CHAPTER 4

AFFECTED ENVIRONMENT

This chapter describes the conditions in the study area, including the physical elements of the environment and the socioeconomic and environmental conditions that could be affected by the project.

DESCRIPTION OF PROJECT AREA

For purposes of assessing the environmental consequences of the proposed action and alternatives, the project area will consist of the following subareas:

- Upper American River. The area encompassing the American River Watershed upstream from Folsom Reservoir, including (1) the Auburn Dam site, (2) the 42,000 acres of land around the damsite which encompass the Auburn State Recreation Area and lie within the Bureau of Reclamation's authorized Auburn Dam project limits, (3) areas along the South Fork of the American River which are suitable for mitigating impacts to fish and wildlife resources, (4) communities in Placer and El Dorado Counties surrounding the Auburn State Recreation Area, and (5) the three largest non-Federal reservoirs in the watershed—Union Valley, Hell Hole, and French Meadows.

- Natomas. The area encompassing the east levee of the Sacramento River from the mouth of the Natomas Cross Canal to the mouth of the American River, a portion of the north levee of the American River, the Natomas East Main Drainage Canal and Pleasant Grove Creek Canal, and the Natomas Cross Canal.

- Folsom Reservoir Area. The area encompassing Folsom Dam and Reservoir and including the stilling basin downstream from the dam, the residential development surrounding the dam and reservoir, and the footprint of the reservoir which would be subject to periodic changes in surface elevation.

- Lower American River. The area encompassing (1) the American River Parkway and (2) the flood plain of the lower American River from Folsom Dam downstream to the confluence with the Sacramento River.

- Upper Sacramento River. The area encompassing (1) Shasta and Keswick Reservoirs, (2) the upper reach of the Sacramento River from the Fremont Weir to Keswick Reservoir, (3) Clair Engle Reservoir and the Trinity River, and (4) Oroville Dam and

Reservoir and the Feather River from Thermolito Afterbay to the confluence with the Sacramento River.

- Downstream From American River. The area encompassing (1) the Sacramento River downstream from the mouth of the Natomas Cross Canal, (2) the Yolo Bypass and the lands immediately adjacent to the bypass, (3) the Sacramento Weir and Bypass and adjacent lands, and (4) the Sacramento-San Joaquin Delta, the roughly triangular area bounded by the City of Sacramento on the north, Pittsburgh on the west, Tracy to the south, and Stockton to the east.

- Yuba River Area. The area encompassing the Yuba River upstream from Englebright Dam. The area would be used to provide mitigation for impacts to vegetation affected by construction of the Detention Dam Plan.

PHYSICAL CONDITIONS

TOPOGRAPHY AND CLIMATE

The American River basin above Folsom Dam is very rugged, with rocky slopes, V-shaped canyons, and few flat valleys or plateaus. Elevations range from 10,400 feet at the headwaters to about 200 feet at Folsom Dam; the basin slope averages 80 feet per mile. The upper third of the basin has been intensely glaciated and is alpine, with bare peaks and ridges, considerable areas of granite pavement, and only scattered areas of trees. The middle third is dissected by canyons, which have reduced the interstream areas to narrow ribbons of relatively flat land. The lower third consists of low rolling foothills and flood plain areas near the confluence with the Sacramento River.

The climate of the study area is characterized by cool, wet winters and hot, dry summers. The major portion of the seasonal rainfall occurs in two or three of the winter months. The seasons are so distinctly different that the period from May to October may be termed the dry season and November to April the wet season. Microclimates within the study area are closely associated with the topography of the area. There is a marked difference in temperature and precipitation within short distances, (that is, between valley and foothill areas). Precipitation varies throughout the area, ranging from 16 to 20 inches on the valley floor to about 70 inches in the higher mountains above Folsom Dam and Reservoir. The annual precipitation is concentrated almost entirely (90 percent of the runoff-producing precipitation) during the winter storm season (from November through March). Precipitation usually falls as rain up to about the 5,000-foot elevation and as snow at higher elevations. However, some storms may produce rain up to the highest elevations of the basin. Conversely, at rare intervals, snow may fall as low as the valley floor.

Temperatures in the valley are high in the summer and moderate in the winter. In the mountains, temperatures are generally lower at higher elevations. The summers are

moderate at higher elevations, and the winters are severe. Peak wind velocities in California are generally associated with winter-type storm fronts, although the sustained winds are strongest in the summer. The prevailing wind direction in the lower American River basin is from the south and southeast during April through September and from the north during October through March. The most important storms affecting the study area are cyclonic wave disturbances along the polar front that usually originate in the vicinity of the Aleutian Islands. The normal trajectory of the waves along this front is to the south and east from the Pacific Ocean to the west coast. In the summer, this frontal zone is far to the north, and the accompanying precipitation seldom reaches as far south as California. The air which reaches the region is generally stable. Thunderstorms rarely cause rainfall in the project area. From October to April, the frontal zone moves southward, moving the cyclonic wave disturbances over California.

HYDROLOGY

The American River basin encompasses a 1,875-square-mile drainage area behind Folsom Dam. An average of 2.7 million acre-feet of runoff drains annually from this basin. Total reservoir storage of the American River basin is 75 percent of the mean annual runoff, or about 2 million acre-feet. Folsom Reservoir is the largest reservoir on the American River and has a capacity of 975,000 acre-feet. Since the completion of Folsom Dam in 1955, the flow regime below the dam has been significantly changed. Before the dam was built, the lower river was often dry in the summer; with the dam, flows in the lower river can be maintained year round.

Flood-producing runoff occurs primarily during October through April, and it is usually most extreme during November through March. During April through July, the rain/flood season is followed by a period of moderately high runoff from snowmelt. Runoff from snowmelt usually does not result in flood-producing flows, but ordinarily is adequate to fill the reservoir's empty space. Empty space is available in the reservoir because this space is reserved for flood control during the winter months. Detailed information can be found in the Hydrology appendix.

GEOLOGY, SEISMOLOGY, AND SOILS

The American River basin is in the central Sierra Nevada. The lower portion of the basin, which includes Folsom Dam and the Auburn Dam site, lies within a foothill metamorphic belt 30 to 50 miles wide and 250 miles long. The east, the upper portion of the basin, lies within the Sierra Nevada granitic batholith, which has intruded into and makes the eastern margin of the metamorphic belt. The metamorphosed volcanic and sedimentary rocks in the lower portion of the basin range in age from 140 to more than 300 million years old. These strata are complex, faulted and folded. Following this faulting and folding, these strata were eroded to a landscape of moderate relief. Volcanic and sedimentary rocks were deposited over this surface. The present drainage patterns were formed by regional uplift

and western tilting, which induced erosion and canyon cutting. Within the metamorphic belt, the Foothill Fault system, a series of subparallel, northwest trending vertical faults, includes at least two major fault zones. The easternmost is the Melones Fault zone, and the westernmost is the Bear Mountains Fault zone, which intersects the main body of Folsom Reservoir. This system is geologically old (200 million years); the last major seismic movement was about 140 million years ago.

Geologic formations underlying the Sacramento Valley include igneous, metamorphic, and sedimentary rock types, which range in age from precretaceous to recent. The valley is situated on vast alluvial deposits that have slowly accumulated over the last 100 million years. The materials have been derived from the surrounding uplands; transported by major streams; and deposited in successive clay, silt, sand, and gravel layers on the valley floor.

The area below Folsom Dam is part of the Great Valley Geomorphic province of California. The broad valley was filled with erosion debris that originated in the surrounding mountains. Most soils in the area are recent alluvial flood plain soils consisting of unconsolidated deposits of clay, silt, and sand that occur as flood plain deposits. Fresh alluvium is deposited with each floodflow, particularly within the bypasses.

Sedimentation rates in the American River basin and adjacent river basins are relatively low due to limited development, the general shallowness of soils, a low rate of upstream erosion, and numerous containment basins. Estimates of the annual sediment yield range from 0.1 to 0.3 acre-foot per square mile. Since the completion of Folsom Dam in 1955, only about 2 percent of the reserved sediment storage space in the reservoir has been filled.

SOCIOECONOMIC PROFILE

FLOOD CONTROL

Sacramento River Flood Control Project

The SRFCP (Sacramento River Flood Control Project) was originally authorized by the Flood Control Act of 1917 and subsequently modified by various Flood Control and/or River and Harbor Acts in 1928, 1937, and 1941. The project was constructed by the Corps between 1918 and 1968; the State is the non-Federal sponsor. The principal features, a comprehensive system of levees, overflow weirs, drainage pumping plants, and flood bypass channels, are on or adjacent to the Sacramento River and the lower reaches of its main tributaries from Ord Bend downstream to Collinsville, about 184 miles. This includes the levees along lower American River from the confluence to Cal Expo on the north bank and to Mayhew drain on the south bank.

This project operates by containing potential floodwaters of streams, river channels, and sloughs between levees and diverting those floodwaters into the Butte Basin and Sutter and Yolo Bypasses. Approximately 1,000 miles of levees provide flood protection to Yuba City, Marysville, Sacramento, West Sacramento, and numerous smaller communities; highways, railroads, and airports; and about 800,000 acres of agricultural lands. During its history, the project has prevented billions of dollars in flood damage.

American River Flood Control Project

The American River Flood Control Project was constructed by the Corps in 1958 and is operated and maintained by the American River Flood Control District. The project consists of a levee extending about 7 miles from high ground near Carmichael downstream along the north side of the American River to a previously existing levee ending near the Interstate Business 80 crossing.

Folsom Dam and Reservoir

Folsom Dam and Reservoir is a multipurpose water project constructed by the Corps and operated by Reclamation as part of the CVP. Folsom Dam regulates runoff from about 1,875 square miles of drainage area. Folsom Reservoir has a normal full pool storage capacity of 975,000 acre-feet with a minimum seasonally designated flood control storage space of 400,000 acre-feet. The reservoir provides flood protection for the Sacramento area; water supplies for irrigation, domestic, municipal, and industrial uses; and hydropower. The reservoir also provides extensive water-related recreational opportunities, water quality control in the Delta, and maintenance of flows stipulated to balance anadromous and resident fisheries, wildlife, and recreational considerations in and along the lower American River.

The Regional Director of the Mid-Pacific Region of the U.S. Bureau of Reclamation, based in Sacramento, California, has overall operation responsibility for Folsom and Nimbus Dams. The Folsom facilities are operated to secure the greatest practicable benefits from flood control and other authorized purposes; however, the limited capacity of the Folsom Dam spillway at intermediate storage levels constrains efficient utilization of the space allocated to flood control in the reservoir. Because sufficient head is not available at the spillway gates, the maximum design release of 115,000 cfs through the five main spillway gates, in combination with powerplant releases, is not possible until the reservoir pool reaches elevation 445.6 feet (790,000 acre-feet). At this elevation the storage encroaches into the flood control space by about 180,000 acre-feet.

A second operational constraint is the inability to release water above the objective release of 115,000 cfs without a significant risk of levee failure. The limitations of the downstream levees were evident during the February 1986 flood when considerable erosion and levee boils occurred due to several days of flows over 115,000 cfs.

Hydropower Reservoirs

Approximately 820,000 acre-feet of storage capacity exists in American River basin reservoirs upstream from Folsom Reservoir. These facilities have at times proved beneficial in attenuating inflow to Folsom Reservoir, although the extent of this beneficial effect is limited by the following factors: (1) these reservoirs were constructed and are operated for hydropower generation and water supply (they do not include dedicated space or physical features for flood control); (2) they control only 14 percent of the drainage area; (3) they are disproportionately concentrated in the upstream area of the Middle Fork American River, and (4) their impact occurs only during the early part of the runoff period because, once filled, they are not effective in reducing flood volume and peak flow. Nevertheless, recent studies by the Corps indicate that under current operations, the three largest upstream reservoirs (French Meadows, Hell Hole, and Union Valley) could provide as much as 200,000 acre-feet of creditable flood storage.

WATER SUPPLY

Central Valley Project

The CVP was authorized in 1937, and Reclamation constructed the CVP and now operates it for water supply, hydropower generation, flood control, navigation, fish and wildlife, recreation, and water-quality control. The CVP service area extends about 430 miles through much of California's Central Valley, from Clair Engle and Shasta Reservoirs in the north to Bakersfield in the south. The CVP also includes the San Felipe Unit, which delivers water to the Santa Clara Valley. In 1988, CVP deliveries totaled about 5.3 million acre-feet, or about 75 percent of total contracted deliveries of 7.1 million acre-feet. These deliveries included almost 1.9 million acre-feet to the Sacramento River Service Area, 285,000 acre-feet to the American River Service Area, and about 3.1 million acre-feet to the Delta Export Service Area.

The CVP is operated as an integrated system to meet multiple authorized purposes. Minimum fishery releases to the lower American River from Nimbus Dam are made in accordance with water rights Decision No. 893 (D-893) by the SWRCB. The SWRCB increased the D-893 minimum release schedule in its Decision 1400 (D-1400). This decision was applied to the water rights permit for Auburn Dam and does not apply to the operation of Folsom and Nimbus Dams. However, Reclamation voluntarily operates Folsom and Nimbus Dams to meet the D-1400 minimum fishery flows, except during droughts when the release pattern is reduced below the D-1400 requirements (but very seldom to flows as low as allowed by D-893). For further background information on the CVP, see the "Long-Term Central Valley Project Operations Criteria and Plan; CVP-OCAP," October 1992, commonly referred to as the "OCAP Report."

