed boat ramp facilities, less developed car-top boat ramps, and areas from which the project can be viewed, such as bridges and the Lake Oroville Visitors Center. The locations of the KOPs include the upper, narrow ends of branches, the wide open main basin of the reservoir, and areas outside of the FERC Project boundary. Table 4.11-1 includes a brief description of the KOPs at Lake Oroville.

Table 4.11-1. Lake Oroville Key Observation Points.

Location of KOP	Description
MR-1: Nelson Bar Car-top Boat Ramp (BR)	Represents the aesthetic conditions of the upper West Branch from the car-top BR at Nelson Bar.
MR-2: Lime Saddle BR	Represents the aesthetic conditions of the portion of the West Branch near Lime Saddle from one of the more used facilities at the project.
MR-3: Lime Saddle Peninsula	Represents the aesthetic conditions of the area south of the Lime Saddle Marina in the West Branch.
MR-4: Foreman Creek Car-top BR	Represents the aesthetic conditions of the main basin of the reservoir from a car-top BR located at the northernmost part of the main basin.
MR-5: Canyon Creek Bridge	Represents the aesthetic conditions of the Canyon Creek inlet from an area adjacent to SR 162.
MR-6: Bidwell Bar Bridge (SR 162)	Represents the aesthetic conditions of the portion of the main basin of the reservoir that can be seen from near the Bidwell Bar Bridge.
MR-7: Stringtown Car-top BR	Represents the aesthetic conditions of the middle portion of the South Branch from a car-top BR.
MR-8: Bidwell Canyon BR	Represents the aesthetic conditions of the southern part of the main basin from one of the more used boat ramp facilities at the project.
MR-9: Bidwell Canyon Marina	Represents the aesthetic conditions of the southern part of the main basin near the largest marina in the project.
MR-10: Bidwell Canyon Cove to South	Represents the aesthetic conditions of the cove south of the Bidwell Canyon Marina from an area located between the marina and the Loafer Creek BR.
MR-11: Loafer Creek BR	Represents the aesthetic conditions of the southern part of the main basin from a very popular boat ramp facility.
MR-12: Lake Oroville Visitors Center Tower	Represents the aesthetic conditions of the western part of the main basin from a popular facility on top of Kelly Ridge that is outside of the FERC Project boundary.
MR-13: Oroville Dam Visitors Area East Side	Represents the aesthetic conditions of the western part of the main basin and the area near the Oroville Dam from an established overview area and from Oroville Dam Road.
MR-14: Spillway BR	Represents the aesthetic condition of an inlet off of the main basin from a heavily used boat ramp facility.

Source: SP-L4

The water level elevation of Lake Oroville fluctuates throughout the year and influences the nearby aesthetic environment. As drawdown occurs during the course of the summer and fall, an increasingly broad ring of shoreline appears between the vegetated shoreline and the water of the reservoir. Reservoir drawdown has different effects on different locations at Lake Oroville. The upper ends of the arms or branches are the most affected by drawdowns. These shallower areas can have considerable amounts of vertical and horizontal shoreline exposed during drawdowns. The drawdowns also expose shoreline in the main basin of the reservoir, but to a lesser degree than in the upper arms or branches. In steep portions of the main basin, such as the area near the Bidwell Bar Bridge, drawdowns can expose a considerable amount of vertical shoreline. Unlike the upper arms or branches, however, steep areas of the main basin of Lake Oroville are deep, so they do not become dewatered.

SP-L4 examined and included photographs of three different elevations at Lake Oroville over a 2-year period to evaluate the influence of very different reservoir elevations on the aesthetic environment. The report also used exceedance data to determine the frequency that each elevation could be expected to be reached or exceeded, based on water year history for the years between 1922 and 1994, and based on actual Lake Oroville water usage data from 2001. For a detailed discussion describing exceedance data, please see Section 6.1.2.1 of the SP-L4 report.

The exceedance data in Table 4.11-2 indicate that the three elevations used for this assessment represented a range of reservoir elevations that vary in terms of likeliness to occur at various times of the year. Reservoir elevations that approach or reach full pool (900 ft) are not common events, whereas an elevation of 830 ft has a good chance of occurring or being exceeded during most water years (75–85 percent). The elevation 710 ft was selected to represent very low elevations. The likelihood of an elevation of 710 ft being met or exceeded throughout the year in any given year is very high, at 95 percent. Conversely, the likelihood of a water surface elevation lower than 710 ft in any given year is 5 percent. Even though this elevation occurs infrequently, it is important to include it in the analysis to have a “worst-case” scenario example to analyze. The following describes the effects of the three elevations on the aesthetic environment. See the figures in Section 6.1.2.1 of the SP-L4 report for photographs from around Lake Oroville at the three elevations.

Table 4.11-2. Lake Oroville exceedance data at three elevations.[1]

Month	Elevation 900 ft	Elevation 830 ft	Elevation 710 ft
April	0%	85%	95%
May	30%	80%	95%
June	25%	75%	95%
July	5%	45%	95%
August	5%	30%	95%
September	0%	30%	95%
October	0%	25%	95%

[1]Data indicate percentage or likelihood that the elevation is met or exceeded for a particular month. Another way to evaluate the data is to realize that if an elevation has a likelihood of being exceeded of, for example, 95 percent, the likelihood of Lake Oroville being at or below that elevation would be 5 percent.
Source: DWR 2004

Elevation 900 ft (Full Pool)—Full pool (elevation 900 ft) is not a common occurrence at Lake Oroville. The likelihood of an elevation of 900 ft being met or exceeded in May and June is 30 and 25 percent, respectively. The likelihood is lower in other months. At full pool, the water of the reservoir completely covers all of the shoreline of Lake Oroville up to the vegetation line and, in some areas, rises above it. Shoreline debris such as tree stumps, and exposed features such as rock outcroppings that are exposed at lower reservoir elevations, are submerged at this elevation. At full pool, trash and other floating debris that collects along exposed shorelines at lower pool elevations is carried with the rising pool and can be deposited along the high pool elevation shoreline in adjacent vegetation.

Elevation 830 ft—Lake Oroville reaches or exceeds this elevation with great regularity during the spring months. The likelihood of this elevation being met or exceeded in April, May, or June is approximately 85, 80, and 75 percent, respectively. During the summer months, the likelihood of this elevation being met or exceeded is less, approximately 45, 30, and 30 percent in July, August, and September, respectively. At elevation 830 ft, the exposed shoreline at many locations becomes a primary part of the scenery but does not dominate the scene. Some parts of the reservoir have less exposed shoreline and may have features (such as marinas) that receive viewer attention and thus lessen the adverse effect of exposed shorelines. Because of the exposed shoreline, most viewers would be expected to find Lake Oroville less attractive at this elevation than at full pool.

Elevation 710 ft—An elevation of 710 ft is almost 200 ft below full pool. Based on exceedance data, the chance of this elevation being reached or exceeded for any month between April and October is 95 percent, which conversely means that the likelihood of this elevation being even lower or met in any given month, below April and October, is approximately 5 percent. Reservoir elevations that are this low generally only occur during the fall of very dry water years. This elevation would likely be considered the least attractive of the three elevations by most viewers.

Diversion Pool and Thermalito Forebay

The approximately 4.5-mile-long Diversion Pool follows the river bed of the Feather River, beginning approximately 0.5 mile downstream from the Oroville Dam and extending to Thermalito Diversion Dam. The approximately 50- to 200-ft-wide Diversion Pool has a riverine character as it meanders through thickly vegetated hillsides. Views within the Diversion Pool are confined and directed by the adjacent steep hillsides. Major aesthetic features that can be observed in the vicinity of the Diversion Pool include the downstream face of Oroville Dam, electric transmission lines (both project and non-project), an unpaved access road that runs parallel to part of the right side of the Diversion Pool, railroad tracks that follow the left side of the Diversion Pool, the railroad bridge near the end of the reservoir, and the Diversion Dam. Most viewers in this area are recreationists involved in activities such as walking, canoeing (and other non-motorized boating), windsurfing, bicycle riding, horseback riding, and fishing.

Only the upstream face (approximately 15 feet) of the 1,300-ft-long Diversion Dam is visible from this area. The downstream face of the Diversion Dam rises 143 feet above the Feather River channel (in the LFC area).

The linear form of the Diversion Dam, along with its color and texture, contrasts with the nearby landscape, particularly when viewed from downstream. When viewed from upstream near the Diversion Pool, the dam is much less visible.

From Thermalito Diversion Dam, the 10,000-ft-long Thermalito Power Canal connects the Diversion Pool to Thermalito Forebay. The linear concrete-lined channel and adjacent chain-link fence pass through flat grasslands and are adjacent to some residential areas. The Thermalito Power Canal is one of the least visible major project features. It is primarily seen by the public where Cherokee Road, SR 70, and Table Mountain Boulevard cross over it. The Thermalito Power Canal contrasts highly with the landscape it passes.

Thermalito Forebay begins at the west end of the Thermalito Power Canal and extends approximately 3 miles southwest to Thermalito Forebay Dam. The forebay is an hourglass-shaped, 630-acre reservoir, just west of SR 70 in the transition zone between the flatlands of the Central Valley and the more steeply sloped terrain of the foothills. The northwest edge of Thermalito Forebay is located just southeast of the Campbell Hills, while the remainder of it is situated in flat valley land. The downstream edge of the reservoir is formed by a low earthfill dam (91 ft high at its highest point) that extends for more than 3 miles along Thermalito Forebay's southern edge. Thermalito Forebay Dam is one of the least visible major project features.

The hourglass shape of the reservoir results in two major segments, North Forebay and South Forebay. The majority of people who view Thermalito Forebay do so as recreationists from either of the two main recreation areas (the North and South Thermalito Forebay Recreation Areas), or as drivers from nearby transportation routes such as SR 70, Nelson Avenue, or Grand Avenue. Given the relatively flat, open, grass-covered terrain where Thermalito Forebay is located, most views from around Thermalito Forebay are expansive.

To represent existing aesthetic conditions and the types of views available from around the Diversion Pool and Thermalito Forebay, four KOPs were selected. The four KOPs are described in Table 4.11-3.

Because the Diversion Pool, Power Canal, and Thermalito Forebay are all designed to share the same operating water level and are essentially the same hydraulic system, the water levels in each of these facilities rise and subside in unison. The system does not fluctuate much on a daily basis. During the summer, it is generally cycled down 2–4 ft during the middle of the week and then refilled by the weekend. During the winter, it may fluctuate more for varying reasons. When the elevations of these facilities are 2–4 ft below full pool, there are varying amounts of exposed shoreline, which can offer visual contrast to the adjacent landscape. It can be assumed that elevations at the high end of

this range are considered more visually attractive to most viewers than elevations at the lower end of this range, which may be perceived by some viewers as unattractive.

Table 4.11-3. Diversion Pool and Thermalito Forebay Key Observation Points.

Location	Description
TD-1: Oroville Dam Road	Represents the aesthetic conditions of the view that people driving on Oroville Dam Road have of the spillway on the downstream face of Oroville Dam.
TD-2: Diversion Pool Day Use Area	Represents the aesthetic conditions of the southern part of the Diversion Pool from the adjacent access road.
TD-3: North Thermalito Forebay Recreation Area	Represents the aesthetic conditions of the east part of Thermalito Forebay from a very popular recreation area.
TD-4: South Thermalito Forebay Recreation Area	Represents the aesthetic conditions of the southern and western part of Thermalito Forebay from a primitive recreation area.

Source: SP-L4

However, because the Diversion Pool and Thermalito Forebay elevations change so little over much of the year and introduce two bodies of water into the landscape of the project area, operations do not have much of an influence on aesthetic environment of areas near the Diversion Pool and Thermalito Forebay.

Thermalito Afterbay

The approximately 4,300-acre Thermalito Afterbay is formed by a low “L”-shaped earthfill dam with a maximum height of 39 ft. The Thermalito Afterbay Dam extends for nearly 8 miles along the impoundment’s western and southern edges, and has a very flat, level, and linear appearance. The western edge of Thermalito Afterbay Dam runs parallel to SR 99. Thermalito Afterbay Dam is one of the most visible project features. Its linear form, shape, and uniform texture contrast highly with the surrounding landscape.

The north and east edges of Thermalito Afterbay (and several islands) are defined by the surrounding rolling terrain and have an undulating, natural appearance. Because the terrain that surrounds most of Thermalito Afterbay is either flat or rolling, and because Thermalito Afterbay is so large, views in this part of the project are open and extensive. On clear days, the Sierra Nevada foothills can be seen from many parts of Thermalito Afterbay. Other major aesthetic features in the vicinity of Thermalito Afterbay include the Feather River itself, which is visible from nearby areas in the southeast part of the project area; the SR 162 (Oroville Dam Boulevard) causeway and bridge that cross the north part of Thermalito Afterbay from west to east; SR 99 (which is located west of Thermalito Afterbay dam and next to the Thermalito Fish Hatchery Annex); several recreation areas (Monument Hill Recreation Site, Larkin Road Car-top Boat Ramp [BR], and the Wilbur Road Recreation Site); a few scattered residences; and parts of the undeveloped OWA (some of which are adjacent to Thermalito Afterbay and some of which can be viewed to the southeast from near the Thermalito Afterbay Outlet). Viewers of Thermalito Afterbay and surrounding landscape include people participating in activities such as boating, swimming, picnicking, fishing, and hunting; motorists; and people viewing Thermalito Afterbay from residences in the area.

To represent existing aesthetic conditions and the types of views available from around the Thermalito Afterbay, three KOPs were chosen (Table 4.11-4).

Table 4.11-4. Thermalito Afterbay Key Observation Points.

Location	Description
TA-1: Larkin Road	Represents the aesthetic conditions of the view that people using this primitive recreation area have of eastern portion of Thermalito Afterbay.
TA-2: Monument Hill Day Use Area	Represents the aesthetic conditions of the views that people using this developed recreation area have of the north part of Thermalito Afterbay.
TA-3: SR 99	Represents the aesthetic conditions of the views that people driving north on SR 99 have of the west side of the Thermalito Afterbay Dam (or levee).

Source: SP-L4

Thermalito Afterbay is a large, shallow, open body of water that has frequent water level fluctuations and a high surface-to-volume ratio. Thermalito Afterbay has several fluctuation cycles and daily, weekly, and occasional seasonal adjustments. Thermalito Afterbay generally fluctuates on a daily basis as a result of water releases from Lake Oroville (related to power generation) and releases into the Feather River. The amount of daily fluctuation varies depending on factors such as time of year, diversion rates, release rates, and type of water. Typical daily changes for most months for the years of 2001 (a dry year) and 2003 (a wet year) were between 1 and 2 ft, with changes more frequently in the 1-ft range.

Weekly fluctuations vary more than daily fluctuations as DWR attempts to adjust power generation into particular hours of the week. A common refill pattern is that Thermalito Afterbay is at its low point on Monday and builds storage capacity over the week to reach a maximum elevation on Saturday. After a maximum is reached on Saturday, Thermalito Afterbay is often decreased through the first part of Monday and the cycle frequently starts over. The weekly fluctuations usually range from 2 to 6 ft, although there are times during the year when the Thermalito Afterbay elevation is allowed to be higher or lower as a response to systemwide operations or energy prices. Fluctuations of approximately 9–11 ft sometimes occur during a several-week period and are most likely to occur in the winter. The general refill pattern of keeping Thermalito Afterbay highest on weekends and having fluctuations of between 2 and 6 ft results in a reservoir that generally looks “full,” although at the lower end of the range, shoreline and mudflats can be exposed in shallower areas. It can be assumed that elevations at the high end of this range are considered more visually attractive to most viewers than elevations at the lower end of this range. The lowest elevations that expose the greatest amount of shoreline and have the greatest adverse influence of Thermalito Afterbay occur infrequently and generally take place in the winter.

Low Flow Channel

The upper portion of the LFC below the Diversion Dam passes through the central part of the city of Oroville. Most of the area adjacent to this portion of the LFC is developed and includes project facilities, such as the Feather River Fish Hatchery (which includes

a 0.5-mile-long fish ladder, underwater fish viewing area, office, hatchery spawning building, rearing channels, lighted parking areas, and other facilities) and the 91-ft-high, 600-ft-long concrete fish barrier dam. The Feather River Fish Hatchery facilities contrast with the nearby landscape in terms of shape, color, and texture. The Fish Barrier Dam (and its waterfall) and the Fish Barrier Pool are generally visually compatible with their surroundings. Other non-project developments include the Feather River Nature Center, the Table Mountain Boulevard Bridge, scattered residences overlooking the LFC, and trails along the adjacent levee system. People who view the upper part of the LFC include passing motorists, recreationists, and visitors to the Feather River Fish Hatchery.

Lands adjacent to the LFC downstream of the SR 70 bridge are much less developed than those adjacent to the upper part, next to the central part of the city of Oroville. Much of the Feather River floodplain adjacent to the LFC, particularly along the lower portion, was drastically altered during hydraulic mining activities in the mid-1800s until the early 1900s. It is covered by coarse debris from the hydraulic mining era and mounded remains of dredge tailings, some of which were later used as material for the construction of Oroville Dam. The dredge tailings cover large areas and contain sinuous ridges of cobble, boulders, and gravel piles up to 40 ft in height. Various vegetation communities, such as riparian and oak woodlands, have become established throughout the area.

Views from within and near the LFC are variable due to adjacent topography, vegetation, and levels of development. Some areas have extensive open views of the LFC and other areas have restricted views. The majority of viewers see the upper portion of the LFC from areas near the city of Oroville. These areas include the levee and associated trail system, the Feather River Fish Hatchery complex, and the Feather River Nature Center. A number of people also have views of the LFC as they pass over it via bridges such as the Table Mountain Boulevard Bridge and the Table Mountain Bicycle Bridge. People who view the lower portion of the LFC do so from areas within the OWA, SR 70, or the Thermalito Afterbay Outlet, as well as other undeveloped access points.

To represent existing aesthetic conditions and the types of views available from the portion of the LFC situated near and within the FERC boundary, two KOPs were chosen. The two KOPS are briefly described in Table 4.11-5.

Table 4.11-5. Low Flow Channel Key Observation Points.

Location	Description
BR-1: Feather River Nature Center	Represents the aesthetic conditions of the views that people using the Nature Center have of the upper part of the LFC.
BR-2: Thermalito Afterbay Outlet	Represents the aesthetic conditions of the views that people recreating near this popular area in the lower part of the LFC have of the Thermalito Afterbay Outlet area and the Feather River.

Source: SP-L4

Oroville Wildlife Area

Although the OWA includes Thermalito Afterbay, this description focuses on the main portion of the OWA that is south and east of Thermalito Afterbay. The OWA consists of a series of ponds, levees, mining tailings, and flat and low-lying areas. Although the OWA is managed for wildlife, it supports recreation and contains limited camping, a one-lane boat ramp, several unimproved boat ramps, and a number of roads in varying conditions. Views within the OWA are varied; in some portions, sparse vegetation and flat terrain allow for expansive views, while in other areas, vegetation and dredge tailings limit views considerably. Views within the main part of the Clay Pit State Vehicular Recreation Area (SVRA) (which is not located within the FERC Project boundary) are more expansive due to the level topography of the area and the relative scarcity of shrubs and trees. Most use in the OWA and Clay Pit SVRA is dispersed, and views occur throughout the area.

To represent existing aesthetic conditions and the types of views available from the within the OWA, two KOPs were chosen and are described in Table 4.11-6.

Table 4.11-6. Oroville Wildlife Area Key Observation Points.

Location	Description
OWA-1: One-Mile Pond	Represents the aesthetic conditions of the views that people see from this area.
OWA-2: Bird Viewing Area	Represents the aesthetic conditions of the views that people see from this area.

Source: SP-L4

4.11.2 Noise

This section includes a summary of acoustic fundamentals and a description of existing ambient-noise conditions within the FERC Project area. Noise is generally defined as sound that is loud, disagreeable, or unexpected. Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). A commonly used unit for frequency is Hertz (Hz). The human ear is sensitive to frequencies from 20 Hz to 20,000 Hz (the audible range) and can detect the vibration amplitudes that are comparable in size to a hydrogen atom (USEPA 1974). Typical indoor and outdoor noise levels are presented in Figure 4.11-2.

4.11.2.1 Acoustic Fundamentals

Sound and the Human Ear

With respect to how humans perceive increases in noise levels, an increase of 1 A-weighted decibel (dBA) is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly perceptible, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment for this type of source.

Sound Propagation

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, is dependent on surface characteristics, atmospheric conditions, and the presence of physical barriers. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels.

Noise Descriptors

The selection of a proper noise descriptor for a specific source is dependent upon the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998; Lipscomb and Taylor 1978).

- L_{max} (maximum noise level): The maximum noise level during a specific period of time. The L_{max} may also be referred to as the “highest (noise) level.”
- L_{min} (minimum noise level): The minimum noise level during a specific period of time.

- L_X (statistical descriptor): The noise level exceeded X percent of a specific period of time.

- L_{eq} (equivalent noise level): The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}.

- L_{dn} (day-night noise level): The 24-hour L_{eq} with a 10-dBA "penalty" for the noise-sensitive hours between 10 p.m. and 7 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

- CNEL (community noise equivalent level): A noise level similar to the L_{dn} described above, but with an additional 5-dBA "penalty" for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If the same 24-hour noise data are used, the CNEL is typically approximately 0.5 dBA higher than the L_{dn}.

- SEL (single-event [impulsive] noise level): A receiver's cumulative noise exposure from a single impulsive-noise event, which is defined as an acoustical event of short duration and which involves a change in sound pressure above some reference value.

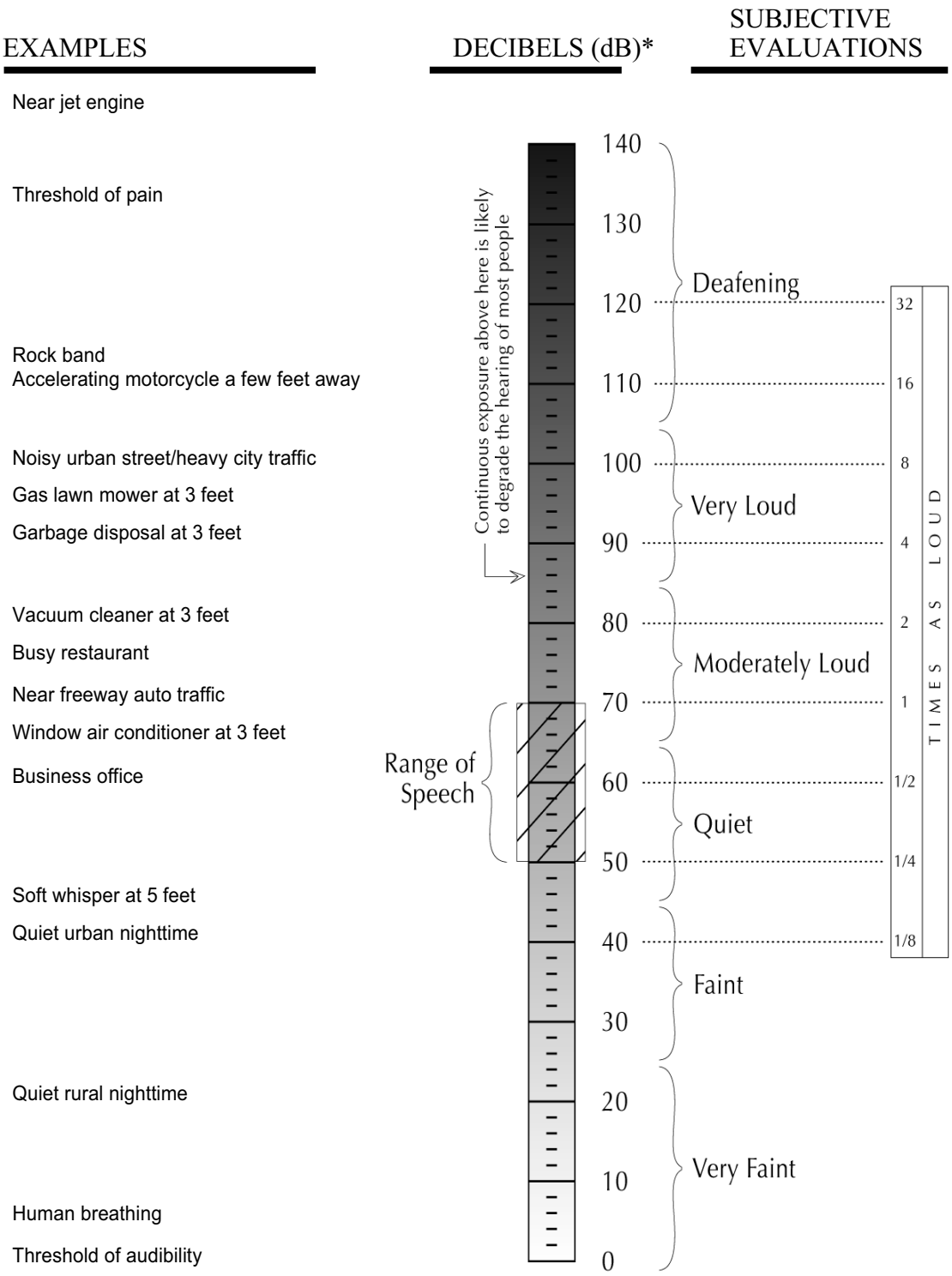
Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. Construction vibrations can be transient, random, or continuous. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 4.11-7 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 4.11-7. Human response to different levels of groundborne noise and vibration.

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Note: VdB = vibration decibels referenced to 1 microinch per second (µin/sec) and based on the root mean square (RMS) velocity amplitude.

Source: FHWA 1995



* dB are "average" values as measured on the A-scale of a sound-level meter.
Source: From *Concepts in Architectural Acoustics* (Egan 1972) and *The Noise Guidebook* (HUD n.d.).

Figure 4.11-2. Typical noise levels.

4.11.2.2 Existing Sensitive Receptors

Noise- and vibration-sensitive land uses generally include those uses where exposure would result in adverse effects (e.g., annoyance and structural damage), as well as uses where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other sensitive land uses include hospitals, convalescent facilities, parks, hotels, churches, libraries, and other uses where low interior noise levels are essential, including any uses where people sleep at night. With respect to the FERC Project area, existing noise-sensitive receptors consist primarily of urban and rural residences. Refer to Figures 4.6-2a, 4.6-2b, and 4.6-2c in Section 4.6, Land Use, for the locations of these noise-sensitive land uses. Note that the urban and rural residential land uses depicted in these figures have been identified as the existing noise-sensitive receptors.

4.11.2.3 Existing Noise Sources

The existing noise environment in and surrounding the FERC Project area is influenced by transportation noise emanating from rail traffic on the Union Pacific line, which runs north of Oroville through the Feather River Canyon; vehicular traffic on area roadways (e.g., SRs 70, 99, and 162); air traffic from the Oroville Airport and the Lake Oroville Landing Area Seaplane Base; and boat traffic on Lake Oroville. Noise from surrounding operations (e.g., commercial and industrial uses) and from outdoor activity areas (e.g., people talking, dogs barking, operation of landscaping and agricultural equipment) also contribute, to a lesser extent, to the existing noise environment.

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4.12 AIR QUALITY

The FERC Project area is located in Butte County, California, which is within the Northern Sacramento Valley Air Basin (NSVAB) and under the local jurisdiction of the Butte County Air Quality Management District (BCAQMD). Ambient air pollutant concentrations are determined by the amount of emissions released by pollutant sources and the ability of the atmosphere to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and the presence of sunlight. Therefore, existing ambient air quality conditions in the area are determined by such natural factors as topography, meteorology, and climate, in addition to the amount of emissions released by existing air pollutant sources, as discussed separately below.

4.12.1 Topography, Meteorology, and Climate

The NSVAB is relatively flat and is bordered by the North Coast Ranges to the west and the northern Sierra Nevada to the east. Air flows into the NSVAB through the Carquinez Strait, the only breach in the western mountain barrier, and moves across the Sacramento–San Joaquin Delta (Delta) from the San Francisco Bay Area.

Most precipitation in the area results from air masses that move in from the Pacific Ocean, usually from the west or northwest, during the winter months. More than half the total annual precipitation falls during the winter rainy season (November through February). The prevailing winds are moderate in speed and vary from moisture laden breezes from the south to dry land flows from the north.

The mountains surrounding the NSVAB create a barrier to airflow, which leads to the entrapment of air pollutants when meteorological conditions are unfavorable for transport and dilution. Poor air movement is most common in the fall and winter, when high-pressure cells are present over the NSVAB.

4.12.2 Existing Air Quality—Criteria Air Pollutants

Concentrations of ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable and fine particulate matter (PM_{10} and $PM_{2.5}$), and lead are used as indicators of ambient air quality conditions. These are the most prevalent air pollutants known to be deleterious to human health, and extensive health-effects criteria documents are available; therefore, these pollutants are commonly referred to as "criteria air pollutants." Table 4.12-1 describes attainment area standards, designations, and attainment for these criteria air pollutants.

Table 4.12-1. Ambient air quality standards and designations.

Pollutant	Averaging Time	California		National Standards [1]		
		Standards [2,3]	Attainment Status (Butte County) [4]	Primary [3,5]	Secondary [3,6]	Attainment Status (Butte County) [7]
Ozone	1-hour	0.09 ppm (180 µg/m^3)	N (Moderate)	– [9]	Same as Primary Standard	– [9]
	8-hour	0.070 ppm [8]	–	0.08 ppm (157 µg/m^3)		N
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m^3)	A	35 ppm (40 mg/m^3)	–	U/A
	8-hour	9 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)		
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	–	–	0.053 ppm (100 µg/m^3)	Same as Primary Standard	U/A
	1-hour	0.25 ppm (470 µg/m^3)	A	–		–
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	–	–	0.030 ppm (80 µg/m^3)	–	U
	24-hour	0.04 ppm (105 µg/m^3)	A	0.14 ppm (365 µg/m^3)	–	
	3-hour	–	–	–	0.5 ppm (1300 µg/m^3)	
	1-hour	0.25 ppm (655 µg/m^3)	A	–	–	–
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	20 µg/m^3	N	50 µg/m^3 [11]	Same as Primary Standard	U/A
	24-hour	50 µg/m^3		150 µg/m^3		

Table 4.12-1. Ambient air quality standards and designations.

Pollutant	Averaging Time	California		National Standards [1]		
		Standards [2,3]	Attainment Status (Butte County) [4]	Primary [3,5]	Secondary [3,6]	Attainment Status (Butte County) [7]
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m^3	N	15 µg/m^3	Same as Primary Standard	U/A
	24-hour	–	–	35 µg/m^3 [12]		
Lead [10]	30-day Average	1.5 µg/m^3	A	–	–	–
	Calendar Quarter	–	–	1.5 µg/m^3	Same as Primary Standard	A
Sulfates	24-hour	25 µg/m^3	A	**No National Standards**		
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m^3)	U			
Vinyl Chloride [10]	24-hour	0.01 ppm (26 µg/m^3)	U/A			
Visibility-Reducing Particle Matter	8-hour	Extinction coefficient of 0.23 per kilometer—visibility of 10 miles or more (0.07—30 miles or more for Lake Tahoe) because of particles when the relative humidity is less than 70 percent	U			

Notes: μg/m^3 = micrograms per cubic meter; ppm = parts per million

[1] *National standards (other than ozone, PM, and those based on annual averages or annual arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. The PM_{10} 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. The $PM_{2.5}$ 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the U.S. Environmental Protection Agency (USEPA) for further clarification and current federal policies.*

[2] *California standards for ozone, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards in Title 17, Section 70200, of the California Code of Regulations.*

[3] *Concentration expressed first in units in which it was promulgated (i.e., parts per million [ppm] or micrograms per cubic meter [μg/m^3]). Equivalent units given in parentheses are based on a reference temperature of 25 degrees Celsius (C) and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25 degrees C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.*

[4] *Unclassified (U): The data are incomplete and do not support a designation of attainment or nonattainment.*

Attainment (A): The state standard for that pollutant was not violated at any site in the area during a 3-year period.

Nonattainment (N): There was a least one violation of a state standard for that pollutant in the area.

Nonattainment/Transitional (NT): A subcategory of the nonattainment designation. The area is close to attaining the standard for that pollutant.

[5] *National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.*

[6] *National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.*

[7] *Nonattainment (N): Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.*

Attainment (A): any area that meets the national primary or secondary ambient air quality standard for the pollutant.

Unclassifiable (U): any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

[8] *This concentration took effect on May 17, 2006.*

[9] *The 1-hour ozone NAAQS was revoked on June 15, 2005.*

[10] *ARB has identified lead and vinyl chloride as toxic air contaminants with no threshold of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.*

[11] *USEPA has revoked the annual standard for PM_{10}; the revocation went into effect on December 18, 2006.*

[12] *The 24-hour standard for $PM_{2.5}$ has been reduced from 65 μg/m3to 35 μg/m^3, effective December 18, 2006.*

Sources: ARB Website, USEPA Website, Federal Register 2006

4.12.2.1 Monitoring Station Data and Attainment Area Designations

Criteria air pollutant concentrations are measured at several monitoring stations in Butte County. The Chico and Paradise stations are the closest monitoring stations to the FERC Project area with recent data for ozone, CO, NO_2, PM_{10}, and $PM_{2.5}$. In general, the ambient air quality measurements from these stations are representative of the air quality in the vicinity of the project area. Table 4.12-2 summarizes the air quality data from the most recent 3 years for these two monitoring stations. With respect to ozone, Butte County is currently designated by the U.S. Environmental Protection Agency as a nonattainment area for the State 1-hour and national 8-hour ambient air quality standards, respectively. Butte County is also designated as a nonattainment area for the State PM_{10} and $PM_{2.5}$ standards.