State Water Project

Thirty agencies throughout California have contracted with the SWP (State Water Project) for an annual total of 4.2 million acre-feet of water. Existing SWP facilities can supply less than 2.4 million acre-feet during droughts. Additional facilities are planned to increase the supply. The Coastal Branch Aqueduct is currently under construction and will serve San Luis Obispo and Santa Barbara Counties; authorized, but not yet built, are conveyance facilities to improve transfer of water across the Delta and treatment facilities to remove salty agricultural drainage water from the San Joaquin Valley.

The initial facilities of the SWP, completed in 1973, include 18 reservoirs, 17 pumping plants, 8 hydroelectric powerplants, and 550 miles of aqueducts and pipelines. Water from the Feather River watershed and the Delta is captured and conveyed to areas of need in the San Francisco Bay area, the San Joaquin Valley, and southern California. Parts of the project have been serving Californians since 1962.

The northernmost SWP facilities consist of three small lakes on Feather River tributaries in Plumas County, including Lake Davis, Frenchman Lake, and Antelope Lake. The branches and forks of the Feather River flow into Lake Oroville, the SWP's principal reservoir, with a capacity of 3.5 million acre-feet.

The North Bay Aqueduct, completed in 1988, supplies water to Napa and Solano Counties from the northern Delta. Near Byron in the south Delta, the Delta Pumping Plant lifts water into Bethany Reservoir. From this reservoir, some Delta water is lifted by the South Bay Pumping Plant into the South Bay Aqueduct, which serves Alameda and Santa Clara counties.

Most of the water flows from Bethany Reservoir into the California Aqueduct, which winds along the west side of the San Joaquin Valley into southern California.

Regional Water Projects

The American River Watershed is contained within Sacramento, El Dorado, and Placer Counties. Water supply demands within the watershed include agricultural, municipal, and industrial uses. The primary sources of water supply for the study area are ground water and surface water. Principal sources of surface water in the region are the American, Sacramento, and Cosumnes Rivers.

Communities above and adjacent to Folsom Reservoir, including Roseville, Auburn, Georgetown, Placerville, El Dorado Hills, Citrus Heights, Carmichael, Orangevale, and Fair Oaks, and areas downstream from Folsom Reservoir, including Rancho Cordova, Sacramento, Elk Grove, Galt, and Lodi, receive all or part of their municipal and industrial water supplies from the reservoir. Some agricultural demands originate in areas northwest of Folsom Reservoir. However, the major irrigation demands are in southeast Sacramento County. In western Placer County, there is potential for additional irrigation demands from

Folsom Reservoir via diversion pipelines or from the upper American River via Auburn Ravine.

HYDROPOWER

The CVP hydropower system consists of eight powerplants and two pump-generating plants. This system is fully integrated into the Northern California Power System and provides a significant portion of the hydropower available for use in northern and central California. The installed power capacity of the system is 2,058 MW (megawatts). By comparison, the combined capacity of the 368 operational hydropower plants in California is 12,866 MW. The PG&E (Pacific Gas and Electric Company) is the area's major power supplier with a generating capacity from all sources of over 20,000 MW.

Power generated from the CVP system is dedicated first to meeting CVP project power requirements, primarily for pumping facilities. The remaining power is marketed by the Western Area Power Administration as commercial power with first preference to entities such as irrigation districts, municipalities, military installations, and Federal and State Government installations in California.

LAND USE AND SOCIOECONOMICS

This section describes the existing and projected future land use and related socioeconomy in the American River Watershed Project area that could be affected by the project. The focus of this discussion is on the lands in the American River flood plain and the lands in the upper American River area in and around the damsite near Auburn.

Flood Plain Area

The following sections profile the land use and related socioeconomic character of the urbanized portions of the American River flood plain and assess the prospects for continued development in the undeveloped portions of the flood plain. For purposes of this analysis, the study area is divided into three subareas: North Sacramento, South Sacramento, and Rancho Cordova. Data are provided on land use, population, employment, income, and public facilities and services. These data provide baseline information to conduct the socioeconomic impacts analyses presented in chapters 6 through 10.

Land Use

North Sacramento. The North Sacramento area covers approximately 6,000 acres in the flood plain north of the American River, south of Arcade Creek and west of the NEMDC. This highly urbanized area, which includes land of the Campus Commons subdivision and the Cal Expo facility, is protected from flooding by Folsom Dam and the

north levee of the American River. The north levee of the American River runs from the mouth of the NEMDC to high ground near the Carmichael Bluffs. The predominant land use in this area is residential (4,760 acres). Commercial (445 acres), industrial (50 acres), and public (45 acres) land uses make up the balance of the development in the area. A small amount of agricultural/vacant land (600 acres) remains undeveloped. The total value of the property subject to flood damage in the area was estimated to be $8.2 billion, of which 68 percent is residential, 28 percent commercial/industrial, and 4 percent public infrastructure.

South Sacramento. The South Sacramento area covers approximately 45,000 acres south of the American River. This area, more than half of which lies within the flood plain, is bounded by the Sacramento River on the west, the Beach Lake levee on the south, and Bradshaw Road on the east. Flood protection is provided by Folsom Dam, the south levee of the American River extending from the Mayhew Drain to the Sacramento River confluence, and the east levee of the Sacramento River from the confluence to the town of Freeport. The protected area contains downtown Sacramento, the State Capitol, CSUS, the Riverpark neighborhood, the Richards Boulevard area, and portions of the city's Land Park, Pocket, and Meadowview community plan areas. Within this area the predominant land use is residential (28,590 acres). Commercial (3,410 acres), industrial (505 acres), public (6,890 acres), and agricultural/vacant (5,605 acres) land uses make up the balance of South Sacramento. The total value of the structures subject to potential flood damage was estimated to be $22.9 billion, of which 60 percent of the value is residential, 29 percent is commercial/industrial, and 11 percent is public infrastructure.

Rancho Cordova. The unincorporated Rancho Cordova area lies almost entirely within the flood plain south of the American River between Hazel Avenue and Bradshaw Road. This developing area is protected from flooding by Folsom Dam, the Sacramento County levee upstream from the Mayhew Drain, and high ground along the south side of the American River extending from the levee to Lake Natoma. The predominant land use in the area is residential (1,500 acres). Commercial (100 acres) and industrial (20 acres) uses make up the balance of the development in Rancho Cordova. Rancho Cordova also contains a substantial amount of open space south of Highway 50 (2,520 acres). The total value of the property subject to potential flood damage in the area was estimated to be $2.4 billion, of which 71 percent of the value is residential, 27 percent is commercial/industrial, and 2 percent is public infrastructure.

City of Folsom. The City of Folsom covers approximately 16,000 acres and has a population of 39,850. It is bounded by Highway 50 on the south, Lake Natoma on the west, the Placer/Sacramento line on the north, and the El Dorado/Sacramento County line on the east. None of the incorporated city lies within the American River flood plain. Land uses within the city include residential (1,700 acres), commercial (179 acres), and industrial (152 acres). (City of Folsom, 1988.)

Population, Employment, and Income. The flood plain is occupied by about 400,000 people, who are distributed throughout the area. Natomas, one of Sacramento's

fastest growing areas in the 1980's, accounts for 35,000 residents, most of whom live in the South Natomas community plan area. The Dry Creek area is sparsely populated due to its relatively large lot sizes and contains only 2,500 residents. North Sacramento with 55,000 residents and South Sacramento with 290,000 contain the bulk of the study area population. Rancho Cordova with 17,500 residents accounts for the balance. Based on a citywide average of 2.5 persons per household, it is estimated that flood plain residents occupy approximately 180,000 housing units in the area as a whole. Average housing costs range from $89,400 per home in North Sacramento to $89,000 in Natomas, $83,300 in South Sacramento, and $117,000 in Rancho Cordova. Flood plain residents are part of the labor force employed in the Sacramento Metropolitan Statistical Area comprising El Dorado, Placer, Sacramento, and Yolo Counties. The service industry, retail trade, and government provide nearly two-thirds of all the jobs in this diverse labor market; the average annual income for the City of Sacramento is $15,265. (Hornor, 1994.)

Public Facilities and Services

Water Supply. The City of Sacramento obtains its water supply from both surface- and ground-water sources. The city has water rights to both the American and Sacramento Rivers under a perpetual contract with Reclamation (City of Sacramento, 1988). In 1987, the City of Sacramento used about 33 percent of its total water rights. Thirty public and privately owned water purveyors supply water for areas outside the city limits. Residential users within the City of Sacramento consume 8,000 gallons per acre per day. Per capita residential water use is estimated at 0.19 acre-feet annually (Boyle Engineering, 1989). The daily consumption of water is about 4,000 gallons per acre for commercial users and about 1,700 gallons per acre for industrial users.

Sewage System. The City of Sacramento and Sacramento County are served by the Sacramento Regional County Sanitation District. District facilities in North Natomas were constructed to serve South Natomas and adjacent areas. Flows for the Sacramento area average 400 gallons per day for single-family dwelling units, 300 gallons per day for multifamily units, and 2,625 gallons per day for commercial/industrial property.

Solid Waste. Prior to 1992, the City of Sacramento collected and transported all residential solid waste to the landfill site at 28th Street and A Street. However, the capacity of this site has been exhausted, and the city is currently using the county landfill site on Kiefer Boulevard, which is expected to be at capacity by approximately 2005. Each Sacramento resident disposes of approximately 4.26 pounds of solid waste per day, and commercial/industrial land users dispose of about 1 pound of solid waste per 100 square feet per day.

Emergency Services. The Sacramento City Police Department provides protection for most of the urbanized portion of the project area. The Police Department currently has a ratio of 1.7 police officers (uniformed and civilian) per 1,000 persons. The unincorporated North Natomas area is under the jurisdiction of the Sacramento County

Sheriff's Department. The Sutter County Sheriff's Department provides protection for south Sutter County.

Upper American River Area

The upper American River area encompasses portions of Placer and El Dorado Counties and includes the lands within and immediately around the damsite near Auburn ("canyon area") and the lands occupied by the surrounding communities.

Land Use. The canyon area consists of about 42,000 acres of land ranging from gently sloping to extremely steep land in the canyons along the Middle and North Forks of the American River and includes the site of the Reclamation's authorized multipurpose Auburn Dam. Most of the property within the canyon area (26,100 acres) is owned by the Bureau of Reclamation. These lands are managed by the California Department of Parks and Recreation as part of the Auburn State Recreation Area under a contract with Reclamation. Recreational use of these lands is restricted by terrain, lack of offroad parking, and road access to river facilities. Despite these limitations, the Department of Parks and Recreation estimates informal recreational use within the Auburn State Recreation Area at 550,000 visitor days annually. The canyon area supports a system of trails which are used for recreation. Scheduled events include the Tevis Cup (endurance horse ride) and the Western States Endurance Run (foot race). Most activity is within the river and on the river bars. Limited portions of the canyon area (about 11,000 acres) are under the ownership of the Bureau of Land Management or U.S. Forest Service. The remainder of the area (about 5,000 acres) consists of isolated, privately owned parcels.

The communities surrounding the canyon area, including Auburn, Cool-Pilot Hill, Greenwood, Garden Valley, Georgetown, and Lotus-Coloma, have generally experienced growth significantly higher than statewide averages. The primary stimuli for this growth have been the attraction of rural and scenic settings, recreational and scenic attributes, mild climate, availability and price of homesites, and relative proximity to major employment centers. Major constraints to growth vary by subarea and include water supply and conveyance limitations, sewage service and septic tank suitability, lack of access and transportation capacity, slope and soil conditions, and zoning restrictions. Higher intensity urban uses are concentrated primarily in the Auburn area. The predominant land uses within the remainder of the study area are low-density residential, rural residential parcels (improved and unimproved), forest and recreation, open space and conservation, and nonintensive agriculture and grazing land.

Growth. Growth rates for the communities within the upper American River area are expected to be higher than the State average over the next 15 years based on California Department of Finance projections, Department of Water Resources 1989 projections for western El Dorado County, and information from county planning staffs and regional planning organizations. Projected population for 2010 is 79,252. Buildout population under current area plans is estimated at 114,056.

Population. Only Auburn is expected to reach buildout under current plans by the year 2010. Based on projected population rates, none of the El Dorado County subareas would reach buildout by 2010. In areas such as Cool-Pilot Hill and Georgetown, where buildout populations greatly exceed current population, buildout can be expected relatively far in the future. Auburn, with 73 percent of the total population, would continue as the largest urban center. However, the El Dorado County subareas are expected to experience significantly higher rates of growth than the Auburn area; Cool-Pilot Hill and Georgetown are expected to be major population centers.

Housing. The demand for additional housing to accommodate future population growth is likely to be substantial. As there is limited housing development in the El Dorado County subareas, the impacts would be greatest in these plan areas. A total of 31,700 housing units are anticipated within the overall plan area by 2010. Based on current area plans, there would be an estimated 50,291 housing units at buildout. Auburn would continue to have the greatest concentration and mix of housing. In El Dorado County, the largest concentration would be in Cool-Pilot Hill, which also would have the largest increase in medium and high density units. Medium density development is also included in the plans for Garden Valley and Georgetown and to a lesser degree in Lotus-Coloma.

Water Supply. The population of California is expected to increase by about 75 percent, or to nearly 60 million, by the year 2020. Much of this increase will be in the central and northern portion of the state. In the five-county area of El Dorado, Placer, Sacramento, San Joaquin, and Sutter, this increase is expected to be significantly greater. The current population of about 2 million in this area is projected to increase to about 3.8 million by 2020, or by nearly 95 percent.

The additional population will place demands on existing water supplies (see table 4-1), especially for M&I (municipal and industrial) uses. The 1990 agricultural and M&I water demands in the five-county area was about 2.7 million acre-feet per year. By 2020 this demand is expected to increase by about 300,000 acre-feet per year to approximately 3 million acre-feet per year. There will be a reduction in demands for agricultural uses by about 250,000 acre-feet per year due to water conservation measures, marginal lands ceasing production, or some lands being converted to urban uses. Demands for M&I uses, however, are expected to increase by over 0.5 million acre-feet per year, even accounting for water conservation measures.

As today, future water supplies will be provided from a combination of surface and ground-water sources. A breakdown of these relative supplies is shown in table 4-1. It is expected that the total future supplies will equal about 2.5 million acre-feet.

Future demands less future supplies are a measure of potential unmet water needs. The estimate future (2020) unmet needs will amount to over 500 acre-feet per year in the five-county area. This growing need for additional supplies will not be met throughout the service areas of the CVP and SWP (State Water Project) systems. Accordingly, any

TABLE 4-1

American River Watershed and Vicinity - Water Needs (2020)
(1,000 acre-feet per year)

County	Water Demands						2020 Supply			Unmet Need
	1990			2020						
	Agricultural	M&I[1]	Total	Changes Agricultural	Increase M&I	Total	Surface Water	Ground Water	Total	
El Dorado	19.2	26.9	46.1	0.8	38.4	85.3	48.2	0	48.2	37.1
Placer	245.9	99.3	345.2	-17.7	65.4	392.9	190.4	124.6	315.0	77.9
Sacramento	361.5	390.1	751.6	-79.9	305.5	977.2	326.7	476.0	802.7	174.5
San Joaquin	1120.7	111.3	1232.0	-109.5	125.6	1248.1	500.6	617.9	1118.5	129.6
Sutter	307.8	0.9	308.7	-54.5	26.1	280.3	124.7	119.6	244.3	36.0
Delta Salinity			70.0			70.0			0	70.0
Total	2055.1	628.5	2753.6	-260.8	561.0	3053.8	1190.6	1338.1	2528.7	525.1

[1] M&I = municipal and industrial.
Source: U.S. Bureau of Reclamation, American River Water Resources Investigation, Spring 1995.

decrease in the capability of the system to deliver water supplies will add to the expected future net demands for water.

Sewage System. Sewage treatment plant facilities and sewage lines would have to be expanded in all the subareas to serve projected population growth. The buildout under the current Auburn plan would require expanding the existing treatment plants. This is anticipated under ongoing planning by the servicing districts. Higher density development, anticipated in all the subareas, would require public sewer service, which does not currently exist. A major expansion program would be required in the Georgetown Divide Public Utility District, which would service all but the Lotus-Coloma area. The El Dorado Irrigation District would service Lotus-Coloma.

Solid Waste. Solid waste generated by the projected buildout population in the Auburn Plan Area could be accommodated by existing and planned landfill capacity and recycling programs. The solid waste generated in the El Dorado County subareas in combination with other waste generated in the county would require a new landfill site or significant expansion of the existing site by 2000 and other methods to reduce waste volumes.

Emergency Services. Demand for medical services would increase due to the population growth. The City of Auburn renovated a building to house fire and police departments. The major expansion requirement would be increased personnel. The Placer

County Sheriff's office would require a significant increase in personnel and presumably facilities, including jail expansion.

RECREATION

This section summarizes the recreation resources and opportunities in the study area. The SAFCA Interim Reoperation of Folsom Dam and Reservoir report (December 1994) and Jones & Stokes Associates Folsom Dam and Reservoir Permanent Reoperation Study Supplemental Report (May 1995) were used to prepare this section.

Lower American River

The American River Parkway includes a series of 14 parks distributed on publicly owned lands along the lower American River. Earthen levees as much as 20 to 30 feet high border much of the lower half of the parkway and block out surrounding urban development and activity. These physical barriers and extensive stands of mature riparian forest give the parkway a "wilderness in the city" quality.

The Jedediah Smith Trail provides bicycle, pedestrian, and equestrian trails from Discovery Park to Folsom Reservoir and is one of the parkway's most popular features. The trail also connects with the Sacramento River Trail and Old Sacramento State Historic Park. The 23 miles of river below Nimbus Dam is included in both the State and Federal wild and scenic river systems. Entrance fees are charged for all automobile access roads during peak-use seasons from late spring to early fall.

Managed by Sacramento County Parks and Recreation Department, the parkway is recognized as one of the Nation's premier urban parkways, providing outstanding recreation for the 750,000 people who live within a 30-minute commute. Estimated parkway use in 1988 was 5.5 million visitors. That figure is expected to grow to 7.5 million by 2000 and to 9.6 million by 2020 (Hinton, 1987). A 1983 Sacramento County survey showed that 32 percent of these visits were associated with water-dependent activities (swimming, boating, and fishing) and 53 percent were associated with water-enhanced activities such as jogging, nature study, hiking, and picnicking.

The lower American River is a major site for recreational boating, including rafting, kayaking, and canoeing, and accounts for about 662,000 user-days annually, or 12 percent of the total recreation for that area (SWRCB, 1988). Seasonal temperatures and riverflows affect commercial rafting. When ambient temperatures are cold, rafting declines, even during the peak recreation season. About 90 percent of the annual rental business occurs between Memorial and Labor Days, although prime conditions may exist into October (David Hill, pers. comm., 1989).

Swimming and wading are other popular water-dependent activities affected by riverflows. These activities account for about 10 percent of the total recreation in the

parkway, or about 552,000 annual visits. Of the 10 popular swimming areas, only Paradise Beach and Tiscornia Park have beaches with extensive areas of sand.

Folsom Reservoir

For purposes of evaluating the recreational resources, the Folsom Reservoir area includes Folsom Lake and Lake Natoma.

Folsom Reservoir. Folsom Lake State Recreation Area is one of the most heavily used units in the California park system. Proximity to a major metropolitan area, arid summer climate, high regional interest in recreation, and diminishing open space and recreation resources make the lake a significant regional and State recreation resource. Activities include sailing, water and jet skiing, and wind surfing. The lake's upper arms are designated slow zones for quiet cruising, fishing, and nature appreciation. Brown's Ravine Marina provides 670 berthing slips for year-round mooring (depending on lake levels) and small craft rentals and supplies. Recent dredging of the marina for fill material for the Mormon Island Dam repairs should allow longer periods of use at the marina for both moored and launched boats.

The lake has up to 75 miles of undeveloped shoreline providing quality swimming beaches, some with lifeguard services. Summer water temperature averages 72 °F, enhancing both water-oriented and shoreline activities. An area with important scenic, natural, and cultural values surrounds Folsom Lake and provides opportunities for camping, picnicking, hiking, and nature study. About 180 miles of unpaved roads and trails are available for hiking and horseback riding, in addition to the 8.4-mile paved bike trail connecting with the parkway's Jedediah Smith Trail.

According to the Department of Parks and Recreation, the optimal lake elevation for recreation use is 436 feet, which makes all facilities available and allows the beaches to accommodate high use levels. Approximately 9,600 surface acres are available at this elevation. Lake elevations higher than this reduce the carrying capacity of the lake, since some boat ramps and parking spaces are eliminated. Most of the boat ramps are unusable about elevation 420 (8,500 surface acres); by elevation 405 (7,300 surface acres), only one boat ramp is still usable for launching.

Changes in water-surface elevations from May through August will have greater effects on use patterns. In winter, use patterns exhibit a greater degree of flexibility relative to water-surface elevations. One hundred percent of potential use is never realized because of displacement; that is, as conditions become ideal for one recreational activity, they deteriorate for another. For example, with increased water and jet skiing, windsurfing and sailing conditions deteriorate because of wake disturbances.

Use at Folsom Reservoir is currently about 2.3 million visitor days during the peak-use period. About 95 percent of the day-users and one-third of the campers come from the Central Valley, one-third from the San Francisco Bay Area, and the remaining one-third

from elsewhere. Visitation data collected from 1976 through 1987 by the Department of Parks and Recreation show 141,000 as the average monthly visitation to Folsom Lake. Visitation peaks in summer. The lowest use period was in December 1982 (7,224 visits), and the highest use month was 502,187 in June 1985.

Lake Natoma. Formed by Nimbus Dam, Lake Natoma is the downstream end of the Folsom Lake State Recreation Area and serves as a reregulating reservoir for the varying water releases from Folsom Dam. Because there are only slight variants in water fluctuation, the lake has developed an attractive, natural-appearing band of riparian vegetation around its shores.

Lake Natoma is managed by the Department of Parks and Recreation as a passive recreation area; the emphasis is on nonmotorized water recreation. Developed facilities include the aquatic center for California State University at Sacramento, a picnic area, and an 8.4-mile segment of the American River paved bicycle and pedestrian trail, which continues to Folsom Reservoir.

Bank fishing is common at the lake, and people swim and dive at the rock outcrops at the lake's upper end. Since water temperatures during the summer are cooler here than at Folsom Reservoir upstream, the lake is less heavily used for swimming and wading.

Upper American River

Reclamation contracted with the Department of Parks and Recreation to provide recreation and public-use management services on the lands within the boundaries of the multipurpose Auburn Dam project, known as the Auburn State Recreation Area. This area includes 42,000 acres and extends upstream on the North Fork American River to Iowa Hill bridge and upstream on the Middle Fork to Oxbow Reservoir.

Rushing rapids, punctuated by deep clear pools within steep canyons, surrounded by wooded ridgelines, articulate the essence of the American River through this area. This juxtaposition of rugged terrain and free-flowing water creates a dynamic setting for a diversity of unique recreation opportunities from whitewater boating to recreational gold mining and picnicking.

Its proximity to major population centers and diverse recreation base make the Auburn State Recreation Area one of the most used and significant recreation resources in northern California. The expected growth of the surrounding Mother Lode and Sacramento metropolitan areas will make this resource more important for future generations. The recreation area is especially accessible to the surrounding population because of its location near major transportation corridors. Interstate 80 lies along the northwest margin of the area and brings it within a 2-hour drive from much of the San Francisco Bay area, and even less from Reno. Highway 49 traverses the Auburn State Recreation Area from the north and south.

Local interest in outdoor recreation is intense. Bicycling (road and mountain biking) has increased dramatically in the area. There is continuing demand for equestrian trails and other trails. Indications are that there will be a continued increase in demand and a continued deficit in resources to meet this demand regionally.

The Tevis Cup (endurance horse ride) and the Western States Endurance Run (foot race), both 1-day, 100-mile events using the Western States Trail, draw entrants from all over the world. Approximately 72 miles of hiking trails, 66 miles of equestrian trails, and 15 miles of fire road are open to mountain bikes in the Auburn State Recreation Area and provide year-round recreation opportunities. These trails and roads include Manzanita Trail, Middle Road Trail, Pointed Rock Trail, Old Quarry Road Trail, Tinkers Cutoff, Old Stage Road, Old Auburn-Foresthill Road, a number of other trails, and many mountain bike trails. Additionally, the Western States Trail has been included as the trans-Sierra route of the proposed coast-to-coast American Discovery National Trail.

The Department of Parks and Recreation has the responsibility for maintaining these trails; due to budget constraints, the only maintenance is accomplished by volunteer workers, usually associated with the Western States Endurance Run.

Whitewater boating on the Middle and North Forks of the American River is of State and national significance. Both forks offer overnight camping, hiking trails, cultural and natural observation sites, and a diversity of difficulty in whitewater rapids from beginning to advanced boating skill levels. The nearby South Fork of the American River offers a less challenging whitewater experience, and because of the predominance of private lands and development along the river corridor, camping is restricted. The nearest similar "wilderness" whitewater river, providing overnight trips, is the Tuolumne River, about 100 miles southeast of the recreation area.

Also of significance is the scenic value of the upper American River. Many tributary streams flow into the forks of the American River at a very high gradient, creating small cascades and waterfalls. The major rapids on the main stems of the North and Middle Forks provide unique scenic features in a setting with few visible human intrusions. The North Fork of the American remains one of the last free-flowing rivers in California. Equally significant is the concentration of historic sites and remains in the canyons, especially along the Middle Fork.

Although other recreation areas such as the lower American River Parkway are more heavily visited regionally (5 million), the Auburn State Recreation Area (550,000) is still an important recreation resource for the Sacramento metropolitan area. Since it is within a 20- to 50-minute drive for most area residents, the area provides a quick afternoon escape. The cool waters of the area offer a compelling respite when temperatures in the Sacramento area exceed 100 °F. This increase in visitation adds to parking congestion at the confluence on summer weekends. The most popular month for the recreation area is July, when about 20 percent of annual visitation occurs. Some 46 percent of the annual use is between June and August, and use tapers off in the fall and winter.

Upper Sacramento River

The principal recreational resources in the upper Sacramento River area are Shasta and Clair Engle Reservoirs. These facilities are administered by the U.S. Forest Service as National Recreation Areas. These National Recreation areas were established by Congress in 1965 and encompass 203,500 acres (U.S. Department of Agriculture, 1987). Fishing, boating, and sightseeing are popular recreational uses of these two reservoirs.