Table 4.12-2. Summary of annual ambient-air-quality data (2003–2005).

	2003	2004	2005
OZONE			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr/8-hr average, ppm)	0.092/0.076	0.088/0.073	0.083/0.077
Number of days State standard exceeded (1-hr)	0	0	0
Number of days national standard exceeded (1-hr/8-hr)	0/0	0/0	0/0
Paradise–4405 Airport Road			
Maximum concentration (1-hr/8-hr average, ppm)	0.101/0.091	0.103/0.094	0.092/0.085
Number of days State standard exceeded (1-hr)	5	2	0
Number of days national standard exceeded (1-hr/8-hr)	0/8	0/3	0/1
CARBON MONOXIDE (CO)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr/8-hr average, ppm)	3.9/2.54	3.6/2.86	3.3/2.74
Number of days State standard exceeded (8-hr)	0	0	0
Number of days national standard exceeded (1-hr/8-hr)	0/0	0/0	0/0
NITROGEN DIOXIDE (NO_2)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr average, ppm)	0.057	0.056	0.048
Number of days State standard exceeded	0	0	0
Annual Average (ppm)	0.011	0.011	0.009
FINE PARTICULATE MATTER ($PM_{2.5}$)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration ($\mu g/m^3$)	56.1	76.3	82.7
Number of days national standard exceeded (measured [1])	0	0	0

Table 4.12-2. Summary of annual ambient-air-quality data (2003–2005).

	2003	2004	2005
RESPIRABLE PARTICULATE MATTER (PM_{10})			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (μg/m^3)	54.0	115.0	60.0
Number of days State standard exceeded (measured/calculated [1])	1/5.8	5/30.2	3/–
Number of days national standard exceeded (measured/calculated [1])	0/0	0/0	0/0

Notes: 1-hr = 1-hour; 8-hr = 8-hour; μg/m^3 = micrograms per cubic meter; ppm = parts per million

[1] *Measured days are those days that an actual measurement was greater than the level of the State daily standard or the national daily standard. Measurements are typically collected every 6 days. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. The number of days above the standard is not necessarily the number of violations of the standard for the year.*

Sources: ARB Website 1, USEPA Website

4.12.3 Existing Air Quality—Toxic Air Contaminants

Concentrations of toxic air contaminants (TACs) are also used as indicators of ambient air quality conditions. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

According to the *California Almanac of Emissions and Air Quality* (ARB 2005), the majority of the estimated health risk from TACs can be attributed to relatively few compounds, the most important being PM from diesel-fueled engines (diesel PM). Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, and lubricating oil, and whether an emission control system is present. In addition to diesel PM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene are the TACs for which data are available that pose the greatest existing ambient risk in California.

According to the California Air Resources Board, three facilities in the vicinity of the project emit TACs: Sierra Pacific Industries, Pacific Oroville Power, and Granite Construction Company (ARB Website 2).

In addition, naturally occurring asbestos (NOA), which was identified as a TAC in 1986 by the California Air Resources Board, is located in many parts of California and is commonly associated with ultramafic rocks (Clinkenbeard et al. 2002). Asbestos is the common name for a group of naturally occurring fibrous silicate minerals that can separate into thin but strong and durable fibers. Ultramafic rocks form in high-temperature environments well below the surface of the earth. By the time they are

exposed at the surface by uplift and erosion, ultramafic rocks may be partially to completely altered to serpentinite, a type of metamorphic rock. Sometimes the metamorphic conditions are right for the formation of chrysotile asbestos or tremolite-actinolite asbestos in the bodies of these rocks or along their boundaries (Churchill and Hill 2000).

For individuals living in areas of NOA, there are many potential pathways for airborne exposure. Exposures to soil dust containing asbestos can occur under a variety of scenarios, including children playing in the dirt, dust raised from unpaved roads and driveways covered with crushed serpentine, uncontrolled quarry emissions, grading and construction associated with development of new housing, gardening, and other human activities. For homes built on asbestos outcroppings, asbestos can be tracked into the home and can also enter as fibers suspended in outdoor air. Once such fibers are indoors, they can be entrained into the air by normal household activities, such as vacuuming (as many fibers will simply pass through vacuum cleaner bags).

People exposed to low levels of asbestos may be at elevated risk (e.g., above background rates) of lung cancer and mesothelioma. The risk is proportional to the cumulative inhaled dose (number of fibers), and also increases with the time since first exposure. Although there are a number of factors that influence the disease-causing potency of any given asbestos, such as fiber length and width, fiber type, and fiber chemistry, all forms are carcinogens.

The U.S. Department of Conservation, California Geologic Survey (formerly the California Division of Mines and Geology) has prepared a General Location Guide for Ultramafic Rocks in California—Areas More Likely to Contain Naturally Occurring Asbestos (Churchill and Hill 2000). While geologic conditions are more likely for asbestos formation in or near these areas, the presence thereof is not certain. According to this guide, an area that is more likely to contain NOA is located within the northern Project boundary (Churchill and Hill 2000). Refer to Figure 4.12-1 for the locations of areas of serpentinite within the FERC Project boundary and project vicinity.

4.12.4 Existing Air Quality—Greenhouse Gases

Increasing awareness and study of the role that greenhouse gases (GHGs) have on climate change has resulted in the development of several methodologies for quantifying both natural releases and releases related to human activities of several GHG of interest, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluoronated gases. Human activities that result in the release of GHGs include but are not limited to motor vehicle use, wood and coal burning, feedlot and dairy practices, agricultural practices, flooding of vegetated surfaces for game refuges, and water storage/flood management facilities. Compared to emissions from thermal power projects, GHG emissions from hydropower projects are considerably more difficult to measure or estimate. Degassing fluxes from reservoirs vary seasonally and decrease over time. Emissions are dependent on complex biological and chemical cycles occurring in the reservoir that are driven by geography, climate, and types of flooded soils and vegetation. When a reservoir is first filled, a large quantity of biomass is

readily converted to CO_2 and CH_4, which is released through diffusion into the air at the reservoir surface, as well as through the migration of gas bubbles produced below the surface. Over time, the rate of GHG release from reservoirs decreases as the initial pulse of flooded biomass is consumed; however, GHGs continue to be fueled by whatever carbon enters the reservoir throughout its lifetime.

Few studies have been undertaken to quantify GHG emissions from reservoirs and hydropower projects, focusing primarily on facilities located in northern and tropical latitudes. However, the data to date suggests that GHG emissions from reservoirs in the western United States have lower CO_2 and CH_4 emissions than those in eastern and western Canada and Central/South America. This may be due to their age; their low amount of flooded organic matter; highly aerobic conditions, which lead to consumption of CH_4; and suspected greater role for photosynthesis in the withdrawal of CO_2. When the Oroville Facilities were constructed, most of the trees were cut and removed prior to inundation, lessening the amount of flooded organic matter. The Oroville Facilities are representative of this group of temperate reservoirs located in California that are generally older and located in regions where terrestrial vegetation is scarce with little or no peat accumulation, in valleys surrounded by hilly relief.

4.13 AGRICULTURAL RESOURCES

This section describes the agricultural resources within the project study area that could be affected by implementation of the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative. The discussion focuses on agricultural land use issues associated with potential effects of the alternatives on water temperatures at Thermalito Afterbay and related agricultural diversion points, which could, in turn, potentially affect rice yields and production in the Feather River Service Area (FRSA). It should be noted that, although the focus of this evaluation is on potential water temperature effects on rice yields and production, water temperature is only one of the contributing factors potentially affecting agricultural resources.

Four irrigation and water districts currently divert water from Thermalito Afterbay: the Western Canal Water District, the Richvale Irrigation District, the Butte Water District, and the Biggs–West Gridley Water District. Water is delivered within the FRSA via four water diversion locations, namely the Sutter Butte Main Canal, Western Canal, Richvale Canal, and the Western Lateral Canal (see Figure 4.13-1). The geographic extent of the FRSA defines the geographic scope of the potential effects of the Oroville Facilities on agricultural resources.

Under existing environmental requirements, DWR operates the Oroville Facilities to meet water temperature requirements in the Feather River for the protection of listed fish species and to meet water quality standards in the Sacramento–San Joaquin Delta. In addition, the Oroville Facilities provide water for agricultural diversions to senior water rights holders in Butte and Sutter counties. Agricultural operations in these counties enjoy major benefits from the Oroville Facilities through improved water supply reliability for agricultural diversions and flood management that increases agricultural productivity and reliability. In addition to improving the reliability of water supply availability for agricultural resources, the Oroville Facilities also have the potential to affect agricultural resources by influencing water temperatures at the four agricultural diversions located in the Thermalito Afterbay (see Figure 4.13-1).

Several variables that impact or have the potential to impact agricultural resources, and specifically rice production, are not evaluated in this section because they are not adversely affected by Oroville Facilities operations, the Proposed Project, or the FERC Staff Alternative. Examples of these unaffected agricultural resource–related variables include changes in the groundwater table, changes to water quality constituents not including water temperature, conversion of farmland due to construction or erosion, and additional aquatic weeds or weed seeds in the agricultural irrigation distribution and conveyance system, growers' cultural practices, and water management.

Prior to construction of Oroville Dam, several water districts in the Feather River watershed diverted water from the Feather River. DWR entered into agreements with the Western Canal Water District and the Joint Water Districts Board (JWDB) to provide water based upon their pre-1914 water rights (DWR 1969). The agreement between the JWDB, which includes the Richvale Irrigation District, the Biggs–West Gridley Water District, the Butte Water District, and the Sutter Extension Water District, and DWR

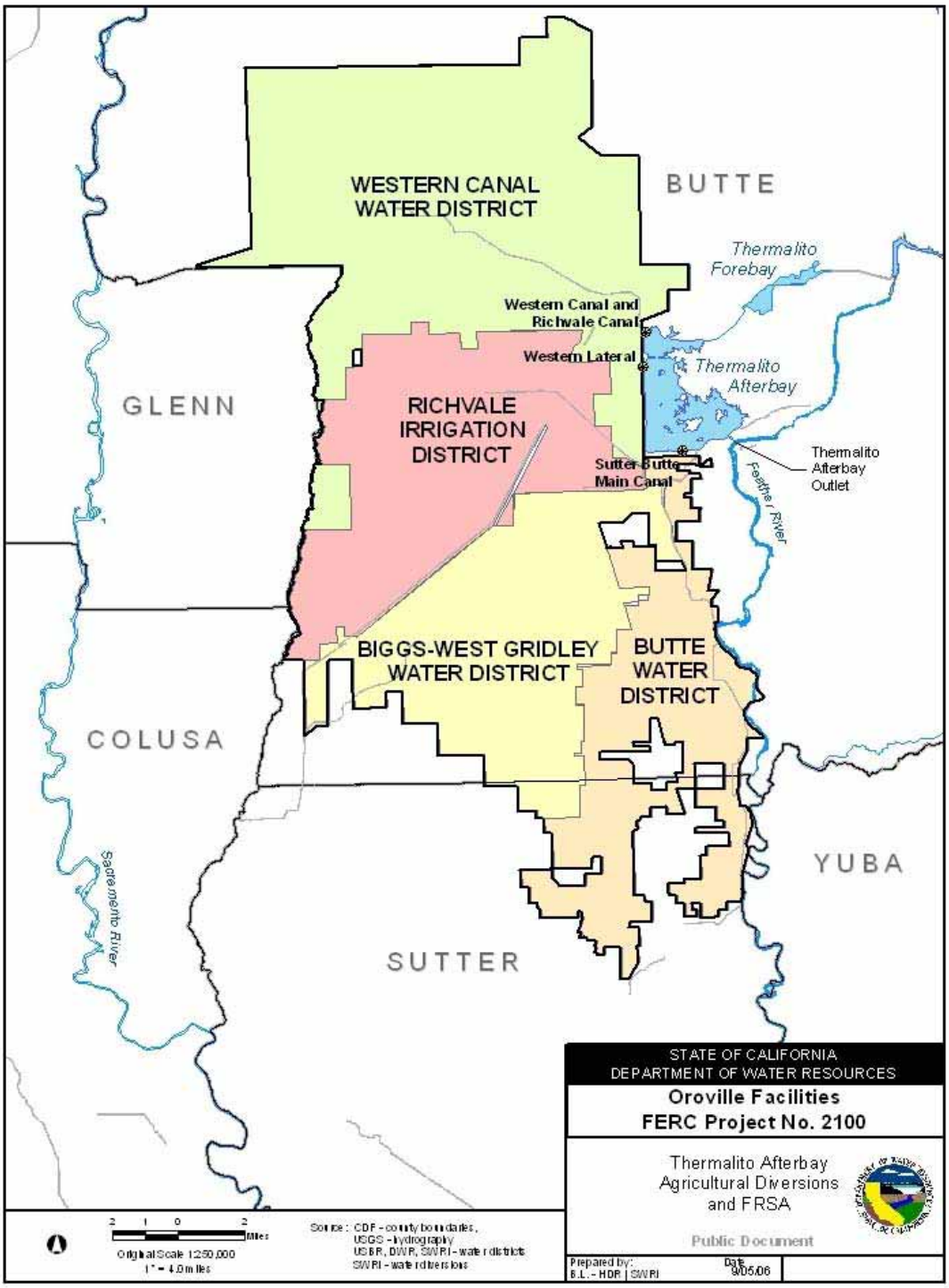


Figure 4.13-1. Thermalito Afterbay agricultural diversions and FRSA.

includes terms describing the amounts of water that the State shall make available to these districts. This agreement, signed May 1969, states that the "[d]istricts shall have the right to divert from the Feather River at the Thermalito Afterbay Diversion Structures each Irrigation Season, five hundred sixty thousand (560,000) acre-feet of water of the Feather River up to and including the year 1980 and five hundred fifty-five thousand (555,000) acre-feet each Irrigation Season thereafter" (DWR 1969). The May 1969 agreement between DWR and the Joint Water District does not contain specific water temperature or water quality goals or criteria. The agreement between DWR and the Western Canal Water District, signed during January 1986, superseded an agreement between DWR and Pacific Gas and Electric Company to provide water to the Western Canal for irrigation purposes. The January 1986 agreement specified that DWR would provide 295,000 acre-feet (af) of water from March 1 through October 31. Additionally, during the period from November 1 through March 1 DWR agreed to deliver additional water to the Western Canal Water District for additional beneficial uses. However, during drought years, some deliveries could be curtailed.

4.13.1 Current Agricultural-Related Water Diversions

The primary water use of FRSA-diverted water is for agricultural irrigation, although some water is allocated for habitat production (USBR et al. 2004). Agriculture-related land uses within the study area include fallow fields, hayfields, orchards, pastures, rice, row crops, and vineyards. The irrigation districts in the FRSA deliver water from the Oroville Facilities to approximately 172,568 acres of farmland in Butte and Sutter counties, of which approximately 114,000 acres is planted with rice. However, the actual acreage of rice planted varies from year to year depending on several variables including climatic conditions, economics, and crop rotations.

Currently, monthly irrigation diversions of up to 150,000 af are made from the Thermalito Afterbay during the May-through-August irrigation season. Annual diversions are slightly less than 1 million acre-feet (maf), leaving approximately 3 maf for flow in the Feather River downstream of the Oroville Facilities (DWR 2001).

Figure 4.2-12 in Section 4.2.2, Surface Water Quality, shows the relationship of the water temperatures at the diversions and the volume of water being diverted from Thermalito Afterbay when water is being used for rice production. Oroville Facilities operations affect the water temperatures and water temperature distribution in Thermalito Afterbay, which affect water temperatures at the agricultural diversions and the Thermalito Afterbay Outlet (see Section 5.2.2, Surface Water Quality, for additional information on project effects on water temperatures). Warmer water temperatures at the agricultural diversions would be beneficial to rice production, but potentially would conflict with coldwater fisheries management in the lower Feather River below the Thermalito Afterbay Outlet (see Section 5.4, Aquatic Resources, for additional information on effects of Thermalito Afterbay water temperatures on aquatic resources).