Facilities at Shasta Reservoir include boat ramps, 22 developed campsites (21 of which accommodate camp trailers and recreational vehicles), and 4 day-use picnic areas. Clair Engle Reservoir has 21 private and/or government-managed campgrounds, 4 day-use picnic areas, 5 resorts or marinas, and 11 boat ramps. During low lake levels, boat launching is available at only one or two of the marinas. Low lake levels during the recent drought caused a decline in the recreational use of Clair Engle Reservoir. This decline prompted the USFS (U.S. Forest Service) to restore some of the more popular campgrounds (Arnold, USFS, pers. comm.). Popular forms of recreation include water and jet skiing, sailing, canoeing, swimming, camping, picnicking, and hiking (Reclamation, 1991).

No campgrounds are established on Keswick Reservoir. Recreational use of the lake is predominantly for fishing. Keswick Reservoir has one boat launching facility.

AFFECTED NATURAL ENVIRONMENT

FISHERIES

Fishery habitats evaluated include the lower American River, Folsom Reservoir, and upper American River areas and the upper and lower Sacramento River areas.

The aquatic environment and the fish fauna in the lower American River have been significantly altered from historic conditions. Several factors have contributed to this alteration of the lower American River, including the construction of Folsom and Nimbus Dams (in 1955), regulation of riverflows, and the introduction of nonnative fish species. The American River historically provided over 125 miles of riverine habitat to anadromous and resident fish species (Gerstung, 1971). Only the 23 miles from Nimbus Dam to the mouth of the lower American River remain as available habitat to anadromous fish species.

The lower 23 miles of the river, including backwaters and dredge ponds, supports at least 41 fish species, half of which are game fish (FWS, 1991). Common species include chinook salmon, steelhead trout, American shad, rainbow trout, striped bass, black bass, carp, Sacramento squawfish, Sacramento suckers, and hardhead. Recreation and commercial values make the fall-run chinook salmon the most important species in the lower river. The schedule of reservoir releases during spring and summer can cause temperatures in the lower

river to reach marginal to lethal thresholds, forcing these anadromous species to areas near Nimbus Dam, where they face increased predation and competition (FWS, 1991).

Because of the lack of access to the natural spawning areas in the headwaters of the American River and the lack of cold water during spring and summer, natural production of steelhead in the lower American River is negligible. Artificial production of anadromous species at the Nimbus Hatchery maintains the population. Striped bass and American shad are also important species. The other fish species inhabiting the lower river are generally considered of secondary importance because their value as commercial and sport fisheries is minor (FWS, 1990).

Flows in the lower American River are controlled by the coordinated operation of Folsom and Nimbus Dams. Generally, these flows differ considerably from flows under historic (predam) conditions, when flows were generally higher from February through June and lower from early July to February (Rich and Leidy, 1985). Water temperature regimes also have been influenced by the operation of Folsom and Nimbus Dams.

In 1958, the SWRCB (California State Water Resources Control Board) issued Decision 893 (D-893), which established minimum flow releases in the river of 250 to 500 cfs. Since that time, public attention to and use of the river's fishery have increased, and there is concern that D-893 flows will not sustain the recreation and fishery activities that have developed in the lower river over the past 30 years. The instream flows required to protect the salmon and steelhead trout populations have been the subject of much public debate and governmental attention. In 1973, decision 1400, issued by the State Water Resources Board, proposed an increased flow regime of 800 to 1,250 cfs in anticipation of the construction of the large multipurpose Auburn Dam, which was never completed. Although Reclamation is legally required only to maintain D-893 flows, it currently operates Folsom Dam at a level to meet the D-1400 requirement when there is sufficient water in the system.

Flows in the lower American River undergo substantial fluctuations in response to CVP and SWP obligations to maintain SWRCB-mandated water-quality and flow requirements in the Delta. When water is insufficient in the Delta to maintain SWRCB requirements, the CVP and SWP first curtail total water exports from their two pumping facilities in the Delta. If that action is inadequate to achieve SWRCB flow requirements, water releases are increased from upstream reservoirs operated by the CVP and SWP. Released water takes about 12 hours to reach the Delta from Folsom Dam, about 2 days from Oroville Dam, and about 5 days from Keswick Dam. Because of the proximity of Folsom Dam to the Delta and the relatively short time required for water to travel to the Delta, releases from Folsom Dam are often relied on to meet SWRCB Delta flow requirements. This reliance on releases from Folsom Dam often results in rapid fluctuations in flow levels in the lower American River.

In general, flow fluctuations in the lower American River are most frequent and of greatest magnitude during spring and summer, although "step" increases and decreases do

occur during fall. Spring and summer flow fluctuations can be considerable. For example, a flow increase from a mean daily flow of 329 cfs on June 1, 1990, to 7,500 cfs on July 11, 1990, was accompanied by a water-surface elevation change of several feet (McEwan, 1991). Although this specific example illustrates a relatively large change in flow over a period of about 6 weeks, flow fluctuations of lesser magnitude over the same duration are frequent. Presently, the fishery resources of the lower American River are subjected to relatively rapid and erratic flow fluctuations of variable magnitude.

The primary species of management concern and economically most important fishes in the lower American River are the four anadromous species, including chinook salmon, steelhead trout, striped bass, and American shad. The most popular sport fisheries in the lower American River are for chinook salmon during fall, steelhead trout during winter, American shad during late spring, and striped bass during late spring and summer.

Over one-half of all fish species known to occur in the lower American River are nongame fishes. The most abundant species of nongame fishes in the river include Sacramento sucker, Sacramento squawfish, tule perch, and riffle sculpin. Although each species, including nongame species in the lower American River, fulfills an ecological role, the evaluation of potential project impacts and alternatives is focused upon chinook salmon and steelhead trout. These species are considered to be the primary species of management concern because of their economic and recreational value.

Recent studies of habitat availability, fish abundance and distribution, physiology, emigration, and several other aspects of fishery resources in the lower American River have been and are being conducted by the Fish and Wildlife Service; DFG (California Department of Fish and Game); Sacramento County, East Bay Municipal Utility District; the University of California at Davis; and California State University, Sacramento. The intent of those studies has been to reduce the uncertainty regarding habitat requirements of aquatic public trust resources of the lower American River, emphasizing fall-run chinook salmon. The following information incorporates preliminary findings from these studies and from previous work.

Folsom Reservoir

The Folsom Reservoir Area includes Folsom Reservoir, Lake Natoma, and the Nimbus Salmon and Steelhead Hatchery. This subsection describes the aquatic habitat and fisheries in this area potentially affected by the project.

Folsom Reservoir. Folsom Reservoir supports both cold and warmwater fisheries. However, Folsom's productivity is low because of low levels of nutrients and annual fluctuations in the reservoir water surface. The DFG maintains the existing coldwater fishery, consisting of previously planted, land-locked populations of salmon and ongoing hatchery plantings of rainbow trout. Natural production does occur in streams leading to the lake, but is limited by instream factors such as barriers and fluctuating flows. The reservoir

supports many resident nongame fish and warmwater game fish, including large and smallmouth bass, white catfish, brown bullhead, channel catfish, and several sunfishes.

Inundation of the area upon closing of Folsom Dam (constructed in 1955) transformed this previously free-flowing section of the river into a lentic (slow-moving or still waters) aquatic environment (the reservoir). The mean and maximum Folsom Reservoir depths are 66 and 266 feet, respectively. A thermocline develops in the reservoir each year with adequate oxygen for fish in the hypolimnion. No chronic water-quality problems have been identified. Average total dissolved solids and total phosphorus levels in the period from 1970 to 1979 of 46 milligrams per liter and 0.02 milligrams per liter indicate low nutrient levels. This contributes to Folsom Reservoir's lower productivity as compared to many other Central Valley reservoirs.

Folsom Reservoir and other reservoirs in the CVP system are managed for multiple uses, with water supply and flood control being the two principal uses. Optimum or even self-sustaining populations of game fish in reservoirs often are not achieved simultaneously with water supply and flood control management. Such conflicts typically restrict the productivity of reservoir fish populations (Summerfelt, 1993).

Folsom Reservoir is usually subject to substantial reductions in water-surface elevation from late spring and summer until inflow increases during the winter rainy season, primarily during the spring snowmelt runoff period. Fluctuation in water-surface elevation influences fish habitat in reservoirs. For example, fish that spawn on reservoir slopes risk having eggs dewatered or placed at a depth too deep for egg development (Moyle et al., 1989).

Current operation of Folsom Reservoir is believed to adversely affect both spawning and juvenile survival of many resident warmwater fish species, primarily from fluctuations in surface elevation during nesting periods, resulting in either nest flooding or dewatering. The result has been relatively low annual production of centrarchids (bass, sunfish, and crappie) and ictalurids (bullhead and catfish). Consequently, Folsom Reservoir's centrarchid and ictalurid fisheries are marginal compared to those found in similar natural lakes that do not undergo reservoir operations.

Rainbow trout in Folsom Reservoir are not closely associated with littoral habitats; their habitat consists of the coldwater pool (waters below 65 °F). This is restricted to the hypolimnion during periods of thermal stratification, but constitutes the entire reservoir in late fall through spring. Salmonid spawning is not believed to be successful in Folsom Reservoir. Trout populations are maintained by stocking.

Lake Natoma. Lake Natoma was constructed as a regulating afterbay for Folsom Reservoir power generation flow releases. As a consequence, water-surface elevation in the reservoir can fluctuate daily and weekly from 4 to 7 feet (FWS, 1990a).

As a regulating afterbay, variable water temperatures and rapid water turnover (that is, flushing rates) result in a relatively inhospitable environment for fisheries. Lake Natoma supports essentially the same fish species as are found in Folsom Reservoir, but at much reduced levels. Water-level fluctuations, cold temperatures, and limited food production result in few fish. The DFG now plants some 1,000 one-half-pound catchables on an annual "free fish day." The Nimbus Salmon and Steelhead Hatchery is immediately downstream from Nimbus Dam.

Nimbus Salmon and Steelhead Hatchery. The Nimbus Salmon and Steelhead Hatchery, located downstream from Nimbus Dam, is operated by DFG under contract with the Federal Government. The hatchery was built by the Federal Government in the late 1950's as a compensation feature of the Folsom Dam project. Originally, the hatchery was planned to incubate 30 million chinook salmon and steelhead trout eggs and to rear the fry to a size suitable for release in the American River. However, subsequent management decisions changed the operation, and the objective of the current program is to take fewer eggs and raise fewer but larger fish, including 3 million smolt-size (60 fish/lb) fall-run chinook salmon and 300,000 yearling (10 fish/lb) steelhead trout for release in the estuary (FWS, 1990a).

The incubation survival rates of eggs are critically dependent on water temperature in the hatchery as well as in the river. Healey (1979) reported egg mortalities of 80 percent at water temperatures of 61 °F and 100 percent at 63 °F for Sacramento River chinook salmon. Egg incubation survival is highest at water temperatures at or below 56 °F. The temperature of the water released from Nimbus Dam into the hatchery often exceeds this level during the early part of the fall-run chinook salmon spawning and incubation period, resulting in significant losses of eggs. In recent years, egg taking operations have been delayed as late as the latter part of November.

Juvenile chinook salmon in the lower American River experience chronic temperature stress, which is a primary concern during the peak rearing period from April through June. Hatchery production is generally less affected than in-river production by the existing unsuitable spring temperature regime of the river, because the hatchery-reared smolts and yearlings are transported and released directly into the Delta. Also, hatchery-produced fry are usually released before March or April. Nonetheless, spring water temperatures frequently exceed suitable levels for juvenile chinook salmon in the hatchery. Water temperatures suitable for rearing may be achieved during spring by increasing discharge from Folsom and Nimbus Dams. However, depending upon inflow and release patterns, cold water used during the spring reduces the availability of cold water during chinook salmon spawning in fall, with the result delayed egg take or increased egg mortality or both.

A significant steelhead trout sport fishery, generally believed to be supported almost entirely by hatchery production, exists in the lower American River. Eggs are generally taken at the hatchery from January through March. Water temperatures during the summer and early fall in the hatchery often exceed suitable levels for rearing juvenile steelhead trout,

and rearing juveniles are transported to rearing facilities at the hatcheries on the Feather and Mokelumne Rivers.

Upper American River

Steep rocky canyons characterize the upper reaches of the North and Middle Forks of the American River, whereas the lower reaches contain long and wide riffles and pools. Historical documentation is limited regarding fisheries in the area. Today, year-round residents of the North Fork include several warmwater species, among them smallmouth bass, bullhead, and sunfish. There are many pools and riffles in the river with gravels suitable for trout and smallmouth bass, but low summer flows and high water temperatures greatly reduce the use of this habitat by coldwater species. Surveys by the FWS on September 20 to 28, 1989, found 38 fish, including warmwater species such as smallmouth bass, riffle sculpin, Sacramento sucker, Sacramento squawfish, and brown bullhead, while trout were scarce. Lake Clementine contains a similar species composition; however, DFG periodically plants trout.

Historical records of fish resources in the Middle Fork are limited. In the past, rainbow and brown trout have been stocked.

Construction of the Middle Fork American River project by Placer County Water Agency resulted in cooler water temperatures in summer and fall and improved habitat suitability for resident and stocked coldwater species, including rainbow and brown trout. FWS surveys in the Middle Fork, September 20 to 28, 1989, recorded 51 fish, including Sacramento hitch, Sacramento sucker, Sacramento squawfish, riffle sculpin, and brown and rainbow trout.

During May and September 1989, FWS biologists surveyed the North and Middle Forks of the American River to observe the aquatic habitat and to determine the types and relative abundance of resident fish. The North Fork supports a variety of warmwater species including smallmouth bass, bullhead and sunfish, on a year-round basis. Although a few trout are present, summer/fall water temperatures are generally too warm for suitable summer rearing. Ongoing instream mining operations and the results of earlier construction at the Auburn Dam site are the most apparent disturbances along the river. The Middle Fork American River, in contrast, supports both warmwater and coldwater species year-round. Cooler temperatures resulting from the Middle Fork American River Project support brown and rainbow trout for about 10 miles below the dam. Habitat is more suitable for warmwater species below this point.

North Fork. Below the Colfax-Iowa Hill Bridge, the North Fork flows through steep-sided canyons with 30-60 percent or greater slopes. Riffles are generally small in area and interspersed between series of deep pools and cascades. All 25 miles surveyed by FWS contain suitable rearing habitat for resident fish. However, low summer flows and high water temperatures reduce habitat suitability for coldwater species.

A total of 58 riffles and 64 pools occur from the Colfax-Iowa Hill Bridge downstream 25 miles to the Auburn Dam site. Forty-three of the fifty-eight riffle areas (77 percent) are in an 8-mile stretch between Shirttail Creek and Lake Clementine. The average riffle is 196 feet long, 82 feet wide, and 4 feet deep. The average pool is 246 feet long, 77 feet wide, and 14 feet deep. The majority of these riffles had significant areas with a combination of gravels from 0.25 inch to 3.0 inches diameter and underlying cobbles suitable for trout and smallmouth bass spawning (Reiser and Bjornn, 1979; FWS, 1983, 1984). Sediments covered less than 25 percent of these gravel areas (FWS, 1991).

Historical background on fish resources of the North Fork is limited. The DFG records of stream surveys from 1934-38 prior to Folsom Dam construction indicated that a variety of warm and coldwater species were observed. Post-Folsom Dam surveys in 1965 also included smallmouth bass (*Micropterus doloieui*) in addition to those found in the 1930's, and densities of approximately 100 trout per mile were observed (FWS, 1991).

Lake Clementine begins about 3.5 miles above the Auburn Dam site and extends 5 miles upstream. Similar fish species occur in the North Fork and in Lake Clementine. The DFG periodically stocks rainbow trout in Lake Clementine. The most recent records for angler use estimate about 5,000 angler-days annually are spent on Lake Clementine (Kennedy Engineers, 1971). Access to lower Lake Clementine is limited due to parking and boat launching space constraints (FWS, 1991).

Below Lake Clementine, there are fewer riffles, and increased sediment deposition is evident. Below the Middle fork confluence, gravel sizes decrease and sandbar deposits increase. The three-fourth mile stretch of channel above Reclamation's cofferdam site is covered by sand deposits which accumulated during operation of the cofferdam (FWS, 1991).

Throughout the reach from Colfax-Iowa Hill to the Auburn Dam site, fringes of riparian vegetation overhang the channel. Willow, alder, and blackberry are predominant. Large gravel bars are also sparsely vegetated with these species. The steep canyons and narrow channel likely have a much greater influence on water temperature than the overhanging vegetation. Daily incidence of direct sunlight exposure on the river is greatly reduced by the steep and closely adjoining canyon walls (FWS, 1991).

Disturbance of the substrate is evident along most of the river channel, due apparently to numerous instream mining operations. Tailing piles and diversions are common. Surveys (FWS, 1989) indicate that low flows and high temperature in the summer favor greater abundance of warmwater species. Smallmouth bass, riffle sculpin, Sacramento sucker, Sacramento squawfish, and brown bullhead were found in significant numbers in pools and riffles, whereas trout were scarce. A fish sampling survey conducted by FWS along the North Fork American River between September 20-28, 1989, identified 25 smallmouth bass, 2 Sacramento squawfish, 3 riffle sculpin, 3 Sacramento sucker, 3 brown bullhead, 3 green sunfish, and 1 rainbow trout (FWS, 1991).

Sport fishing is concentrated at the major access points along the river (for instance, at the Colfax-Iowa Hill Bridge, Yankee Jim Bridge, Ponderosa Bridge and other vehicle access roads) (FWS, 1991).

Middle Fork. From Oxbow Reservoir/Ralston Afterbay downstream to the confluence, the Middle Fork flows through steep-sided canyons of 30 percent or greater slopes. Riparian vegetation comprised of willows, alder, blackberry and some cottonwood overhangs the channel in many places. Similar to the North Fork, the steep canyon walls and narrow stream channel likely influence water temperature more than the overhanging vegetation. Construction of the Placer County Water Agency's Middle Fork American River project in 1962, above and including Oxbow Reservoir, provided much cooler water temperatures during the summer and fall, thereby improving habitat suitability for resident coldwater species (FWS, 1991).

Overall, 66 riffles and 67 pools occur in this segment of the Middle Fork. The average riffle is 132 feet long, 106 feet wide, and 6 feet deep. Riffle areas in the uppermost portion (upper 3 miles) above Kanaka Rapids generally contained cobbles and boulders (10-160 inches diameter) unsuitable for trout and smallmouth bass spawning. Below Kanaka rapids, wide beds of gravel of 0.25 inch to 3.0 inches in diameter and larger, with less than 25 percent fines covering the surface, were common. There are also numerous smaller gravel areas in shallow pools, along channel margins, and on inside bends. Suitable spawning habitat for trout and smallmouth bass is present from below Kanaka Rapids to the confluence (FWS, 1991).

Evidence of gold dredging activity and substrate disturbance (tailing piles and turbidity) is common throughout the river segment. Twenty-one active dredges were observed during a 2-day float. The greatest activity and substrate disturbance is in the upper 5 miles from Oxbow Reservoir to Cache Rock where 15 dredges were observed. Since the survey was conducted at the beginning of the dredging season, dredging activity probably increases greatly through the summer (FWS, 1991).

Historical records of fish resources in the Middle Fork are also limited. The DFG records of stream surveys done in 1938 prior to Folsom Dam construction indicate a variety of species present. In addition, records indicate that rainbow and brown trout were stocked from 1930-49 and then again in the mid-1960's (post-Folsom Dam). Compared to the North Fork, the Middle Fork has a much greater relative abundance of coldwater species versus warmwater species (FWS, 1991).

A fish sampling survey conducted by FWS along the Middle Fork American River from September 20 to 28, 1989, identified 18 Sacramento hitch, 10 Sacramento sucker, 11 Sacramento squawfish, 2 riffle sculpin, 4 brown trout, 3 rainbow trout, and 3 fish which could not be identified (FWS, 1991).

In summary, the North Fork American River from the Auburn Dam site to the Colfax-Iowa Hill Bridge contains about 20 miles of free flowing stream habitat and 5 miles

of reservoir habitat (Lake Clementine) suitable for warmwater fish production. Major disturbances appear to have been caused by instream mining and the washed out Auburn cofferdam. In contrast, the Middle Fork American River contains about 24 miles of free-flowing stream habitat suitable for both warmwater and coldwater fish, the coldwater habitat being a consequence of the Middle Fork American River project. Instream mining appears to be a major disturbance factor in this reach (FWS, 1991).

The effects of a 200-year sized detention dam on sediment transport were analyzed to help in the design of the dam and outlet configuration. This draft report ("Geomorphic, Sediment Engineering and Channel Stability Analysis, Resource Consultants and Engineering," 1993) compared the base (no-action) condition to a detention dam with 12 sluice gates. This was done to learn how sediment would affect the sluices and gates. This study looked at the quantity and size of the material being transported by the river. Where the material would likely be deposited during high flows under the base and project conditions was also evaluated. As a result of this study, the number of sluices has been increased from 12 to 20. The gates have also been redesigned so they will operate to minimize drawdown-induced sloughing.

The river in the study area is divided into a series of reaches between geologic or manmade features which restrict flows in the channel, causing bars to form from the bedload materials. On the Middle Fork, Reach 1 extends from the upstream limit of the project area at river mile 21.0 (near Oxbow Dam) to river mile 66.5; Reach 2 extends downstream to river mile 62.2, the upstream end of the pool caused by Landslide Rapid; Reach 3 consists of the pool behind Landslide Rapid and extends downstream to river mile 61.2; Reach 4 extends from Landslide Rapid to Greenwood Bridge at river mile 59.3; Reach 5 extends from Greenwood Bridge to the upstream end of the pool formed by Mammoth Bar at river mile 54.1; Reach 6 extends downstream to Murderers Gulch at river mile 52.4; Reach 7 extends from Murderers Gulch to the confluence with the North Fork at river mile 50.3; Reach 7a includes the North Fork up to North Fork Dam; Reach 8 is from the confluence and the damsite at river mile 47.2. Approximately 90 percent of the sediment in the project area consists of medium to coarse gravels and cobbles, with the remainder divided between coarse sand, fine gravel, and boulders.

The study estimates that under "normal" conditions, approximately 14,500 tons of sediment is delivered as bedload on an average annual basis in the Middle Fork project area, and an additional 1,700 tons is delivered in the North Fork. The difference between the amount of sediment delivered by the two forks is a result of the North Fork Dam and Lake Clementine, which traps most of the sediment coming down the North Fork. A total of 16,900 tons is delivered past the damsite annually, showing that the system is degradational, losing approximately 700 tons annually. For detention dam conditions, the annual delivery from the North Fork is reduced to approximately 110 tons, and the amount passing through the dam sluices would be approximately 13,500 tons, indicating that the system would accumulate approximately 1,100 tons in the study area (Resource Consultants and Engineering, 1993).

During a 200-year storm, the relative sediment balance changes significantly. Approximately 560,000 tons of sediment would be delivered by the Middle Fork, and approximately 270 tons would be delivered by the North Fork; of this total, approximately 265,000 tons would be carried past the damsite. This indicates that the project area is aggradational, accumulating about 295,207 tons during a 200-year storm without the dam in place. With a dam in place, the North Fork would deliver approximately 40 tons, and the amount passing the damsite would be 70 tons, increasing the aggradation to 560,000 tons. Given the tendency for material to accumulate upstream from constrictions such as Mammoth Bar and channel blockages such as Landslide Rapids or the detention dam, it is likely that sedimentation and bar formation would continue at the same general locations in the future whether the project is in place or not. The exact location and quantity of sediment deposited would be greater with the dam in place (Resource Consultants and Engineering, 1993).

To minimize the impacts to the riverine resources such as the existing riffle pool complex along the river and impacts to vegetation on the canyon walls from drawdown-induced sloughing during an inundation event, the number of sluices was increased from 12 to 20, and the gates were redesigned to allow operation.

The change in design and operation of the dam has made the without and with-project conditions much closer, significantly reducing the effects of sedimentation on the aquatic environment and the limited fisheries resources in the project area. With a dam in place, sediment would be transported during the early part of a storm when the water is contained in the stream channel. As flows increase and the water begins to back up behind the dam, sediment in the water would start to settle out. When the storm passes and the drawdown begins, the flow rate would accelerate as the water returns to the channel. This acceleration of flows would again transport sediment downstream until the velocities were not sufficient to move the bedload. The second episode of sediment transport would somewhat cleanse the material deposited during the impoundment.

During February 1986, a 2-day average flow of 46,000 cfs was measured at the Foresthill gaging station, and water depths of 30 feet were noted at high-water marks on the canyon wall. Flows were estimated to have velocities of 20 to 25 feet per second. This storm was calculated to have a return frequency of about a 67-year storm. During a 200-year storm, it is calculated that peak inflows past the damsite would be about 300,000 cfs. Model runs indicate that this would result in water depths of approximately 60 feet. For a 400-year storm, peak inflows would be about 510,000 cfs and water depths about 68 feet. Flows of this magnitude would likely result in all but the most sheltered fish being swept out of the river into Folsom Reservoir. Flows of this magnitude would also cause the cobbles and sediment in the riverbed to move and be redeposited into new bars or at the existing bars along the river

Upper Sacramento River

The regional setting for fisheries analyses includes the upper Sacramento River area (including the upper reaches of the river, Shasta and Keswick Reservoirs, and Clair Engle

Reservoir on the Trinity River). This subsection describes aquatic habitats and fisheries resources within this general area.

Shasta and Keswick Reservoirs. Shasta Dam and Reservoir are located about 15 miles north of the City of Redding, Shasta County, in northern California. Shasta Reservoir stores and releases flows of the Sacramento, Pit, and McCloud Rivers. Keswick Dam, about 9 miles downstream from Shasta Dam, regulates releases of water into the upper Sacramento River, including those from Shasta Reservoir and those imported from the Trinity River through the Spring Creek Tunnel.

Shasta Reservoir is a deep reservoir supporting a wide variety of warmwater and coldwater fishes. Seasonal water-surface elevation fluctuations of the reservoir are extreme, averaging 55 feet. In addition to fluctuations in water-surface elevation, the littoral zone (shallow water near shoreline area) aquatic habitat areas are subject to disruption resulting from wave action caused by wind and boats. Shasta Reservoir is a "two-story" impoundment, supporting a warmwater fishery in the upper warmwater layer epilimnion and a coldwater fishery in the colder lower layer hypolimnion. Fish inhabiting the reservoir include several species of trout, landlocked salmon, largemouth and smallmouth bass, channel catfish, white catfish, threadfin shad, Sacramento sucker, Sacramento squawfish, and common carp.