Oroville Facilities operations that affect Thermalito Afterbay water temperatures include Oroville Dam releases and those operational variables that determine the effective residence time of water in Thermalito Afterbay. Oroville Facilities operations that

determine the effective residence time of water in Thermalito Afterbay include: (1) the volume of inflows compared to the total releases from Thermalito Afterbay, including the Thermalito Afterbay Outlet and the agricultural diversions; (2) the Thermalito Afterbay stage elevation; and (3) power generation operations, including the frequency, magnitude, and duration of peaking and pump-back. The timing and magnitude of diversions from Thermalito Afterbay affect the residence time of water in the Thermalito Afterbay, which, in turn, influences the amount of warming that can occur in the Thermalito Afterbay prior to the agricultural diversion of the water. Specifically, increased volumes of agricultural diversions contribute to reduced water residence times during the irrigation season, which directly affects water temperatures at the agricultural diversions. Additionally, water warming can be further reduced during times when ambient air temperatures are cool, which limits warming in Thermalito Afterbay and in the agricultural conveyance canals. Agricultural diversion volumes and ambient air temperatures are independent of operation of the Oroville Facilities, which limits the opportunity to change operations to influence agricultural diversion water temperatures. (See Section 5.2, Surface Water, for more information on effects of the Oroville Facilities on Thermalito Afterbay water temperatures.)

Figure 4.2-12 in Section 4.2.2, Surface Water Quality, illustrates the water temperatures at the diversion locations during the early growing season, the pattern of water diversion volumes, and the relationship of diversion volume to the resulting water temperatures. Water temperatures for rice production are reported to be suitable above 60 degrees Fahrenheit (°F) to 65°F (Mutters et al. 2003a). Graphical representation of water temperatures shown in Section 4.2.2 indicates that the Western Canal diversion location remains below 65°F for the majority of the early growing season. Because of the relatively short residence time of water in the agricultural conveyance systems, especially during periods of high volumes of diversions and agricultural water deliveries, there is little opportunity for water to warm before it is delivered in the field at the point of use. After water is delivered to a rice field, it warms to an equilibrium with the ambient air temperature. Areas in the rice fields that are affected by delivery water temperatures are localized to the areas of the field immediately adjacent to the field water inlet. Later in the rice growing season, when ambient air temperatures are warmer and delivery volumes are lower, there is some warming of water within the conveyance systems, especially in the farthest reaches of the system at greater distances from the diversion location to the point of the water application.

The diversion locations for the Western Canal and Richvale Canal are located on the opposite side of the Thermalito Afterbay inlet in the northernmost portion of Thermalito Afterbay (Figure 4.13-1). The northern portion of Thermalito Afterbay has reduced circulation and mixing with the southern portion of the Thermalito Afterbay volume due to constriction from the SR 162 bridge structure.

Water entering the Thermalito Afterbay inlet from the power canal flows directly toward the northern diversions, which reduces the opportunity for the inflow to mix with warm water from the southern portion of the Thermalito Afterbay, and reduces inflow residence time. The physical proximity of the Thermalito Afterbay inlet water and the

Western Canal and Richvale diversion locations contribute to the reduced water temperatures at these locations in comparison to the Sutter Butte Main Canal diversion location shown in Figure 4.13-1. However, Oroville Facilities pump-back operations tend to draw warmer water from the main body of Thermalito Afterbay into the northern portion of the Thermalito Afterbay, providing some warming at the northern water diversion locations. The Sutter Butte Main Canal diversion is on the south side of Thermalito Afterbay, which allows water in the Thermalito Afterbay to warm by typically 4–6°F prior to diversion.

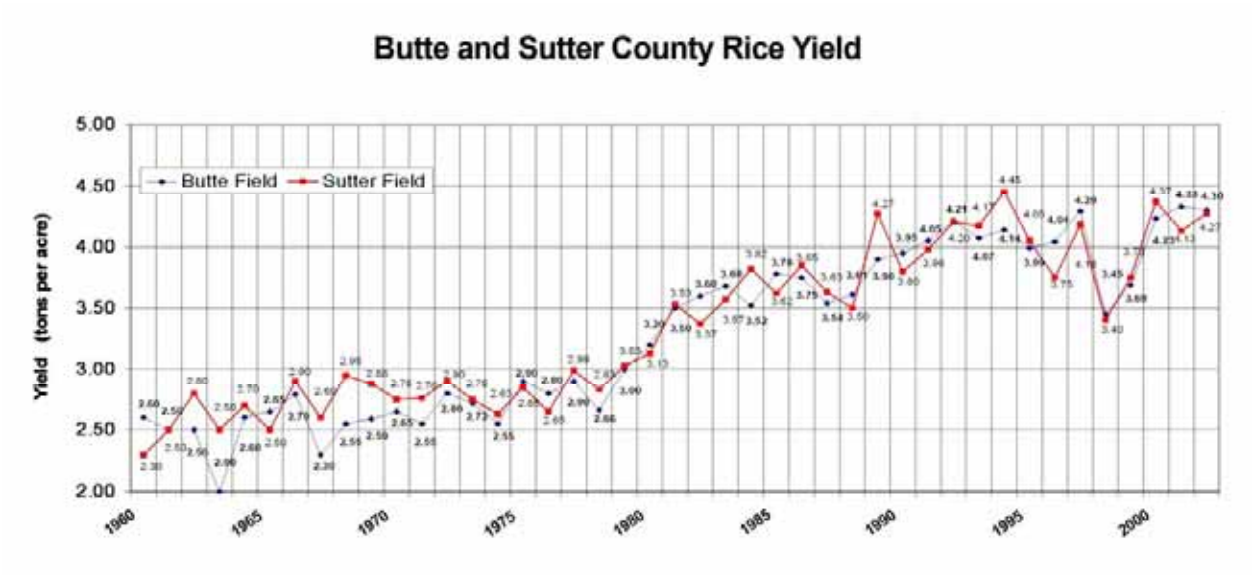
4.13.2 Agricultural Production

California is the number one agricultural producer in the United States, earning $27.6 billion in agricultural markets in 2001. The total land acreage dedicated to farming in California is 27.7 million acres, and 13 percent of the national gross cash receipts from farming can be attributed to California farming products (California Department of Food and Agriculture 2002). Rice ranks as the 32nd most valuable agricultural commodity produced in California. During 2001, rice production accounted for $209 million of the agricultural production value in California, or approximately 1 percent of California's total gross cash income from farming (California Department of Food and Agriculture 2002). The top 3 counties for rice production in California are Colusa (25.3 percent of the total value), Sutter (19.1 percent), and Butte (18.7 percent) (CASS Website).

Historically, Butte County's economy has been agriculturally based, and commercial agriculture continues to be the County's principal economic base (see Section 4.9.1, Population and Housing). The Feather River and groundwater are the largest sources used to meet the County's water demands. Butte County had approximately 381,532 acres of farmland in 2002 (NASS 2004), and farming accounted for 41.6 percent of the County's total inventoried land area of 917,909 acres (Farmland Mapping and Monitoring Program 2004a). The region supported approximately 256,519 acres of total cropland, of which 222,735 acres were irrigated land (NASS 2004). Rice is the highest total value crop grown in Butte County. Approximately 94,700 acres of rice were harvested in Butte County, which constituted approximately 18.7 percent ($101.2 million) of the value of California's rice production during 2002 (CASS Website). Other major crops in the County are almonds, walnuts, and plums.

Figure 4.13-2 shows rice yields over time for Butte and Sutter counties. The general trend in rice yield shows an increase over time. This increase in yields is attributable to a number of production factors, including rice variety genetics, fertilization practices, weed control, pest and disease management, increased acreage under production, and water supply reliability.

Sutter County also has a highly agricultural economy. Sutter County's water supply includes surface water from the Feather and Sacramento rivers, other surface water, surface water reuse, and groundwater wells (USBR et al. 2004). During 2002, 1,391 farms occupied 371,964 acres (NASS 2004) of the 389,439 total acres inventoried in the County (Farmland Mapping and Monitoring Program 2004b). The main agricultural



Source: Annual reports from and personal communications with Butte County Agricultural Commissioner's Office and Sutter County Agricultural Commissioner's Office

Figure 4.13-2. Rice yields over time in Butte and Sutter Counties.

commodities within the County during 2002 were rice, dried plums, peaches, and walnuts. Sutter County accounted for 19.1 percent ($103.1 million) of California's total rice production value during 2002 with more than 96,000 acres of rice having been harvested (CASS Website).

Rice is cultivated in the majority of the area under agricultural production in the FRSA (see Figure 4.13-3). Heavy red and gray clay soils and their associated low water infiltration rate characteristics make much of the areas to the northwest, west, and southwest of the Oroville Facilities ideal for rice production. These soil types also limit crop selection alternatives and account for the general monoculture of rice production in these areas. (See Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on soil types.) Crop types supported by water diverted from the

Thermalito Afterbay and downstream in the Feather River include field crops, pasture, deciduous fruit, and nuts. Other agricultural land uses that occur adjacent to the Oroville Facilities include dryland grain farming, grazing, truck crops, nurseries, ranchettes, and forestry upland of the Oroville Facilities.

4.13.3 Agricultural Land Designation

As part of the Land Inventory and Monitoring (LIM) system developed by the U.S. Department of Agriculture (USDA), definitions were established for designations of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. Farmland maps are created by the Farmland Mapping and Monitoring Program (FMMP), under the direction of the USDA. The FRSA farmland designations are provided in Figure 4.13-4.

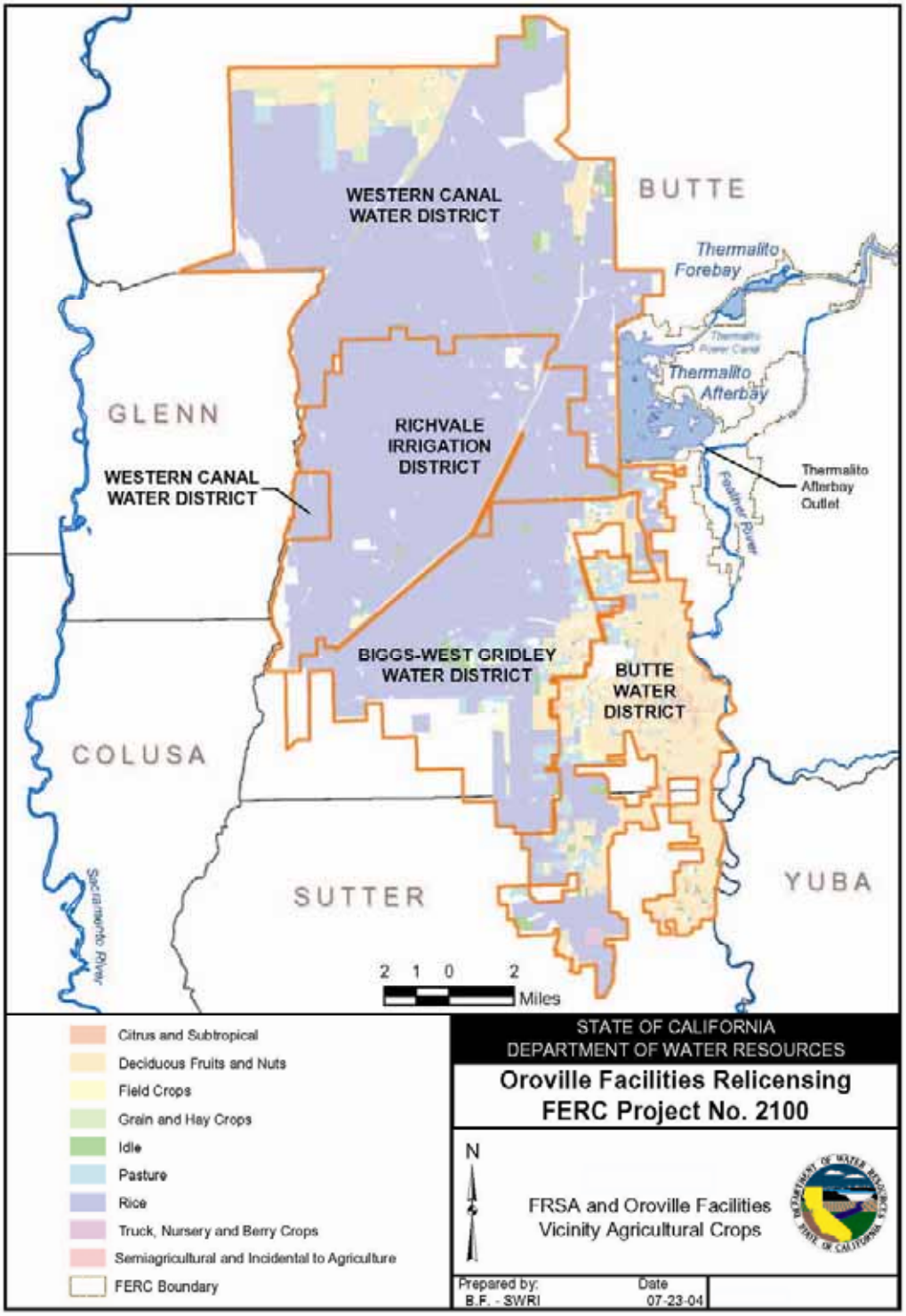


Figure 4.13-3. FRSA and Oroville Facilities vicinity agricultural crops.

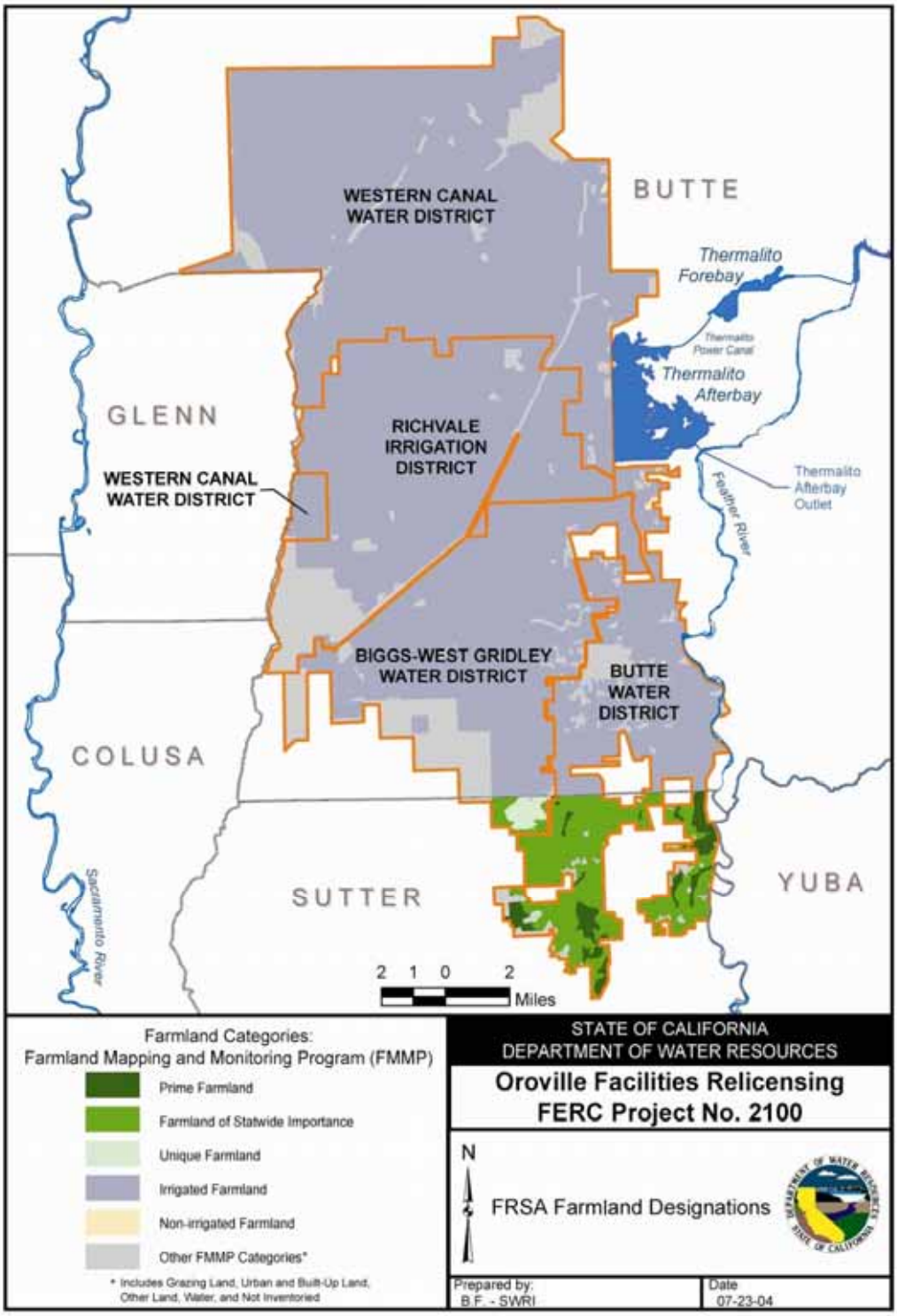


Figure 4.13-4. FRSA farmland designations.

Prime Farmland is land that has been deemed to encompass the best combination of physical and chemical characteristics for the production of crops. If treated and managed according to current farming methods, Prime Farmland has the soil quality, growing season, and moisture supply to produce sustained high crop yields. Ten categories, each with specific criteria, have been established for Prime Farmland. For farmland to meet the designation, it must meet criteria in all ten categories, which include water, soil temperature range, acid-alkali balance, water table, soil sodium content, flooding, erodibility, permeability, rock fragment content, and rooting depth.

Farmland of Statewide Importance includes lands not designated as Prime Farmland that have a good combination of physical and chemical characteristics for the production of crops. Eight of the above listed criteria for Prime Farmland must be met to allow for a designation of Farmland of Statewide Importance. Criteria for permeability and rooting depth are not required to be met for this categorization of farmland.

Unique Farmland cannot be either Prime Farmland or Farmland of Statewide Importance because it is land that does not meet the criteria for either land designation. However, Unique Farmland exhibits a particular combination of soil quality, location, growing season, and moisture supply such that the land produces a sustained high quality and/or high yield of a specific crop (e.g., oranges, avocados, rice) when managed according to current farming methods. Unique Farmland tends to be used for specific high-value crops, of which favorable conditions exist for the growth of the specific crop on the particular parcel of land. High-value crops are determined by the California Department of Food and Agriculture and are listed in its annual publication, *California Agriculture* (California Department of Food and Agriculture 2002).

The total acreage of each type of farmland designation in each water district, as determined by the FMMP, is provided in Tables 4.13-1 and 4.13-2. Approximately 6,300 acres of Prime Farmland within Sutter County are located in the FRSA. An interim mapping study has been conducted for Butte County. Where no farmland mapping study has been conducted, an interim mapping study typically is conducted, from which designations of land are made as either Irrigated Farmland or Non-irrigated Farmland. The interim designations collectively represent the four categories of farmland and are intended to be renamed after advanced soil surveys have been conducted. The total number of acres of farmland within the FRSA, as listed in Tables 4.13-1 and 4.13-2, represents the agricultural resource area potentially affected by Oroville Facilities operations.

Table 4.13-1. Farmland Mapping and Monitoring Program summary for Butte County by water district service area.

	Other		Irrigated Farmland[1]		Non-irrigated Farmland[1]		Unique Farmland		Farmland of Statewide Importance		Prime Farmland		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Western Canal WD	4,828	7	61,210	93	33	0	0	0	0	0	0	0	66,038	100
Richvale ID	5,079	14	32,287	86	0	0	0	0	0	0	0	0	37,366	100
Butte WD	2,215	12	15,617	88	60	0	0	0	0	0	0	0	17,832	100
Biggs–West Gridley WD	5,770	17	27,984	83	0	0	0	0	0	0	0	0	33,754	100

Notes: ID = Irrigation District; WD = Water District. Butte County contains only Interim Farmland map categories.

[1] *Two categories of Interim Farmland, Irrigated Farmland and Non-irrigated Farmland, are mapped in lieu of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. No Farmland of Local Importance occurs within the water district service areas of concern in Butte County. The "Other" category represents Grazing Land, Urban and Built-up Land, Other Land, Water, and Areas Not Mapped.*

Source: Farmland Mapping and Monitoring Program 2004a

Table 4.13-2. Farmland Mapping and Monitoring Program summary for Sutter County by water district service area.

	Other		Irrigated Farmland[1]		Non-irrigated Farmland[1]		Unique Farmland		Farmland of Statewide Importance		Prime Farmland		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Butte WD	3,126	8	0	0	0	0	130	0	27,262	74	6,278	17	36,796	100
Biggs–West Gridley WD	283	7	0	0	0	0	1,817	45	1,892	47	26	1	4,018	100

Notes: WD = Water District. Sutter County utilizes an Important Farmland Mapping system compiled by the Farmland Mapping and Monitoring Program.

[1] *The categories "Irrigated Farmland" and "Non-irrigated Farmland" are only used for Interim Farmland Maps. Therefore, no lands within the water district service areas of concern in Sutter County are designated as either Irrigated Farmland or Non-irrigated Farmland. No Farmland of Local Importance occurs within the water district service areas of concern in Sutter County. The "Other" category represents Grazing Land, Urban and Built-up Land, Other Land, Water, and Areas Not Mapped.*

Source: Farmland Mapping and Monitoring Program 2004b

4.13.4 Cultural Practices and Rice Production

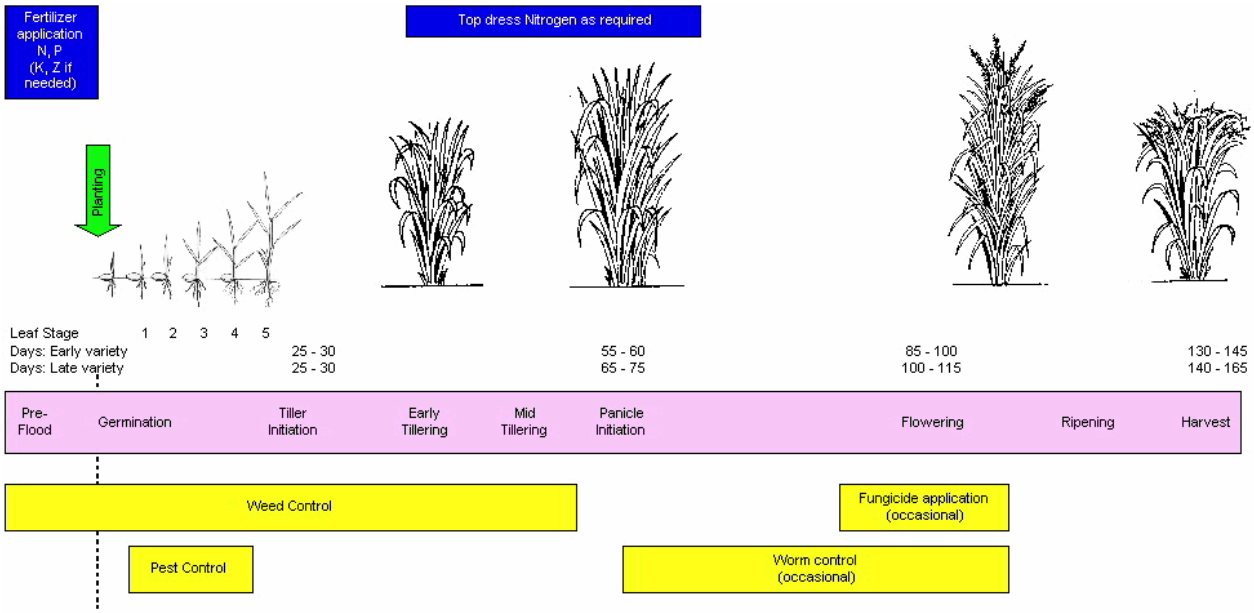
Irrigation water is an essential component of high-value agricultural crop production. Agricultural cropland is often irrigated before crop planting in the spring to leach accumulated salts out of the crop root zone and to recharge the moisture availability of the soil profile. Crops are irrigated at frequent intervals during the growing season; in the case of rice production, irrigation is nearly continuous, with the exception of some periods of water holding and recirculation for specific cultural practices related to herbicide and insecticide applications. For rice production, the field is often flooded after harvest to facilitate rice straw decomposition and provide waterfowl habitat. Because rice is the dominant crop type grown in the FRSA and is potentially affected by FRSA water temperatures, the remainder of this section focuses on rice production practices as they relate to the potential effects of water temperatures.

Rice production typically occurs on clays or other poorly drained soils with impervious layers. These soil types are fairly impermeable to water, which increases their water use efficiency for rice production. Rice is an aquatic crop requiring almost continuous flooding until the time of harvest. Fields intended for rice crop seeding typically are initially flooded during April or May, which accounts for the peak in agricultural water diversion volumes during this time period. Planting primarily occurs during April and May, with the majority of planting within the FRSA occurring during May.

Rice plants go through five growth stages: germination, tiller initiation, panicle initiation, flowering, and harvest (see Figure 4.13-5). Continually flowing water is needed for rice production. Water is reused through subsequent rice paddies several times before it is released back into the main water channel or agricultural drainage. Rice paddies are laser-leveled or contour-leveled so that there is a slight slope within the field to aid in the flow of water. Berms or checks are constructed to control the flow of water over the growing rice and to ensure that there is an equal water depth within each basin (UC Cooperative Extension Rice Project Website). Water depth management in rice production is important for weed control, rigorous rice crop growth, and management of potential plant diseases.

Pest management during rice cultivation often requires the use of pesticide applications. Under State regulations, treated waters are required to be held within fields to facilitate the breakdown of pesticides before draining. Holding water for the extended period of time required for decomposition of chemical pesticides can cause stress to rice if tailwater is not managed properly (UC Cooperative Extension Rice Project Website).

After the panicle initiation rice crop growth stage, the water level in the rice paddy often is raised to protect the reproductive organs of the plant from colder air temperatures at night. Sterility may occur if the panicle is exposed to air temperatures below 55°F 10–15 days before heading (UC Cooperative Extension Rice Project Website). Fields are not drained until the panicle is fully tipped and brown. Early drainage can result in low milling yields from breaking or cracking during harvesting if the kernels are not completely filled (UC Cooperative Extension Rice Project Website).



Source: California Rice Research Board Website 2004

Figure 4.13-5. Rice growth and cultural practice timeline.

Low water temperatures early during the growing season can cause delayed or failed germination, reduced growth rates, reduced or delayed tillering, panicle sterility, or seed head blanking (Williams and Wenning 2003). Yield reduction associated with cold water has been reported to be most pronounced when cold water exposure occurs early during the growing season (6–7 weeks after planting) (Mutters et al. 2003a, 2003b). However, reproduction, which occurs slightly later, also is reportedly affected by reduced water temperatures (Mutters 2003b).

Rice production requires warmer water during the spring and summer for germination and growth of rice (i.e., 65°F from approximately April through mid-May, and 59°F during the remainder of the growing season) (DWR 2001). Research indicates that a 100 percent yield loss can occur in locations exposed to water temperatures below 55°F in as little as 4 days (100 hours) of exposure, and about a 60 percent yield loss can occur in locations exposed to water temperatures below 60°F in as little as 8 days (200 hours) of exposure (Mutters et al. 2003a).

Effects of cold water on rice yield tend to be localized near the field irrigation inlet, although effects have been observed in adjacent checks where cold water has seeped though the dividing levee (Mutters et al. 2003b). Water applied to rice paddies is diverted from the main diversion canals via turnouts. The temperature of water entering the paddy tends to be the coldest water temperature in the field, such that losses to yield are most often observed in association with the turnouts, with decreasing expression of cold water–related effects in proportion to the distance from the turnout.

During 2005, DWR performed a study on six rice fields within the Western Canal Water District, Richvale Irrigation District, and Biggs–West Gridley Water District to determine the effects of water temperatures delivered from the Thermalito Afterbay on rice yields. The study was designed to confirm the cold water to rice yield relationship described in the literature (Mutters et al. 2003a, 2003b; Williams and Wenning 2003) and to determine the distribution of any potential impacts across each district and the FRSA. Preliminary results indicate that yield losses occur at approximately 260 hours of exposure to water temperatures below 65°F. The distribution of impacts across the FRSA is not currently available.

To avoid potential losses associated with cold water exposure, some growers use "warming checks," which are areas of the field at the turnout dedicated to warming field inflow water where either (1) there are no crop inputs or (2) increased yield losses associated with the cold water are expected. Warming checks can vary in size from approximately 1–5 acres depending on the inlet water temperatures and the volume of water flowing into the field, which is determined in part by the size of the field. In some locations, up to 10 percent of the field size can be reserved for the warming checks (pers. comm., Mutters 2004). The strategy of utilizing warming checks to obtain more suitable water temperatures may not be completely effective, particularly early in the season when temperatures are far below optimal (Cline 2002). Growers in the FRSA do not use dedicated warming checks as a common practice. Another strategy used for water temperature management in the field is the use of tailwater recirculation to blend warm water from the tail end of the field with the cooler water at the field inlet. Growers in the FRSA do not use field tailwater recirculation practices probably because of low water costs, increased pumping costs, and the amount of land required for the recirculation system conveyance.

4.14 TRANSPORTATION AND TRAFFIC

This section describes the current traffic and transportation systems in the project area that are affected by operation of the Oroville Facilities. It includes descriptions of local roads and State Highways in the vicinity of the project; provides current use data in terms of average annual daily traffic (AADT) and current and projected future levels of service (LOS); and provides current responsibilities for road maintenance.

Data on existing traffic conditions and Oroville Facilities access routes, obtained from study plan reports Study Plan R-1 (SP-R1), Vehicular Access Study (DWR 2003), and SP-9, Existing Recreational Use (DWR 2004a), as well as DWR visitor count data for the Oroville recreational area, Butte County Public Works traffic count data, Butte County Association of Governments (BCAG) traffic count data, and Butte County Regional Transportation Plan (BCAG 2004) were used to describe transportation and traffic conditions. Additionally, data from the PDEA were used to describe the environmental setting for traffic and roadway maintenance issues. These data were compiled from interviews with local service providers and from information developed during the relicensing studies, particularly information included in SP-R19, Fiscal Impacts (DWR 2004b).

4.14.1 Regional Setting

The project area is located in Butte County approximately 3 hours by car from the San Francisco Bay Area and 1.5 hours from the City of Sacramento. The county encompasses approximately 1,665 square miles in north central California. The western part of the county is located in the northern Sacramento Valley, while the eastern portion extends into the foothills of the Cascade Mountain Range.

Butte County has five incorporated cities that range from small farming communities to regional urban centers. The cities of Biggs and Gridley are located about 5 miles apart in the valley area in the southwest portion of the county, while the City of Chico is located farther north in the western valley area. The City of Oroville, the County seat, is located along the Feather River in the southern portion of the county, and the town of Paradise is on a ridge in the foothills of the Cascades near the center of the county. Numerous unincorporated communities also dot Butte County. Feather Falls, Berry Creek, and Brush Creek are in the Cascade foothills in the eastern portion of the county, while Paradise Pines, Magalia, Stirling City, Forest Ranch, Cohasset, and Butte Meadows are in the foothills in the north area. The western portion of the valley includes the communities of Dayton, Durham, Nelson, and Richvale, with Palermo, Honcut, Cherokee, and Forbestown farther to the east.

4.14.2 Transportation System

The project area is located in a generally rural area, and is served by a roadway network of State Routes and county and local roads. Three major highways, State Routes (SR) 70, 99, and 162, provide regional transportation access to the Oroville Facilities area. Two major interstate highways—Interstates (I) 5 and 80—connect to

these three State Routes. Figure 4.14-1 illustrates the primary regional roadways. The project area is also served by the Oroville Airport and the Lake Oroville Landing Area Seaplane Base.

4.14.2.1 State Route 70

SR 70 is a two-lane north-south highway that provides one of the main connections between Butte County and the rest of the state. SR 70 also continues east through the Feather River Canyon and includes some of the most scenic and historic vistas in the region. Figure 4.14-2 illustrates the location of State Route 70. Extending north from SR 99 in Sutter County, SR 70 travels along the east side of the Feather River through Oroville. The route then traverses the Feather River Canyon, through Quincy in Plumas County, finally terminating at SR 395 near the Nevada border. While along most of its length through Butte County SR 70 is a 2-lane rural highway, the route becomes a 4-lane freeway from just south of Oroville to SR 149.

4.14.2.2 State Route 99

SR 99 is a primary connection between Butte County and the surrounding region. As shown in Figure 4.14-3, the overall state route extends from I-5 south of Bakersfield to Red Bluff via numerous valley communities including Fresno, Modesto, Sacramento, and Yuba City. SR 99 bisects Butte County along the west side of the Feather River through Gridley and Chico. Although the route is primarily a 2-lane rural highway through Butte County, it is a 4-lane expressway/freeway from SR 149 to just north of Chico.