The area between Shasta and Keswick Dams is characterized as a coldwater impoundment supporting a good rainbow trout sport fishery and a brown trout fishery. Keswick Dam is a complete barrier to the upstream migration of anadromous fish. Anadromous fish are those which spawn in freshwater rivers or streams, migrate and develop as juveniles within freshwater and estuarine environments, spend the majority of their adult life stage in the open ocean, and return to freshwater to spawn. Migrating anadromous fish impeded by the structure are transported to the Coleman National Fish Hatchery (Reclamation, 1991) on Battle Creek (southeast of the town of Anderson).

Clair Engle Reservoir. Clair Engle Reservoir is also thermally stratified, providing both warmwater and coldwater habitats. Common fish species in the reservoir include small- and largemouth bass, white catfish, and rainbow trout (Corps, 1991).

Upper Sacramento River. The upper Sacramento River, extending from the Red Bluff Diversion Dam upstream to Keswick Reservoir (approximately river mile 243 to 302), has been significantly altered by the construction (in 1945) and operation of Shasta Reservoir. Regulated flows have affected water temperatures and flows within the Sacramento River. Construction of Keswick Dam (1950) resulted in the historical spawning grounds of the winter-run chinook salmon becoming inaccessible. The upstream portion of this reach of the river has not been altered extensively by the levees and bank revetment. As a result, the river is natural, with typical riverine features such as riffles, runs, glides, and pools. Conversely, the lower reaches of the upper Sacramento River have been significantly altered by regulated flows from Shasta Reservoir; these flows have affected water temperature and flow regimes in the river.

The upper reach of the Sacramento River supports both warmwater and coldwater fish species. Resident species include rainbow and brown trout, largemouth and smallmouth bass, channel catfish, sculpin, Sacramento squawfish, Sacramento sucker, hardhead, and common carp (Reclamation, 1991). This reach of the Sacramento River is of primary importance to anadromous species (Reclamation, 1991) and serves as the primary spawning grounds of winter-run chinook salmon. In addition to winter-run chinook salmon, three other races of chinook salmon (fall, late fall, and spring runs) inhabit the upper Sacramento River. Thus, various life stages of the four races of chinook salmon can be found in the upper Sacramento River throughout the year.

Downstream From American River

For purposes of fisheries analyses, the lower Sacramento River area includes the lower reaches of the river and the Sacramento-San Joaquin Delta. This subsection describes the aquatic habitat and fisheries resources potentially affected by the project in this general area. Table 4-2 lists fishes of the lower Sacramento River.

Lower River. A significant portion of the lower river is leveed and bordered by agricultural land (DFG, 1988). Aquatic habitat is represented by a meandering, channelized, depositional section of the river which is characterized by poor water clarity and little habitat diversity. Fish species composition of the lower portion of the Sacramento River is similar to that of the upper Sacramento River, including resident and anadromous fishes and warmwater and coldwater species. Anadromous fish, such as chinook salmon, striped bass, American shad, and sturgeon, primarily use this section of the Sacramento River as a migration route to upstream spawning areas, although this section of the river does contain limited suitable spawning habitat.

Sacramento-San Joaquin River Delta. Historically, the Delta was a lowland marsh dominated by tules and other types of aquatic vegetation. Because of varying flows from the Sacramento and San Joaquin Rivers, water salinity and volume were constantly changing. In the mid-1800's, the construction of levees began to protect the increasingly populated area from floodwaters. The levees also protected the many agricultural areas. Because much of the Delta is now protected by these levees, additional habitat has been altered by human development.

The Delta connects to San Francisco Bay, and together the area comprises the largest estuary on the west coast (EPA, 1993). Its importance to fisheries is illustrated by the over 120 fish species which rely on its unique habitat characteristics (EPA, 1993). Fish species in the Delta include anadromous species (chinook salmon and steelhead trout), Delta smelt (Federally listed as threatened) and Sacramento splittail (proposed for threatened status), in addition to several species which can tolerate a wide range of water salinities.

TABLE 4-2

Fishes of the Lower Sacramento River

Common Name	Scientific Name
Anadromous Game Fish	
Chinook salmon	*Salmon gairdneri*
Steelhead	*Oncorhynchus kisutch*
Silver salmon	*Oncorhynchus gorbuscha*
Pink salmon	*Oncorhynchus keta*
White sturgeon	*Acipenser transmontanus*
Warmwater Game Fish	
* Spotted bass	*Micropterus punctualatus*
* Largemouth bass	*Micropterus salmoides*
* Smallmouth bass	*Micropterus dolomieui*
* Warmmouth bass	*Lepomis gulosus*
* Green sunfish	*Lepomis cyanellus*
* Bluegill	*Lepomis machrochirus*
* Redear sunfish	*Lepomis microlophus*
* White crappie	*Pomoxis annularis*
Sacramento perch	*Archoplites interruptus*[1]
* Channel catfish	*Ictalurus punctatus*
* White catfish	*Ictalurus catus*
* Brown bullhead	*Ictalurus nubulosus*
* Black bullhead	*Ictalurus melas*
Nongame Fish	
Sacramento western sucker	*Catostomus occidentalis*
* Carp	*Cyprinus carpio*
* Goldfish	*Carassius auratus*
Sacramento blackfish	*Orthodon microlepidotus*
Hardhead	*Mylopharodon conocephalus*
Sacramento hitch	*Lavinia exilicauda*
Sacramento squawfish	*Ptychocheilus grandis*
Sacramento Splittail	*Pogonichthys macrolepidotus*[2]
* Mosquitofish	*Gambusia affinis*
Tule perch	*Hysterocarpus traski*
Riffle sculpin	*Cottus gulosus*
Pacific lamprey	*Engonsphenus tridentatus*
* Threadfin shad	*Dorosoma petenense*
* Golden shiner	*Notemigonus crysoleucas*
* Fathead minnow	*Pimephales promelas*
Western roach	*Hesperoleucas symmetricus*
Sacramento tui chub	*Gila bicolor*
Spreckled dace	*Rhinichthys osculus*
* Log perch	*Percina macrolepida*

Source: Modified from Gerstung, 1971.
*Introduced species
[1]Possibly extirpated
[2]Federal Candidate, Category 2

VEGETATION AND WILDLIFE

The vegetation affected by the project ranges from the agricultural landscape of the lower Sacramento River area to the various forests in the upper American River.

Lower American River and Folsom Reservoir

Lands along the American River were often flooded prior to construction of the lower American River levee system. Perennial and seasonal freshwater marshes and riparian habitat occupied what is now the Sacramento metropolitan area. Settlement and development disrupted these natural processes. Flood prevention and land reclamation allowed the flood plain areas of the lower American River to be developed. Today, the lower American River flows 23 miles through the American River Parkway (FWS, 1990).

Folsom Reservoir, Lake Natoma, and the lower American River area extend across a natural transition zone from the higher elevation habitats of the lower Sierra foothills to the valley floor. Although the lower American River area contains the same vegetation cover types as Natomas, the distribution pattern differs from that in Natomas. Lands adjacent to Folsom Reservoir are characterized by savanna grassland and live oak woodland; marsh, riparian scrub-shrub and forest, woodland, and grassland dominate the lower American River along the parkway.

A wetland inventory along the lower American River area concentrated on the parkway area downstream from Goethe Park to the confluence, the area where flood control features have been identified. The lateral limit of the surveyed corridor was defined by the levees. Specifically, wetlands above the average high-water line were targeted. Approximately 655 acres of wetlands were found along the parkway.

However, two vegetation cover types, oak-woodland and grassland, limit overall species diversity in the Folsom Reservoir area. The oak woodland provides an abundance of trees for nesting and observation sites for red-tailed hawks, American kestrels, and other raptors. The evergreen oaks supply a food source for mast eaters such as acorn woodpecker, scrub jays, black-tailed deer, ground squirrels, and gray squirrels (FWS, 1991). The shrub layer provides cover for many species of songbirds, California quail, bobcat, coyote, gray fox, and rodents (FWS, 1991). Other characteristic wildlife of this ecosystem include the raccoon, opossum, bats, western skink, and king snake.

The grassland areas in the Folsom Reservoir area serve as the food base for a wide variety of herbivores such as the kangaroo rat, meadow mice, pocket mice, and pocket gophers. These species provide food for the carnivorous species of the area, which include owls, hawks, coyote, gray fox, gopher snakes, and the Pacific rattlesnake. The Lake Natoma area supports the same wildlife species as are found along the lower American River (FWS, 1991).

The lower American River and parkway area support diverse wildlife populations. The high species diversity in the parkway results from the amount, variety, and quality of habitat and existing protective management measures. Each of the five vegetative cover types is valuable to wildlife. They provide for permanent residency and breeding and serve as a migratory corridor or a buffer from urban developments. Riparian forests are the most significant for wildlife. Their tremendous decline statewide makes them especially significant.

More than 220 species of birds have been recorded along the parkway, and over 60 species nest in Central Valley riparian habitats (FWS, 1991). Common species along the floodway include the great blue heron, mallard, red-tailed hawk, red-shouldered hawk, American kestrel, California quail, killdeer, belted kingfisher, scrub jay, northern flycatcher, tree swallow, and American robin. More than 30 species of mammals also reside along the floodway, including striped skunk, Virginia opossum, brush rabbit, raccoon, western gray squirrel, California ground squirrel, meadow vole, muskrat, black-tailed deer, gray fox, and coyote (FWS, 1991). Additionally, reptiles and amphibians depend on the indigenous habitats of the lower American River. The most common include the western toad, Pacific tree frog, bullfrog, western pond turtle, western fence lizard, southern alligator lizard, western skink, common garter snake, and gopher snake (FWS, 1991).

Field sampling in conjunction with the HEP (Habitat Evaluation Procedure) provided a relative rating of the value of the various cover types based on representative species typically occupying various feeding and/or breeding guilds within those cover types (Corps, 1994; FWS, 1994). A complete list of species was chosen by the HEP team and, along with a description of the habitats these species represent, can be found in the FWS Coordination Act Report (appendix J).

The HEP analysis was divided into two subanalyses, construction impacts and operational impacts of reoperating Folsom Dam. This subdivision was made because of the differences in data used for analysis (that is, project feature construction data, such as length and width of construction footprints, were used for the construction impact analysis; hydraulic data were used for the operational impact analysis and consisted of peak flow-frequency curves, rating curves, and cross-section elevations). In addition, the two subanalyses correlate into different resource categories into which the cover types were placed and the related compensation goals. (See appendix J, Coordination Act Report, for further explanation.)

Upper American River

The study area encompasses 42,000 acres along the steep canyons of the North and Middle Forks of the American River, which are within the project area for the authorized multipurpose Auburn Dam. However, only a portion of this area (less than 5,500 acres) would be inundated after construction of a flood detention dam.

Historically, the riverbed and bars of both the Middle and North Forks of the American River were explored for mining as early as the summer of 1848. Thousands of miners, working alone or for mining companies, invaded the canyons of the upper American River. They worked their way up from Oregon Bar to the confluence of the Middle and North Forks and then up each fork. Placer mining predominated in the beginning, but as more miners arrived, they formed mining companies and worked the river gravels. The methods they employed called for diverting the river with wing dams and flumes to expose the riverbed for mining. The river gravels were dredged and washed in pans or sluices. Before long, another mining method came into use in the upland areas. To recover gold from older gravel deposits, the miners used hydraulic hoses to blast the gravel from the hillsides.

In general, the portions of the American River canyon in the study area have been subjected to intensive exploitation and destruction. Once the gold had been removed, river gravels were left piled on the banks of the river. Hydraulic debris washed down the streams, depositing sediment along the way. This was common along the Middle Fork. However, the North Fork Dam was specifically built to capture this debris on the North Fork of the river.

The areas disturbed by the mining boom were eventually abandoned and left to recover on their own. Vegetation has regenerated extensively, and the area provides little visual evidence of its previous degradation (Turner, 1983).

The study area serves as a transition zone between middle elevation foothill grassland, hardwood woodland and forest communities, and the higher montane, largely evergreen conifer-dominated forest communities. This wide range of physiographic and microclimatic environments provides a diverse and complex vegetation mosaic. Forest dominants in the study area vary among deciduous broadleaved trees, evergreen broadleaved trees, evergreen coniferous trees, and other combinations. Riverine riparian vegetation along the main river corridor includes large areas of flowing open water, rocky shoreline, sand and gravel bars, river-edge willow and shrub thickets, many stands of tall moist forest of varied ages, higher terrace grasslands, and mixed riparian thickets.

Jurisdictional wetlands were identified in the upper American River in June and July of 1990. Wetlands were not found above the high-water mark. This identification focused on the inundation zone created by the 200-year storage plan. The area included the North and Middle Forks of the American River from the damsite to elevation 865 feet.

The proposed damsite and inundation zone is in a region of high wildlife species diversity (FWS, 1991). Many macro- and micro-habitats, including seeps, springs, small ponds, and pools, rock outcrops, limestone outcrops, talus slopes, cliffs, crevices, and caves, contribute to the diversity and abundance of plant and animal life in the area. Much of the area is characterized by steep, often densely vegetated slopes. The canyon bottoms provide surface moisture and associated vegetation cover critical to most area wildlife species.

Species common to this general area include black-tailed deer, coyote, raccoon, fox, and many species of reptiles and amphibians. Black-tailed deer are common in densities of 10 to 30 per square mile (FWS, 1991). Although cover and browse for deer vary from excellent to poor throughout the area, in general, conditions are good to very good (FWS, 1991). The relatively high deer populations (indicated by the extent of visibly browsed shrubs and forbs) and the extensive mosaic of fire-adapted vegetation types indicate the important and dynamic role fire plays in maintaining high habitat values in the region (FWS, 1991). Fires thin dense monotypic stands of trees and shrubs, which are often undesirable as forage, and permit seed regeneration of other species that serve as browse for wildlife.