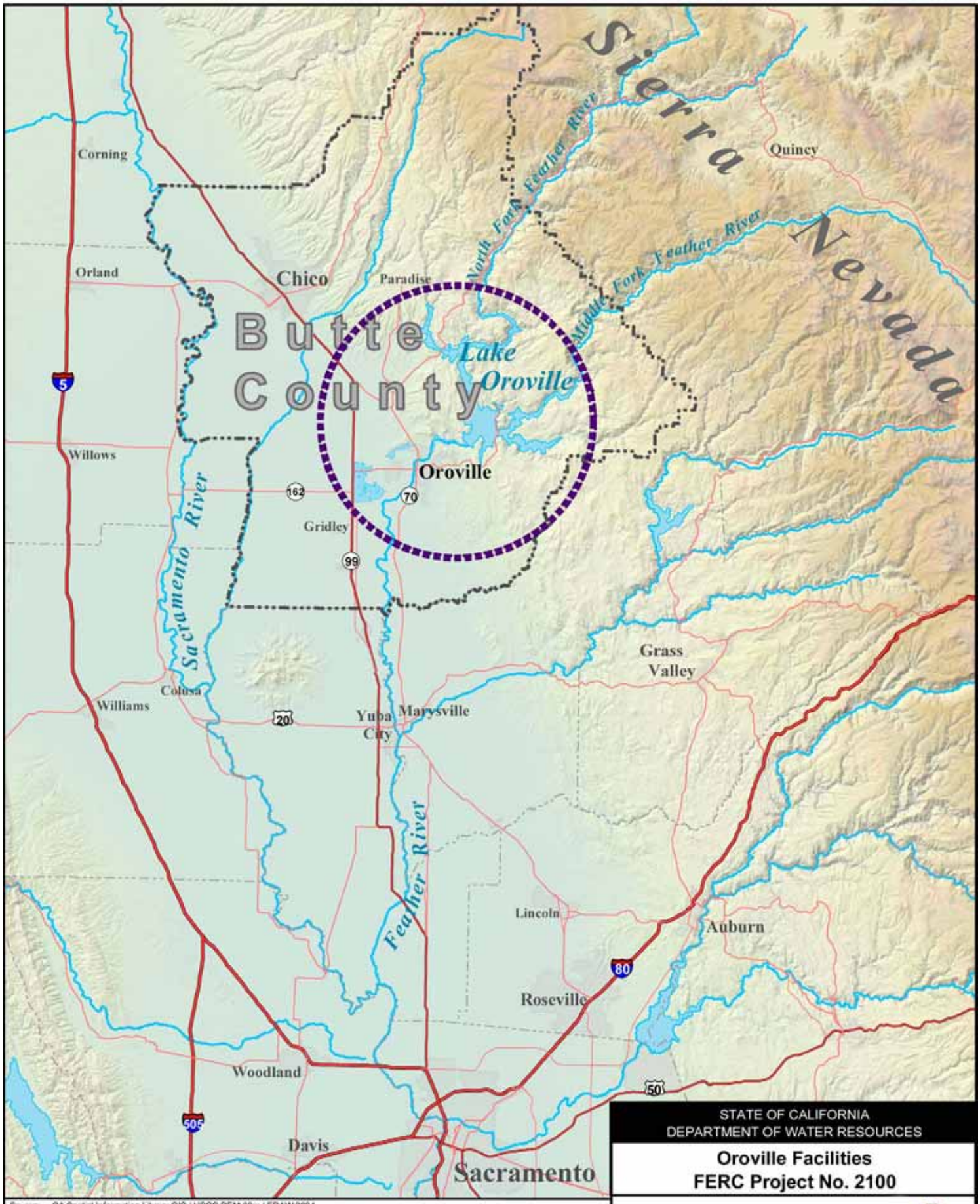
4.14.2.3 State Route 162

SR 162 provides an east-to-west connection for rural communities in the North Valley. The overall route starts at U.S. 101 north of Willits and the route temporarily ends upon entering the west side of the Coast Range mountains. As noted in Figure 4.14-4, SR 162 picks up again on the east side of the Coast Range mountains, extending through Elk Creek and Willows, and ending east of the City of Oroville near Berry Creek. This route is primarily a rural two-lane highway, but in the Oroville area the segment of SR 162 from SR 70 to Olive Highway is a 4-lane arterial road with a continuous left-turn lane. While the State Highway designation ends just past Lake Oroville, the road itself continues as Oroville-Quincy Highway to connect with Quincy via Berry Creek and Bucks Lake.

Several roadway operational projects are planned both within and to the east of the City of Oroville, from Oroville Dam Boulevard to Kelly Ridge Road.

4.14.2.4 Oroville Facilities Connecting Roads and On-Site Roads

The Oroville Facilities are accessed by various County roads and City of Oroville streets, and access to individual areas is provided by on site roads.



Source: CA Spatial Information Library GIS / USGS DEM 30m / EDAW 2004

10 5 0 10 20 Miles

Original Scale 1 : 760,320
1" = 12 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Figure 4.14-1

Primary Regional Roadways

Prepared by: PJ -- EDAW, Inc.
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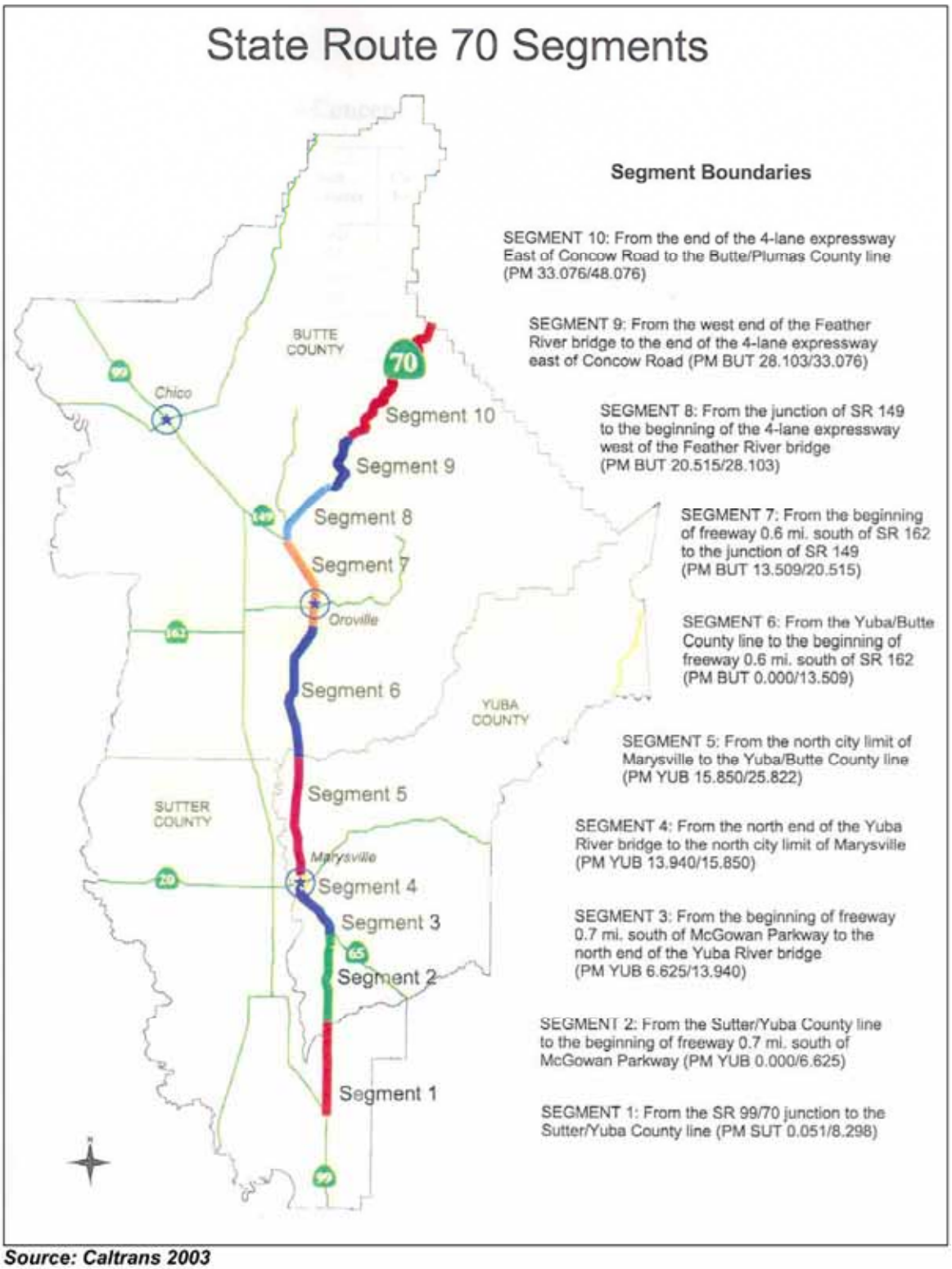
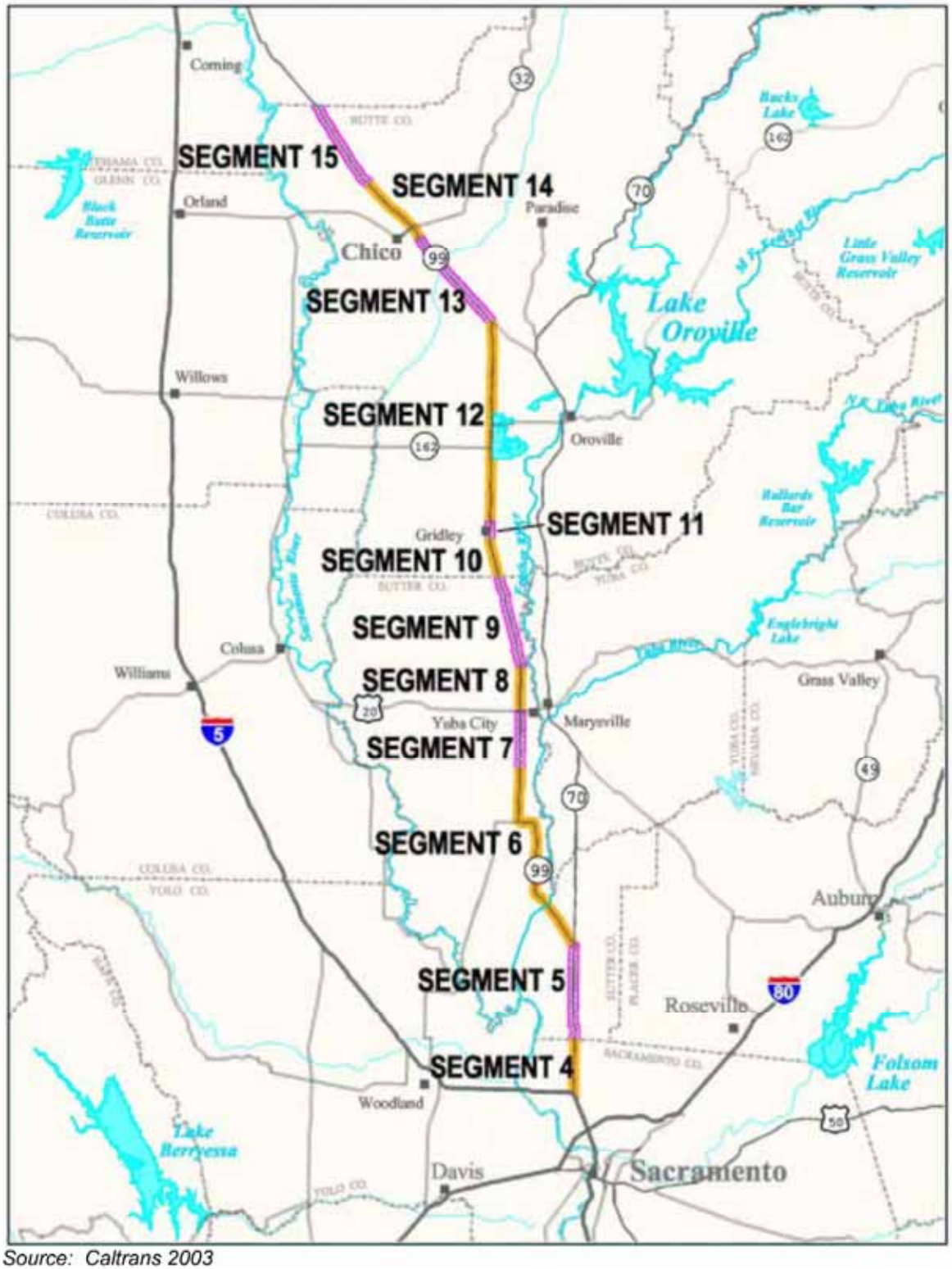


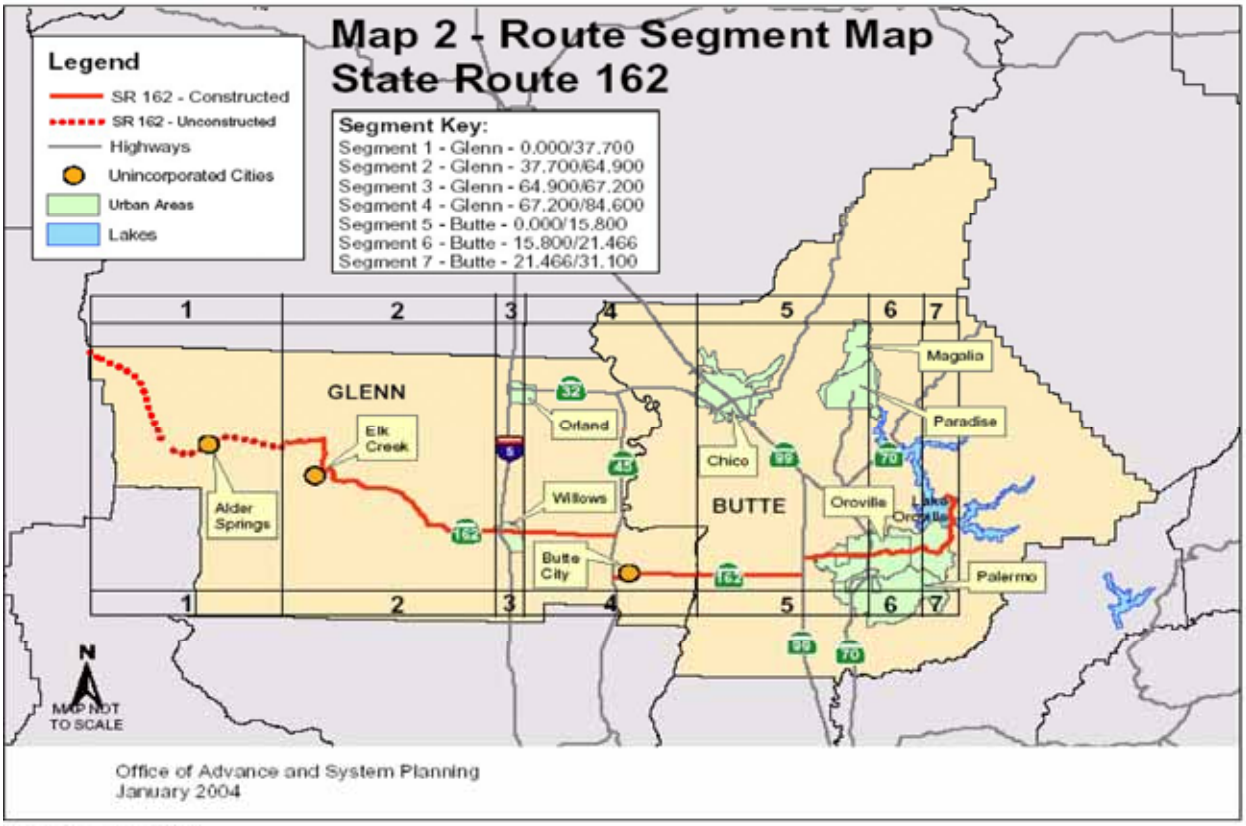
Source: Caltrans 2003

Figure 4.14-2. Road Segments on State Route 70.



Source: Caltrans 2003

Figure 4.14-3. Road segments on State Route 99.



Source: Caltrans 2004.

Figure 4.14-4. Road segments on State Route 162.

Oroville Dam Boulevard/Oroville Dam Boulevard East connects central Oroville with Oroville Dam. West of Olive Highway, this road is designated as SR 162. Canyon Drive provides access between SR 162 and Oroville Dam. Traffic on the road and highway network in and near the Oroville Facilities is normally free-flowing with little congestion, and roads are in generally good to adequate condition.

Recreation visitation at the Oroville Facilities results in traffic on local roadways. Traffic levels in the Oroville area are generally low; however, recreation use during peak holiday periods can result in short-term traffic congestion, particularly near the marinas and high-use recreation areas and parking lots.

The highest use areas include Bidwell Canyon, Lime Saddle, North Thermalito Forebay, Loafer Creek, Lake Oroville Visitors Center, and Spillway Day Use Area (DUA). The majority of heavy traffic is associated with recreational use of these areas. Many of the recreational visitors' cars and trucks tow boat trailers, which can affect traffic conditions, and many of the roads that lead to the high-use sites pass through residential neighborhoods and commercial areas in and around the City of Oroville.

A vehicular access study for the Oroville Facilities Relicensing (part of SP-R1, Vehicular Access Study (DWR 2003)) was prepared by DWR. That study provides detailed

information regarding recreational access to the project area, including number of visitors to particular areas of the project area, and road conditions.