Specifically, the north slope forest cover type provides a dense tree habitat with undisturbed drainages used for nesting and denning. Species found in this habitat include ringtail cat, grey fox, deer, owls, and many songbird species (FWS, 1991). Thick ground litter provides habitat for amphibians, reptiles, and invertebrates. The ground litter also provides habitat for woodrats and ground foraging birds. In contrast, the south slope forest is a relatively dry open area in which some of the same species of the north slope forest intermix with species more exclusive to the south slope habitat. These species include turkey vulture, bandtail pigeon, scrub jay, acorn woodpecker, various warbler species, California thrasher, and various species of vireos and sparrows (FWS, 1991). Additionally, the open sunny exposures and rocky outcrops provide habitat for the western fence lizard and other species of snakes and lizards.

The drier digger pine conifer forests provide habitat for overlap species from the nearby chaparral, such as gray fox, coyote, deer, wood rat, wrentit, scrub jay, thrasher, brush mice, badger, and bobcat (FWS, 1991). The more mesic ponderosa pine and incense cedar stands often support red fox, porcupine, mountain lion, raccoon, beaver, deer mouse, California vole, mink, and forest birds such as Townsend's solitaire, pine siskin, gnatcatcher, nuthatch, western wood pewee, various thrushes, warblers, and grosbeak (FWS, 1991).

The chaparral cover type is usually a fire-adapted type of habitat that can vary greatly in its value to wildlife. Dense stands with little ground vegetation and almost complete canopy closure present low value to wildlife compared to a recently burned area with open areas and young plants and shrubs for foraging. These open areas with available forage will support species such as wrentit, quail, turkey vulture, deer, mountain lion, bobcat, coyote, gray fox, reptiles, and songbirds. In the Auburn area, chaparral areas are not usually allowed to experience the natural fire regime because of fire avoidance and prevention. Therefore, the chaparral areas are indirectly allowed to mature to decadent, essentially monoculture stands of one or two dominant shrubs with relatively low wildlife values (FWS, 1991).

The grassland habitats in the upper American River area vary in terms of their value for wildlife depending on the location (elevation) and size of the area. Generally, grasslands provide foraging sites for many of the species residing in the adjacent habitats, such as mammals, raptors, reptiles, and amphibians.

The riverine areas along the upper American River support a high diversity of habitats (FWS, 1991). The vegetation here and at the major and minor tributaries that are adjacent to the main river provide a variety of habitats supporting many water and shore birds such as the dipper, sandpiper, great blue heron, killdeer, bufflehead, bittern, egret, mallard, merganser, goldeneye, and wood duck. Water sources near vegetative cover attract large mammals, amphibians, and reptiles such as foothill yellow-legged frog, western toad, slender salamander, California newt, western pond turtle, gopher snake, night snake, western whiptail, and common kingsnake.

Field sampling in conjunction with the HEP evaluation provided a relative rating of the value of the various cover types, based on representative species typically occupying various feeding and/or breeding guilds within those cover types (Corps, 1991/1994; FWS, 1990). For a complete list of species chosen, see the FWS Coordination Act Report (appendix J).

Upper Sacramento River

Riparian habitats historically occurred along the natural banks of the Sacramento River, the lower Feather River, the American River, and other streams in the Central Valley (Smith, 1977). Prior to human settlement, riparian forests are conservatively estimated to have covered 921,000 acres along Central Valley watercourses (Katibah, 1984). As of 1984, remaining riparian habitat was estimated at 102,000 acres, with approximately 49,000 acres considered degraded (Katibah, 1984). Major human-induced changes contributing to the decline in riparian cover include conversion to agricultural uses, logging, streambank stabilization, channelization, reduction of riverflow due to dams and irrigation, and accelerated erosion of riverbanks due to upstream dams and channelization in adjacent areas (Roberts et al., 1980).

Riparian habitats are areas of high biological productivity (Roberts et al., 1980). Many species of wildlife find optimal habitat in riparian systems, and some are entirely restricted to surviving remnants along river channels (Sanders et al., 1985; Eng, 1984; Gaines, 1977). A high diversity of bird species is supported by riparian woodlands (Gaines, 1977). Equally important are the assemblages of mammals, reptiles, amphibians and invertebrates inhabiting riparian habitats (Brode and Bury, 1984; Williams and Kilburn, 1984; Eng, 1984). Persistence of remaining riparian ecosystems is important for maintaining statewide biological diversity.

Shasta and Keswick Reservoirs. Habitats surrounding these reservoirs consist mainly of upland vegetation dominated by conifers. Typical species are ponderosa pine, digger pine, Douglas-fir, and blue oak. At lower elevations on moderate to steep terrain, vegetation is predominantly shrub and scrub oak. A significant drawdown zone caused by fluctuations in water-surface elevations associated with normal reservoir operations rings the reservoirs. No vegetation can become established in this zone and immediately adjacent areas because of wave action from wind and boats and the extreme water-level fluctuations.

On slopes below the lake's high-water line, vegetation is limited to small patches of annuals and willows in moist areas (Corps, 1991a).

Trinity River Division. The Trinity River Division is mainly surrounded by upland habitats dominated by conifers with some small areas of riparian habitat with deciduous species. Large stands of willow and alder often grow on the edge of watercourses. Marshes are found in slow-moving backwaters. Vegetative communities and associated wildlife closely resemble historic conditions.

Maintenance of riparian communities along the Sacramento River is dependent upon flow regimes. Historically, high intensity flows removed debris and deposited new sediments which provided suitable substrates for seed germination. Erosion and sediment deposition are therefore important factors in riparian succession along parts of the Sacramento River (Corps, 1988).

Much of the Sacramento River below Chico Landing is confined by levees stabilized by rock revetment bank protection to the detriment of the natural diversity of riparian vegetation. Agricultural land is common along the lower reaches of the Sacramento River, but less prevalent upstream from Red Bluff (DFG, 1988). Remaining areas of riparian communities consist of riparian forests composed of valley oaks, cottonwoods, wild grape, boxelder, elderberry shrubs, and some scrub areas dominated by willows. The largest and most significant tract of riparian forest remaining on the Sacramento River is a stretch between Chico Landing and Red Bluff. Freshwater, emergent wetlands occur in slow-moving backwaters. Tules, cattails, rushes, and sedges are the primary vegetation in freshwater wetlands.

Many species of terrestrial wildlife rely on the remaining strips of riparian vegetation for foraging, cover, and nesting. Typical wildlife associated with riparian areas includes songbirds, waterfowl, and mammals such as muskrat, otter, mink, and beaver.

Downstream From American River.

Sacramento-San Joaquin Delta (Delta). Most of the vegetation in the Delta is irrigated agricultural fields. Riparian habitats persist in small areas. Freshwater and saline emergent wetlands are present but are greatly reduced from historic conditions. Vegetation in saline wetlands consists of pickleweed, cordgrasses, glasswort, and shoregrass. These wetlands are very sensitive to variations in water salinity, which is determined by waterflows into, within, and through the Delta (San Francisco Estuary Project, 1993).

The wetlands of the Delta harbor many unique and endemic species and provide important habitat for numerous shorebirds, waterfowl, reptiles, and amphibians (Mayer and Laudenslayer, 1988).

Yuba River. The vegetation along the Yuba River upstream from Englebright Dam is similar to that found in the American River canyon area which is in the foothill ecoregion.

This area is included in the transition zone between middle elevation foothill grassland, oak savanna, and hardwood forest communities and higher montane, largely evergreen conifer-dominated forest communities. The vegetative communities are basically the same as those described for the upper American River area.

ENDANGERED SPECIES

The FESA (Federal Endangered Species Act) of 1973 (50 CFR 17) provides legal protection for plant and animal species in danger of extinction and requires identification of critical habitat and development of recovery plans for such species. California has a parallel mandate embodied in the CESA (California Endangered Species Act) of 1984 and the California Native Plant Protection Act of 1977. The plant and animal species protected under FESA and CESA are listed as endangered or threatened.

Before any Federal agency can undertake an action involving modification of the environment, FESA requires that a finding be reached by the U.S. Fish and Wildlife Service concerning the potential of that action to jeopardize the continued existence of any listed species. Unless they are also listed under FESA, species listed by the State are not protected under the FESA. Under CESA, however, the DFG is empowered to review projects for potential impacts to State-listed species and their habitats.

In addition to formal endangered and threatened listings by Federal and State Governments, many other species are of special interest because of limited distribution; declining populations; diminishing habitat; or unusual scientific, recreational, or educational value. These species are not afforded the same legal protection as listed species, but may be added to official lists in the future. There are three general categories of special interest species:

- Those species that have been formally proposed for Federal or State listing as threatened or endangered;
- Those species that are candidates for Federal or State listing as threatened or endangered;
- Those species which are not candidates, but which have been unofficially identified as a species of special interest by private conservation organizations or local governmental agencies.

Federal candidate species are assigned to one of three categories depending upon the state of the information base concerning the biological appropriateness for listing those species. FC1 (Federal Category 1) includes species for which the FWS has compiled substantial information indicating that, in terms of biological vulnerability and magnitude of threat, endangered or threatened status may be warranted. FC2 (Federal Category 2) includes species for which the existing base of information is incomplete, but which appear,

based on the information that is available, to warrant continued consideration for listed status. FC3 (Federal Category 3) includes species which have been evaluated and a determination made that listing is not warranted. Table 4-3 shows species protected under the FESA and CESA that could be present within the study area or on adjacent lands.

Pursuant to Section 7 of the FESA, the Corps is required to submit a BA (biological assessment) and biological data report to FWS. The BA includes a listing of species that would not likely be affected and a list of those species likely to be adversely affected for which the Corps would request formal consultation and a BO (biological opinion). The FWS has 90 days to conclude consultation on species likely to be adversely affected. Within 45 days after concluding consultation, the FWS issues a formal BO. The BO states the opinion of the Service as to whether the Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. If a finding of jeopardy is reached, FWS will identify reasonable and prudent alternatives to avoid jeopardy. Based upon this information, appropriate mitigation measures would be developed and implemented.

Several sensitive species are present in the project area. Federally listed, State-listed, and Federal candidate 1 and 2 species potentially found in the American River basin are presented in appendix K. For the detention dam plan, habitats in the North and Middle Fork American River canyons extending upstream from the Auburn Dam site are the most likely to be affected. For project alternatives involving modified Folsom Reservoir operations, near-shore habitats along the lower American River, Lake Natoma, and Folsom Reservoir are the most likely to be affected, with the probability and magnitude of potential impacts decreasing with increased distance from the water's edge.

A portion of the lower American River has been designated as critical habitat for the valley elderberry longhorn beetle. Critical habitat is defined as specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection, or areas outside the geographical area occupied by the species when listed, as determined by the Secretary, that such areas are essential for the conservation of the species.

Surveys were conducted along the lower American River to determine construction impacts to the elderberry bush. The results are included in appendix K.

A summary of the Federal and State listed species which are more likely to be adversely affected by the proposed alternatives are presented below. A full description of each species shown in table 4-3, including status and distribution, reasons for decline, habitat requirements, occurrence in the project area, and potential impacts of the proposed project, can be found in appendix K.

Table 4-3

Listed, Proposed, and Candidate Species Occurring or With Potential to Occur in the Project Area or on Adjacent Lands

Species	Status[1] Federal	Habitats	Occurrence in Project Area
Fishes			
Winter-run chinook salmon *Oncorhyncus tshawytscha*	T/–	Riverine	Occurs in the Sacramento-San Joaquin Delta and along the Sacramento River
Delta smelt *Hypomesus transpacificus*	T/–	Estuarine	Occurs in the Sacramento-San Joaquin River Delta
Steelhead trout *Oncorhynchus mykiss*	P/–	Riverine	Occurs in Sacramento and American Rivers
Sacramento splittail *Pogonichthys macrolepidotus*	PT/–	Estuaries, lakes, and rivers of the Central Valley	Occurs in the Sacramento-San Joaquin River Delta
Longfin smelt *Spirinchus thaleichthys*	C2/–	Estuarine	Occurs in the Sacramento-San Joaquin River Delta
Green sturgeon *Ascipenser medirostrus*	C2/–	Estuarine and riverine	Occurs in the Sacramento River and Delta
Pacific lamprey *Lampetra tridentata*	C2/–	Estuarine and riverine	Occurs in the Sacramento and American Rivers and Delta
Invertebrates			
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–	Vernal pools and other seasonal freshwater wetlands	No known occurrences; project area lacks suitable habitat
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–	Vernal pools; ephemeral stock ponds	No known occurrences; project area lacks suitable habitat
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–	Riparian and oak savanna habitats with elderberry shrubs	Occurs in lower and upper American River, Sacramento River, and Yolo Bypass
Sacramento Valley tiger beetle *Cicindela hirticollis abrubta*	C2/–	Sand deposits associated with aquatic environments	Recorded from the Sacramento River downstream from American River and from the lower American River
Shirttail Creek stonefly *Megaleuctra sierra*	C2/–	Shallow, fast flowing, mossy riffles	Known to occur only in Shirttail Creek, a tributary of the North Fork American River
Gold rush hanging scorpionfly *Orbittacus obscurus*	C2/–	Dense riparian forests	Lower American River and along the North and Middle Forks of the upper American River
Spiny rhyacophilan caddisfly *Rhyacophila spinata*	C2/–	Well-aerated riffles in clear, cold, swift streams	Known only from small tributaries of the upper American River, just below Forest Hill