4.14.2.5 Air Access

In addition to the regional roadways described above, the Oroville Airport is 3 miles southwest of the City of Oroville and is accessible from SR 162. The airport maintains two runways and air traffic averages approximately 99 arrivals/departures per day (AirNav Website).

The Lake Oroville Landing Area Seaplane Base is 5 miles northeast of the City of Oroville with a 9,000-foot-diameter circular landing zone in the center of the lake. Seaplane operations at the Lake Oroville Landing Area Seaplane Base average approximately 25 arrivals/departures per year (AirNav Website).

4.14.3 Existing Traffic Volumes/Levels of Service

4.14.3.1 State Highways

Table 4.14-1 lists ranges of AADT volumes reported by Caltrans for the state routes in Butte County, while LOS reported in the Transportation Concept Reports (TCR) for these routes is presented in Table 4.14-2.

Level of Service is a quantitative measure of the quality of traffic flow roads or through intersections. Levels of service are assigned letter designations, with LOS A representing the best operating conditions, smooth traffic flow, and LOS F the worst with traffic at a standstill. Two-lane highways can be rated lower, because they present problems for passing if congestion is present. Congestion can be created by just a few slow-moving vehicles when passing becomes difficult or dangerous on a two-lane highway.

AADT on SR 70 in Sutter, Yuba, and Butte Counties ranges between 1,500 and 31,500 (Table 4.14-1). Table 4.14-2 identifies recent and projected LOS for segments of SR 70 in these counties. LOS on SR 70 ranges between A and E, with LOS in Butte County rated from A to E.

AADT on SR 99 in Sacramento, Sutter, and Butte Counties ranges between 10,900 and 75,000 (Table 4.14-1). Table 4.14-2 identifies recent and projected LOS for each segment of SR 99. LOS on SR 99 is rated from B to E in these counties. In Butte County, LOS is rated from A to E.

AADT on SR 162 ranges between 1,050 and 32,000 (Table 4.14-1). The current and projected LOS for each segment are listed in Table 4.14-2. In Butte County, LOS is rated B and E.

Traffic on the road and highway network in and near the Oroville Facilities is normally free flowing with little congestion. Of the 24 segments of State Routes in the project area, 12 have LOS ratings of C or better. The main highway road segments

Table 4.14-1. Annual average daily traffic (AADT) on State Highways.

Route	From (postmile)	To (postmile)	2005 Annual Average Daily Traffic
SR 70	Yuba County line (0.00)	Beginning of Freeway south of Oroville (13.51)	12,100 to14,900
	Beginning of freeway South of Oroville	SR 162 (Oroville) (13.90)	14,900
	SR 162	Montgomery Street (Oroville) (14.61)	23,300
	Montgomery Street	Grand Avenue (Oroville) (15.43)	31,500
	Grand Avenue	Nelson Avenue (Oroville) (15.72)	23,600
	Nelson Avenue	End of Freeway (20.14)	21,600
	End Of Freeway	SR 149 (20.48)	21,600
	SR 149	SR 191 (21.87)	8,200
	SR 191	Plumas County line (48.08)	3,100 to 1,450
SR 99	Sutter County line (0.00)	Wilson Street (Gridley) (4.12)	16,400 to 19,200
	Wilson Street (Gridley)	Spruce Street (Gridley) (4.38)	23,100
	Spruce Street (Gridley)	SR 162 (east) (13.16)	15,100 to 10,900
	SR 162 (east)	SR 149 (21.81)	11,100
	SR 149	Begin Freeway (30.40)	25,500
	Begin Freeway	Skyway (Chico) (30.60)	34,000
	Skyway	East 20th St (Chico) (31.50)	52,000
	East 20th St	SR 32 (Chico) (32.45)	72,000
	SR 32	Cohassatt Hwy (Chico) (34.25)	75,000 to 61,000
	Cohassatt Hwy	East Avenue (Chico) (34.93)	42,500
	East Avenue	End of Freeway (37.32)	29,000 to 19,500
	End of Freeway	Tehama County Line (45.98)	19,500 to 11,900
SR 162	Glen County line (0.00)	SR 99 (Biggs) (9.73)	1,500 to 1,050
	SR 99 (9.73)	12th Street (Oroville) (14.96)	2,700 to 8,600
	12th Street	SR 70 (Oroville) (15.83)	13,200
	SR 70	Washington Ave (Oroville) (17.55)	32,000 to 30,500
	Washington Avenue	Lower Wyandotte Road (Oroville) (18.01)	29,000
	Lower Wyandotte Rd	Foothill Blvd (18.46)	20,900
	Foothill Blvd	Canyon Drive (21.26)	12,400 to 11,000
	Canyon Drive	Forbestown Road (24.19)	7,600 to 4,550
	Forbestown Road	Foreman Road (31.07)	1,850 to 1,500

Source: Caltrans Website 2006

Table 4.14-2. Level of service (LOS)[1] for road segments.

State Route 70					
Milepost	**County**	**Segment**	**2003 LOS**	**20 Year No-Build LOS**	**Concept LOS [2]**
0–0.3	Sutter	1	D	F	C
0–6.6	Yuba	2	D	F	C
6.6–13.9		3	C	F	D
13.9–15.9		4	C	F	D
15.9–25.8		5	D	F	D
0–13.5	Butte	6	E	F	D
13.5–20.5		7	A	B	B
20.5–28.1		8	D	D	C
28.1–33.1		9	A	A	C
33.1–18.1		10	D	D	E
State Route 99					
Milepost	**County**	**Segment**	**2000 LOS**	**20 Year No-Build LOS**	**Concept LOS**
32.1–36.9	Sacramento	4	C	F	E
0–8.9	Sutter	5	B	E	C
14.3–41.2		6	E	C	C
25.0–30.6		7	C	E	D
30.6–35.0		8	C	E	E
35.0–42.4		9	E	F	D
0–3.1	Butte	10	E	F	D
3.1–4.8		11	E	F	D
4.8–24.8		12	E	F	D
30.6–37.8		13	B	C	C
30.6–37.8		14	D	F	C
37.8–46.0		15	E	F	D
State Route 162					
Milepost	**County**	**Segment**	**Current LOS**	**20 Year No-Build LOS**	**Concept LOS**
37.7–64.9	Glenn	2	B	B	D
64.9–67.2		3	A	A	D
67.2–84.6		4	B	C	D
0–15.8	Butte	5	E	F	E
15.8–21.466		6	B	C	B

[1] *Level of Service ratings for two-lane highways: A = no delays, B = no delays, C = minimal delays, D = minimal delays, E = significant delays, F = considerable delays (Source: TRB 2000).*

[2] *Concept LOS is the goal that Caltrans has for various road segments. Implementation is based on prioritization of funding allocations and constraints.*

Sources: Caltrans Website 2003; pers. comm., Flournoy 2003

approaching Lake Oroville have impaired drivability. Caltrans plans to improve State Routes with regular congestion as budget allocations allow (pers. comm., Van Valen 2003). The *Interregional Transportation Strategic Plan* identifies the portion of SR 70 between its junction with SR 99 in Sutter County and SR 149 in Butte County (segments 1–7) as a "High-Emphasis Focus Route," which means it is one of Caltrans' highest priority routes for project planning and programming. The intent is to improve this portion of SR 70 to full freeway standard (Caltrans 2003).

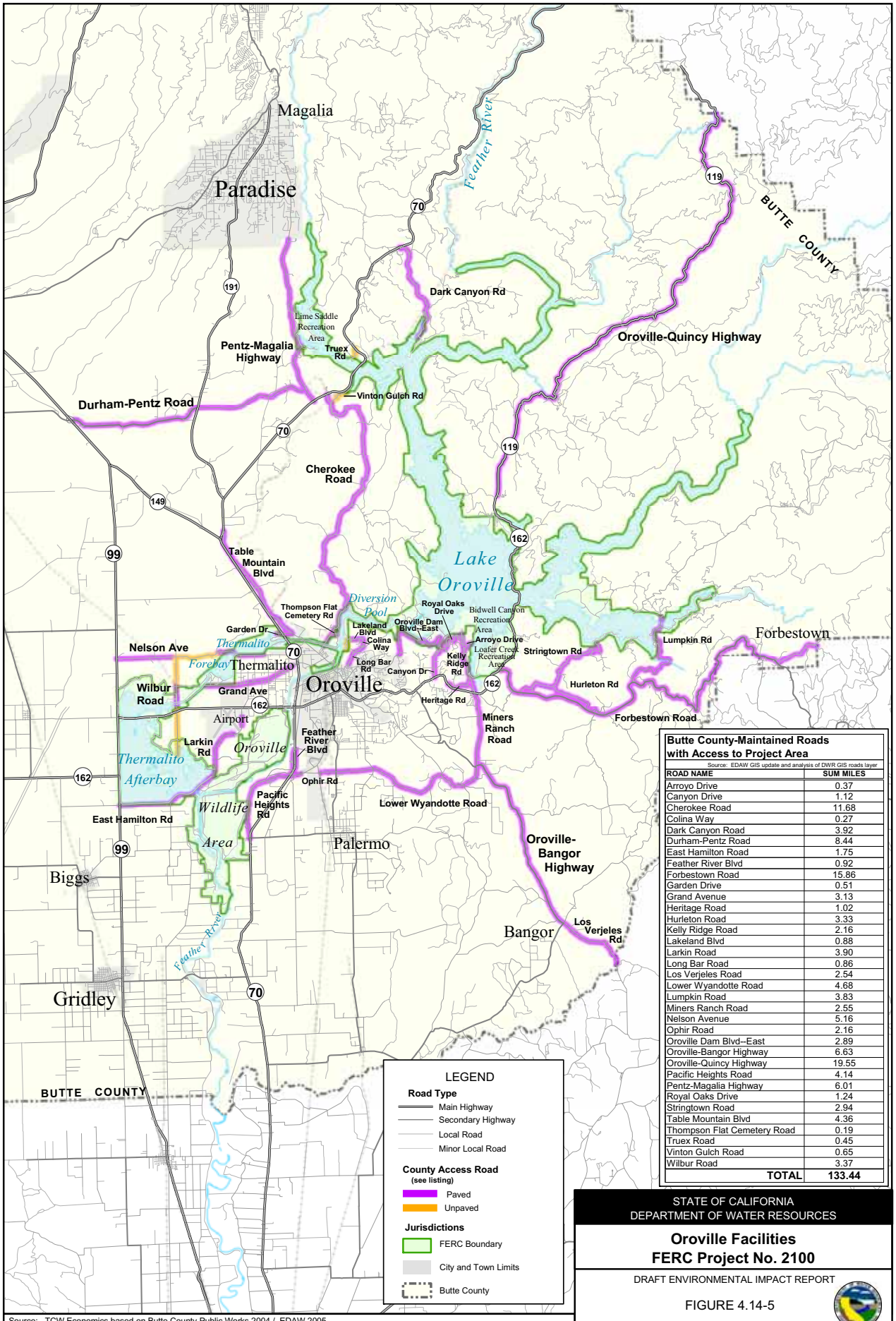
4.14.3.2 Butte County Roads

Butte County roads are used by visitors (i.e., non-residents of unincorporated Butte County) to access the Oroville Facilities. Although several of the roads heavily used by recreationists to reach popular recreation sites in the LOSRA are either State-maintained highways (e.g., SR 70, SR 162) or City of Oroville-maintained streets (e.g., Oroville Dam Boulevard, Montgomery Street), a number of County-maintained roads are also regularly or sometimes used to reach the Oroville Facilities. According to the Butte County Public Works Department (pers. comm., Crump 2003; Edell 2003), the roadway access shown in Figure 4.14-5 and summarized in Table 4.14-2 is used by visitors. Information relative to recreational access was provided in SP-R1, Vehicular Access Study (DWR 2003), for these roadway segments. More information related to these roads is provided in Section 4.14.4.1 below.

Table 4.14-3 identifies daily traffic volumes reported by local agencies for these roads. Data collected in 2006 is identified, along with volumes reported by Butte County for the year 2001, 2002, or 2003.

The Levels of Service occurring on Butte County Roads can be suggested based on generalized Level of Service thresholds contained in Regional Transportation Plan or the Butte County General Plan Circulation Element. Table CIR-8 of the General Plan suggests daily traffic volumes that can be accommodated on various roadways at specific Levels of Service. Two-lane surface streets are shown to accommodate up to 9,600 ADT at LOS A, 11,200 ADT at LOS B, and 12,800 ADT at LOS C. The Regional RTP categorizes Levels of Service based on peak hour traffic volume, but the peak hour methodology can be generally applied to daily volumes by conservatively assuming that 10% of the daily traffic occurs during the peak hour. RTP thresholds designate all traffic conditions as LOS C or better and do not make use of LOS A or B designations. The limit of the LOS C threshold is generally 9,000 ADT on two lane roads urban streets and 5,000 ADT on rural roads. In this DEIR, the RTP thresholds, which are lower, have been used to identify the current operating Level of Service on Butte County roads.

As noted in Table 4.14-3, all study area roads carry traffic volumes that are indicative of LOS C conditions.



Butte County-Maintained Roads with Access to Project Area

Source: EDAW GIS update and analysis of DWR GIS roads layer

ROAD NAME	SUM MILES
Arroyo Drive	0.37
Canyon Drive	1.12
Cherokee Road	11.68
Colina Way	0.27
Dark Canyon Road	3.92
Durham-Pentz Road	8.44
East Hamilton Road	1.75
Feather River Blvd	0.92
Forbestown Road	15.86
Garden Drive	0.51
Grand Avenue	3.13
Heritage Road	1.02
Hurleton Road	3.33
Kelly Ridge Road	2.16
Lakeland Blvd	0.88
Larkin Road	3.90
Long Bar Road	0.86
Los Verjeles Road	2.54
Lower Wyandotte Road	4.68
Lumpkin Road	3.83
Miners Ranch Road	2.55
Nelson Avenue	5.16
Ophir Road	2.16
Oroville Dam Blvd--East	2.89
Oroville-Bangor Highway	6.63
Oroville-Quincy Highway	19.55
Pacific Heights Road	4.14
Pentz-Magalia Highway	6.01
Royal Oaks Drive	1.24
Stringtown Road	2.94
Table Mountain Blvd	4.36
Thompson Flat Cemetery Road	0.19
Truex Road	0.45
Vinton Gulch Road	0.65
Wilbur Road	3.37
TOTAL	**133.44**

Source: TCW Economics based on Butte County Public Works 2004 / EDAW 2005

3 1.5 0 3 6 Miles

Scale 1 : 190,080
1" = 3 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE 4.14-5

County-Maintained Access Roads Serving Project Area

Prepared by: PJ -- EDAW, Inc.
Date 3/29/07
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Table 4.14-3. Traffic volumes on connecting roads.

Road	From	To	Daily Volume	Level of Service
Arroyo Drive			n.a.	-
Canyon Drive			3,199**	C
Cherokee Road	Oroville City limits	Burma Road	528**	C
Colina Way	Long Bar Road	Lakeland Blvd	n.a.	-
Dark Canyon Rd			n.a.	-
Durham Pentz Road			8,289 to 2,255*	C
Feather River Blvd	Outside of City limits		1,870**	C
Forbestown Road	Oroville Quincy Highway	Butte County line	2,978*	C
Garden Drive			1,484**	C
Grand Avenue	West of city limits		601**	C
East Hamilton Road			98**	C
Heritage Road			256*	C
Hurleton Road			426**	C
Kelly Ridge Road			2,187**	C
Lakeland Blvd			n.a.	-
Larkin Road	SR 162	East Hamilton Rd	2,828**	C
Lime Saddle Road			341**	C
Long Bar Road	City limits	Colina Way	930**	C
Los Verjeles Road	La Porte Road	Butte County line	996*	C
Lower Wyandotte Rd	Ophir Road	Oroville Bangor Highway	7,210*	C
Lumpkin Road	Forbestown Road	North shore of South Fork	649**	C
Miners Ranch Road			2,777*	C
Nelson Avenue	West of city limits		995**	C
Ophir Road	Beyond City limits		6,999*	C
Oroville Bangor Highway	Miners Ranch Road	La Porte Road	2,036*	C
Oroville Dam Blvd	East of Glen Drive		1,586**	C
Oroville Quincy Highway	East Fork Canyon Creek	County line	375*	C
Pacific Heights Road			1,101**	C
Pentz Magalia Road	Paradise limits	SR 70	1,653**	C
Royal Oaks Drive	Canyon Drive	Kelly Ridge Rd	1,211**	C
Table Mountain Blvd	Outside City of Oroville		n.a.	-
Thompson Flat Cemetery Road			n.a.	-
Truet Road			n.a.	-
Vinton Gulch Road			n.a.	-
Wibur Road			n.a.	-

*Sources: *BCAG 2006, **Butte County 2006*

LOS thresholds per 2004 Butte County Regional Transportation Plan (BCAG 2004).

4.14.4 Road Maintenance

Roads and highways in the vicinity of the project area are in generally good to adequate condition. Caltrans maintains State Routes and interstate highways in the area. Three major highways, SR 70, 99, and 162, provide transportation access to the Oroville Facilities area. Two major interstate highways—I-5 and I-80—connect to these three State Routes. Butte County and the City of Oroville maintain the majority of local roads used to reach the project area, including the area immediately surrounding the Lake Oroville State Recreation Area (LOSRA). DWR maintains the roads within the project area (i.e., the area within the project boundary) that are not encompassed within the LOSRA. DPR maintains roads within the LOSRA.

The following sections describe existing project-related road maintenance issues for local roadways, including those maintained by Butte County and the City of Oroville, based on information contained in SP-R19, Fiscal Impacts (DWR 2004b), prepared by DWR for the Oroville Facilities Relicensing.

4.14.4.1 Roads Maintained by Butte County

In 2003, the Butte County Public Works Department maintained about 1,355 miles of County roads within unincorporated areas of Butte County (pers. comm., Phillips 2003). The use of County roads by visitors (i.e., non-residents of unincorporated Butte County) to access the Oroville Facilities increases the County's need to regularly maintain these roads. Although several of the roads heavily used by recreationists to reach popular recreation sites in the LOSRA are either State-maintained highways (e.g., SR 70, SR 162) or City of Oroville-maintained streets (e.g., Oroville Dam Boulevard, Montgomery Street), a number of County-maintained roads are also regularly or sometimes used to reach the Oroville Facilities. According to the Butte County Public Works Department (pers. comm., Crump 2003; Edell 2003) and roadway access information provided by SP-R1, Vehicular Access (DWR 2003), the following roadway segments, shown in Figure 4.14-5, are used by visitors:

- Kelly Ridge Road;
- Oroville Dam Boulevard between Glen Drive and Powerhouse Road;
- Canyon Drive between Olive Highway and Oroville Dam Boulevard;
- Royal Oaks Drive between Canyon Drive and Kelly Ridge Road;
- Oroville Quincy Highway between East Fork Canyon Creek and the Butte County Line;
- Forbestown Road between Oroville Quincy Highway and the Butte County line;
- Lumpkin Road from Forbestown Road to the north shore of the South Fork Feather River arm of Lake Oroville;

- The portion of Ophir Road outside of the City of Oroville;
- Lower Wyandotte Road between Ophir Road and Oroville Bangor Highway;
- Miners Ranch Road;
- Oroville Bangor Highway between Miners Ranch Road and La Porte Road;
- Los Verjeles Road between La Port Road and the Butte County line;
- Pentz-Magalia Road south of the Paradise City Limits to SR 70;
- Durham Pentz Road;
- Vinton Gulch Road;
- Truet Road;
- Dark Canyon Road;
- Cherokee Road between the Oroville City Limits and Burma Road;
- Thompson Flat Cemetery Road;
- Long Bar Road between the Oroville City Limits and Colina Way;
- Colina Way between Long Bar Road and Lakeland Boulevard;
- Lakeland Boulevard;
- Nelson Avenue west of the Oroville City Limits;
- Wilbur Road;
- Grand Avenue west of the Oroville City Limits;
- Larkin Road between SR 162 and East Hamilton Road;
- East Hamilton Road;
- Pacific Heights Road;
- Arroyo Drive;
- Heritage Road;
- Garden Drive;
- The portion of Feather River Boulevard outside of the City of Oroville;
- Hurelton Road; and
- The portion of Table Mountain Boulevard outside of the City of Oroville.

These roadway segments total an estimated 133.4 miles (Figure 4.14-5). Additionally, according to Butte County's report, *Operational Impacts of the Oroville Facilities Project on Butte County* (Butte County Office of the Chief Administrative Officer 2006), 8 County-owned dirt and gravel roads totaling 30.3 miles are used exclusively by recreationists to access project facilities. However, FERC staff, as part of their analysis

of road maintenance effects in the FERC DEIS prepared for the Oroville Facilities Relicensing, concluded, based on their review of relevant information and a site visit, that only 1.5 miles of these roads are within the FERC Project boundary and that none of the roads are used exclusively by recreationists to access the Oroville Facilities.

In addition to roads listed above used by recreationists, Glenn Drive, is approximately a two-mile long road and connects Oroville Dam Boulevard to Oroville-Quincy Highway. Glenn Drive is regularly used by State employees and those conducting State business to reach DWR and DPR headquarter facilities. In addition to the State facilities, there are also numerous local residences either located on, or accessed from, Glenn Drive.

No data are available concerning the percentage of roadway use and wear that is associated with non-residents of unincorporated Butte County who visit the Oroville Facilities. (Recreationists who live in Butte County already use County roads, causing wear on roadways). Roadway use and wear, however, can be approximated based on consideration of roadway use by recreation visitors compared to use by the resident population of unincorporated Butte County. Based on recreation use estimates provided by SP-R9, Existing Recreation Use (DWR 2004a), non-residents of unincorporated Butte County (including residents of incorporated cities in the county) who visit the Oroville Facilities add, on average, an estimated 1,910 persons to the county's daily resident population, accounting for 0.9 percent of the countywide resident population and 2.0 percent of the unincorporated area's resident population. This increase in the area's population suggests that non-resident visitors account for about 0.9 to 2.0 percent of the maintenance needed for the roads used by non-resident recreationists. (Note that residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact County roads even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates cited above likely overestimates the actual use of County roads attributable to visitation to the Oroville Facilities.)

4.14.4.2 Bridges and Roads Maintained by DWR or Other State Entity Partnering with DWR

DWR owns and maintains the structural portions of several bridges utilized by the public in Butte County, while Butte County or Caltrans maintains the decking portion (or roadway) of the bridges. Since 1995, DWR has expended $1.2 million on the following bridge structures:

- Recreation Access Road (Oroville Dam Spillway);
- SR 162 (Bidwell Bar Bridge);
- SR 162 (Canyon Creek Bridge);
- SR 162 (Thermalito Afterbay);
- SR 70 (Power Canal);
- SR 70 (West Branch Feather River);

- Lumpkin Road (Enterprise Bridge);
- Recreation Access Road;
- Cherokee Road;
- Table Mountain Boulevard;
- Nelson Avenue;
- Wilbur Road;
- Larkin Road; and
- Hamilton Road.

The following roads are maintained by DWR, DPR, or other State entity partnering with DWR at the Oroville Facilities:

- 1.8 miles of Oroville Dam Boulevard from Oroville Powerhouse Road to the upper Canyon Drive intersection with Oro Dam Boulevard;
- Canyon Drive between both upper and lower Royal Oaks Drive intersections;
- The roadway across the top of the Oroville Dam Crest Road;
- Roadways throughout the LOSRA;
- Car-top BR access roads at Vinton Gulch, Goat Ranch, and others;
- Paved boat ramp access roads at Monument Hill, Larkin Rd, and Thermalito Afterbay Outlet BR/DUA; and
- Thermalito Diversion Dam Access Road (south side of Feather River past Feather River Nature Center, access to Sewim Bo).

4.14.4.3 Roads Maintained by the City of Oroville

With the exception of SR 70 and SR 162, which are maintained by Caltrans, the Oroville Public Works Department maintains streets within Oroville's city limits. Maintenance activities include shoulder grading, pothole patching, crack sealing, chip sealing, and asphalt overlaying. Although Caltrans maintains SR 162, which includes a portion of Oroville Dam Boulevard and Olive Highway (two roadway segments heavily used by Lake Oroville recreationists), the City of Oroville maintains several other streets often used by recreationists and visitors to reach recreation sites, including the portion of Oroville Dam Boulevard between its intersections with Olive Highway and Glen Drive, Montgomery Street between SR 70 and Oroville Dam Boulevard, Nelson Avenue and Table Mountain Boulevard between SR 70 and Montgomery Street, Cherokee Road between Table Mountain Boulevard and the city limits, and the portion of Ophir Road within the city limits. Several other city streets, including 1st Avenue, 5th Avenue,

Feather River Boulevard, and Arlin Rhine Drive, are used to reach recreation sites along the Feather River (pers. comm., Boulant 2003; Gibbons 2003).

The Oroville Public Works Department maintained about 90 total miles of streets and roads during 2002 (Revenue & Cost Specialists 2002). The city-maintained streets and roads identified as being regularly used by recreationists total an estimated 9.8 miles. Visitors traveling to the Oroville Facilities account for an unknown portion of the use and wear on these streets and roads, but visitor use can be approximated based on the effect that out-of-town visitors have on the total population that regularly uses Oroville's streets. Based on Oroville Facilities recreation use estimates, non-resident visitors add an average of 1,900 persons to the city's resident population, accounting for an estimated 12.5 percent of the resident population of Oroville. Assuming that the average non-resident visitor generates the same amount of wear on roadways as an average resident, non-resident visitors to the Oroville Facilities account for about 12.5 percent of the maintenance required for the estimated 9.8 miles of city streets and roads used by visitors.

4.15 PUBLIC HEALTH AND SAFETY

This section addresses public safety issues in the Oroville Facilities Project area, including hazardous materials concerns that may be associated with operation of the Oroville Facilities.

4.15.1 Hazardous Materials

Hazardous materials are defined in Section 66260.10, Title 22, of the California Code of Regulations as:

> A substance or combination of substances which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of or otherwise managed.

Hazardous materials within the FERC Project boundary are managed through the coordination of federal, State, and Butte County laws, regulations, and programs. A thorough search of available environmental databases has indicated that there are 36 sites within the City of Oroville area. This search indicates where there is some type of hazardous materials information, whether it relates to existing underground storage tanks, aboveground storage tanks, hazardous materials handling, hazardous waste generation, or hazardous materials spill incidents. There appear to be no significant hazardous materials or waste issues within the FERC Project boundary. DWR conducts its hazardous materials and wastes management activities within the requirements of local, State, and federal laws and regulations.

4.15.2 Environmental Contamination

The Oroville Facilities support a wide variety of recreational opportunities. These opportunities include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. Contaminant accumulation in fish, sediment, and the aquatic food chain has been identified as an issue of concern. Contamination of fish from mercury and other metals and organic contaminants is a significant concern in many areas of California, including the Feather River watershed. Lake Oroville tributaries in the upper Feather River watershed experienced significant gold mining activity during the Gold Rush era and continue to experience recreational gold mining activity. Numerous large mercury mines were developed in the Coast Range to supply mercury as an amalgam for gold extraction in the Feather River and other areas. Mercury lost to the tributaries during gold mining operations is slowly being transported downstream with sediments. Although the Gold Rush era has long since passed, mercury still remains in the streams tributary to and in Lake Oroville.

Potentially occurring anoxic conditions beneath the sediment/water interface at the reservoir bottom create ideal conditions for biologically mediated liberation of methylmercury by sulfate-reducing bacteria. The redistribution of methylmercury in the water column during lake mixing in the fall and winter may facilitate bioaccumulation into the food web, including plankton, fish, and piscivorous birds and other animals, including humans. In addition, other industrial activities in the upper Feather River watershed have contributed metal and organic contaminants, including polychlorinated biphenyls (PCBs), which also have an affinity for sediments and bioaccumulate in the food web. Re-suspended sediments and recycled metals and organic contaminants in Lake Oroville can be transported downstream to other project waters, including the Diversion Pool, Thermalito Afterbay, Thermalito Forebay, Oroville Wildlife Area ponds, and the Feather River, where uptake and bioaccumulation in aquatic organisms can occur. Sediments trapped behind Oroville Dam potentially contain metals and organic contaminants, which may bioaccumulate in the food web.

In addition to the potential anoxic conditions, which create ideal conditions for the liberation of methylmercury, an algal bloom was reported on June 27, 2005. DWR staff investigated an algal bloom reported on Middle Fork Arm of Lake Oroville. The water level at the Merrimac station was fairly low and the amount of attached algae in the water at the site appeared to be very high. Staff boated up the Middle Fork Arm and reported seeing algae pushed by the wind against the shore near Nutmeg Creek. This algal mass eventually expanded so that by the time they reached the 90-degree turn at the north end of the arm, the entire waterway was covered.

The algae were identified as the blue-green algae (*Anabaena flos-aquae*). Blue-green algae are actually a type of bacteria called cyanobacteria that grow in water and are photosynthetic. Blooms occur when algae that are normally present begin to reproduce rapidly, typically a result of warm water and slow-moving waters that are rich in nutrients. Blue-green algae produce toxins that can affect the nervous system, liver, promote the development of tumors, or affect the gastrointestinal system. Upon evaluation, no booms were necessary to surround the algal bloom and the bloom dissipated within a few days.

Due to the potential risk to humans, associated with eating fish caught in the area and exposure to toxic blue-green algae, the presence of environmental contaminants in the FERC Project area could potentially be a public safety concern.

A discussion of the Proposed Project's effect on water quality is discussed in Section 4.2.2, Quality, in Section 4.2, Surface Water Quantity and Quality.

4.15.3 Oroville Facilities Hazards

FERC is the major federal regulatory agency responsible for regulating non-federal hydroelectric dams. As a part of relicensing, FERC requires that dam safety be addressed. Projects in operation are inspected to see that they are being properly maintained to assure the continued safety of the structures, that no unauthorized modifications have been made to the projects, and that the project is being operated

efficiently and safely. Furthermore, FERC oversees compliance with the terms of the license, including compliance with requirements related to environmental matters, public use, and safety. All constructed projects for which a license has been issued or an application is pending are subject to inspection. Each licensee has the responsibility to ensure that projects are operated and maintained in compliance with FERC regulations and the terms and conditions for any license, including conditions prescribed by resource agencies, and consistent with the requirements of Parts 8 and 12 of the FERC regulations. Normally, all high and significant-hazard-potential dams will be inspected once a year.

Also, the Division of Dam Safety and Inspections (a division of FERC) is responsible for making sure that licensed dams are constructed, operated, and maintained to protect life, health, and property.

DWR manages lands within the FERC Project boundary for the operation of the Oroville Facilities of the SWP, including the Oroville Dam, Lake Oroville, Hyatt Pumping-Generating Plant, Thermalito Pumping-Generating Plant, Thermalito Diversion Dam, Thermalito Diversion Dam Power Plant, Thermalito Forebay, Thermalito Afterbay, the Fish Barrier Dam, and the Thermalito Power Canal. DWR currently operates and manages the Oroville Facilities to maximize its benefit to the SWP, with the primary focus on water supply. The nature of operations at the Oroville Facilities necessitates the operation of a large amount of physical infrastructure that could present a safety hazard to visitors. DWR maintains infrastructure facilities in a manner designed to prevent injuries to persons who may encounter these facilities. The following features have been identified as potentially hazardous features, and all may have implications related to recreation safety:

- Spillways;
- Powerhouse intakes;
- Powerhouse tailrace areas;
- Spillway tailraces;
- Canals;
- Intake areas;
- Boat ramps;
- Natural channels;
- Substations and power lines;
- Bridges;
- Project structures;

- Natural and other hazards (submerged stumps, protruding rock structures, submerged structures); and
- Recreation areas.

4.15.4 Flood Management

Because of the region's proximity to several major watercourses, including the Feather River, flooding has historically been a major concern facing residents of the area. In response to concerns over flooding and the need for water supplies to serve increasing agricultural and population pressures, it was clear that a major water supply/flood control project was warranted in the Oroville area. In the 1950s the California Legislature approved development of the water resources of the Feather River watershed, including a dam near the City of Oroville.

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 acre-feet of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with USACE. The flood control requirements are an example of multiple use of reservoir space. When flood control space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (the point at which specific flood release would have to be made) varies from about 2.8 million acre-feet (maf) to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), required flood control space is at its greatest to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach temporarily into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

For more discussion of flood control issues, refer to Section 4.2.1.3, Flood Management, in Section 4.2, Surface Water Quantity and Quality.

4.15.5 Regional Health Facilities

Major health care providers in the area include Oroville Hospital in the City of Oroville and Enloe Hospital in Chico. Oroville Hospital has 130 physicians and a 24-hour

emergency room. It is the base hospital for all ambulance service in southern Butte County. Enloe Hospital in Chico is the largest hospital in the county and provides helicopter evacuation services for areas within 60 miles of Chico. The primary ambulance service is First Responder, and the response time is generally in the 15-minute range for the majority of the developed recreation sites. However, first response is often provided by a variety of agencies, including the Oroville Police Department, Butte County Sheriff's Office, Butte County Fire, DPR, the California Department of Forestry and Fire Protection, and the California Highway Patrol. Local helicopter evacuation (Enloe FlightCare) is provided through Enloe Hospital in Chico; once contacted, helicopter response time is about 10 minutes to the Oroville Facilities area.

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