Species	Status[1] Federal	Habitats	Occurrence in Project Area
Sacramento anthicid beetle *Anthicus sacramento*	C2/–	Found in sand slip-faces among willows	Potential for occurrence along Sacramento River downstream from American River
Delta green ground beetle *Elaphrus viridus*	T/–	Sparsely vegetated edges of vernal lakes and pools	No known occurrence
Amphibians and Reptiles			
California red-legged frog *Rana aurora draytoni*	PE/SSC	Permanent and semipermanent aquatic habitats, such as creeks and cold water ponds, with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods	No recent occurrences; suitable habitat along tributary streams of upper American River but considered extirpated from the area
Foothill yellow-legged frog *Rana boylei*	C2/SSC	Creeks or rivers in woodlands or forests with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby	No recent occurrences; suitable habitat along tributary streams of upper American River
Northwestern pond turtle *Clemmys marmorata*	C2/SSC	Woodlands, grasslands, and open forests; occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation	Occurs along upper and lower American River
Giant garter snake *Thamnophis couchi gigas*	T/T	Sloughs, canals, and other small waterways where there is a prey base of small fish and amphibians; requires grass banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	Occurrences in Natomas Basin and Yolo Bypass
Birds			
White-faced ibis *Plegadis chichi*	C2/SSC	Prefers freshwater marshes with tules, cattails, and rushes, but may nest in trees and forage in flooded agricultural fields, especially flooded rice fields	Occasionally occurs in the Yolo Bypass
Aleutian Canada goose *Branta canadensis leucopareia*	T/–	Roosts in large marshes, flooded fields, stock ponds, and reservoirs; forages in pastures, meadows, and harvested grainfields; corn is especially preferred	Rare occurrences in Yolo Bypass
Bald eagle *Haliaeetus leucocephalus*	E/E	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, river, or the ocean	Winters at Folsom Reservoir; occasionally observed along American River
Swainson's hawk *Buteo swainsoni*	–/T	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	Nests along Sacramento River, Natomas Basin, and Yolo Bypass

Species	Status[1] Federal	Habitats	Occurrence in Project Area
American peregrine falcon *Falco peregrinus anatum*	E/E	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large populations of other bird species	Occasional winter occurrences in Yolo Basin and along American and Sacramento Rivers
Mountain plover *Charadrius montanus*	C2/SSC	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grainfields	Occasional winter occurrences in Yolo Bypass
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	–/E	Wide, dense, riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley oak riparian habitats where scrub jays are abundant	No known occurrences in project area
Western burrowing owl *Athene cunicularia hypugea*	C2/SSC	Rodent burrows in sparse grassland, agricultural edges, roadsides, and desert habitats	Occurs in Yolo Bypass
California spotted owl *Strix occidentalis*	C2/SSC	Mature forest with permanent water and suitable nesting trees and snags; in southern California, nearly always associated with oak and oak-conifer habitats	No known occurrences
Bank swallow *Riparia*	–/T	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam to allow digging	Four recently active colonies along lower American River
Tricolored blackbird *Agelaius tricolor*	C2/SSC	Nests in dense colonies in emergent marsh vegetation such as tules and cattails or upland sites with blackberries, nettles, thistles, and grainfields; nesting habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony; requires large foraging areas, including marshes, pastures, agricultural wetlands, dairies, and feedlots where abundant insect prey are available	Occasional occurrences in Yolo Bypass
Mammals			
Fringed myotis *Myotis thysanodes*	C2/–	Open woodlands	No known occurrences; potential along upper American River
Long-eared myotis *Myotis evotis*	C2/–	Woodlands	No known occurrences; potential along upper American River
Small-footed myotis *Myotis ciliolabrum*	C2/–	Open stands in forests and woodlands, as well as shrublands; uses caves, crevices, and abandoned buildings	No known occurrences; potential along upper American River

Species	Status[1] Federal	Habitats	Occurrence in Project Area
Long-legged myotis *Myotis volans*	C2/–	Most common in woodlands and forests above 4,000 feet, but occurs from sea level to 11,000 feet	No known occurrences; potential along upper American River
Pale big-eared bat *Plecotus townsendii pallescens*	C2/SSC	Mesic habitats; gleans insects from brush or trees and feeds along habitat edges	No known occurrences; potential along upper American River
Plants			
Layne's butterweed *Senecis layneae*	PE/R	Found primarily in gabbroic and serpentine substrates in northern mixed chaparral, serpentine chaparral, and foothill pine woodland	No occurrences in the project area; nearest occurrences along South Fork of the American River
El Dorado bedstraw *Galium californicum*	PE/R	Restricted to gabbroic substrates in shaded spots in northern and mixed chaparral and oak woodland	No occurrence in the project area; nearest known occurrences are along the South Fork of the American River
Nissenan manzanita *Arctostaphylos nissenana*	C2/–	Grows on metamorphic substrates in chaparral habitats	No occurrences in the project area; nearest known occurrences are along the South Fork of the American River.
Red Hills soaproot *Chlorogalum grandiflorum*	C2/–	Gabbroic and serpentine substrates in northern mixed chaparral, serpentine chaparral, and foothill pine woodland	No occurrences in the project area; nearest known occurrences are along the South Fork of the American River
Saw-toothed lewisia *Lewisia serrata*	C2/–	North-facing moss-covered cliffs above 3,000 feet in mixed evergreen and Sierran coniferous forests	No occurrences in the project area; nearest known occurrences are above 3,000 feet along the upper American River
Stebbins' phacelia *Phacelia stebbinsii*	C2/–	Sierran coniferous forest between 2,000 and 4,800 feet	No occurrences in the project area; nearest occurrences are in the canyon of the north fork of the Middle Fork American River above 2,000 feet
Valley sagittaria *Sagittaria sanfordii*	C2/–	Ponds, marshes, and slow-moving waters of streams, canals, and ditches	Occurs in the flood plain of the lower American River between Howe Avenue and State Route 160
El Dorado mule ears *Wyethia reticulata*	C2/–	Northern mixed chaparral and oak woodland	No occurrence in the project area; nearest occurrences are along the South Fork American River
Northern California black walnut *Juglans hindsii*	C2/–	Riparian woodlands	Flood plains of the Sacramento and American Rivers; no native occurrences
Palmate-bracted bird's beak *Cordylanthus palmatus*	E/–	Saline-alkali soils in seasonally flooded alkali sink scrub habitats	No occurrences in the project area; nearest occurrence is Yolo County, 10 miles northwest of the American and Sacramento River confluence
Antioch Dunes evening primrose *Oenothera deltoides*	E/–	Loose or semistabilized sand	No occurrence in the project area
Crampton's tuctoria/Solano grass *Tuctoria mucronata*	E/–	Clay bottoms of drying vernal pools and lakes surrounded by grasslands	No occurrence in the project area

Species	Status[1] Federal	Habitats	Occurrence in Project Area
Stebbins' morning-glory *Calystegia stebbinsii*	C2/E	Chaparral and cismontane woodland communities on serpentine or gabbroic substrates	No occurrences in the project area
Pine Hill ceanothus *Ceanothus roderickii*	C1/R	Chaparral and oak woodland	No occurrences in the project area
Pine Hill flannelbush *Fremontodendron californicum*	C1/–	Chaparral and oak woodland	No occurrences in the project area
Colusa grass *Neostaphia colusana*	PT/E	Vernal pools	No occurrence in the project area
Slender orcutt grass *Orcuttia tenuis*	PT/–	Vernal pools within valley grassland and blue oak woodland communities	No occurrences in the project area
Sacramento orcutt grass *Orcuttia pilosa*	PE/–	Vernal pools in valley grassland and blue oak communities	No occurrences in the project area

[1]Status definitions:

Federal

E = listed as endangered under the Federal Endangered Species Act.
T = listed as threatened under the Federal Endangered Species Act.
PE = proposed for listing as endangered under the Federal Endangered Species Act.
PT = proposed for listing as threatened under the Federal Endangered Species Act.
P = petitioned to list as threatened under the Federal Endangered Species Act.
C1 = Category 1 candidate for federal listing. Category 1 includes species for which FWS has on file substantial information on biological vulnerability and threat to support proposals to list them. Species that are possibly extinct are indicated with an asterisk (*).
C2 = Category 2 candidate for Federal listing. Category 2 includes species for which FWS has some biological information indicating that listing may be appropriate but for which further biological research and field study are usually needed to clarify the most appropriate status. Species that are possibly extinct are indicated with an asterisk (*). Category 2 species are not necessarily less rare, threatened, or endangered than Category 1 species or listed species; the distinction relates to the amount of data available and is therefore administrative, not biological.
– = no designation.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = Rare
SSC = species of special concern.
– = no designation.

Winter-run Chinook Salmon

Winter-run salmon are distinguished from other runs of chinook salmon in the Sacramento River by the timing of their upstream migration and spawning season. They return almost exclusively as 3-year-olds to the river for spawning, after maturing in the ocean. Upstream migration extends from mid-November to mid-July. The bulk of the fish spawn in May and June in the main stem of the Sacramento River upstream from Red Bluff. Juvenile seaward migration begins in July and continues through December. Winter-run chinook salmon require clean, free-running water for migration, spawning, and rearing. The winter-run salmon has been recorded at river mile 16 of the lower American River. The

different runs of salmon are hard to distinguish by sight alone. Genetic testing, which has not been completed, is necessary to confirm this information.

Delta Smelt

The Delta smelt is endemic to California and the only true native estuarine species found in the Delta. The Delta smelt can tolerate salinities ranging from zero to 12 ppt. Preferred rearing habitat for the smelt is at the 2 ppt isohaline. Typically, they are most abundant in the entrapment zone where incoming saltwater and outflowing freshwater mix.

Delta smelt historically congregated in upper Suisun Bay and Montezuma Slough when flows in the Sacramento and San Joaquin Rivers were high. Because of substantial human-caused changes in the relative ratios of seasonal freshwater outflows, the center of Delta smelt abundance has shifted since 1981 to the Sacramento River channel in the Delta. The smelt is now rare in Suisun Bay and virtually absent from Suisun Marsh where they once were seasonally common.

Sacramento Splittail

Splittail are endemic to California's Central Valley, where they were once widely distributed. Dams and diversions have increasingly prevented upstream access to large rivers. The species is now restricted to a small portion of its former range. Splittail enter the lower reaches of the Feather and American Rivers on occasion; however, the species is now largely confined to the Delta, Suisun Bay, Suisun Marsh, and Napa Marsh. Spawning success of the splittail is highly dependent on freshwater outflow and the availability of flooded streambank vegetation.

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle is host-specific to elderberry shrubs, reproducing in and feeding on elderberry. Elderberry that supports the beetle is most commonly found in riparian habitat. The specific locations with the riparian system that are most likely to support the beetle are not well understood. Populations of beetle are known along the lower American (CNDDB, 1993; Jones and Stokes, 1987). Two areas of beetle critical habitat are within the project area near the lower American River. Additional portions of the lower American River are designated as essential habitat for the recovery of the beetle (FWS, 1987). The beetle has also been found in elderberry shrubs near ponds along the lower American River (Sands, 1985). Because of their obligate association with elderberry, beetle persistence is dependent on the presence of elderberry shrubs. Changes in streamflow that adversely affect elderberry plants may negatively influence the valley elderberry longhorn beetle indirectly. Individual beetles may be affected if high spring flows inundate habitat when the adult beetles emerge.

Giant Garter Snake

The giant garter snake typically inhabits sloughs, marshes, and drainage canals characterized by slow-flowing or standing water, permanent summer water, mud bottoms, earthen banks, and an abundance of preferred forage species. The giant garter snake is highly aquatic, but avoids areas of dense riparian overstory, preferring instead emergent aquatic vegetation, such as tules and cattails, and herbaceous terrestrial cover composed of annual and perennial grasses, blackberry, and mustard. This vegetation, along with burrows, undercut banks, and large rocks, provides escape cover. Because the snake must bask in the sun to thermoregulate, areas devoid of overstory shading are also necessary (ARWI, 1991).

Giant garter snakes rely on canals and ditches as movement corridors. These movement corridors are vital to migration patterns and, most importantly, for continuing genetic exchange between subpopulations. Although it is unknown how far giant garter snakes travel in a given timeframe, they have been observed in small irrigation ditches, suggesting that they have traveled a significant distance from the main canals. Giant garter snakes are active between early April to mid-October. After the first part of October, the snakes begin to search for suitable winter retreats, where they remain all winter (ARWI, 1991).

Bald Eagle

Bald eagles are typically found near open water (reservoirs, lakes, and rivers). Fish are the primary prey, and fall-run chinook salmon are a principal component of the diet of bald eagles in the project region (Detrich, 1978). Large, dead trees near open water are used for perching and are an important habitat component (FWS, 1986). Bald eagles winter fairly regularly in the vicinity of Folsom Reservoir, although generally in low numbers. Based on winter surveys conducted from 1979 through 1982, Detrich (1981, 1982) reported bald eagle numbers ranging from one to seven at Folsom Reservoir. Bald eagles are occasionally observed foraging along the lower American River (FWS, 1990a). Reoperation of Folsom Dam could diminish the suitability of Folsom Reservoir and the lower American River as bald eagle wintering habitat in two ways: (1) if the fisheries prey base is substantially reduced in Folsom Reservoir and the lower American River and (2) if perch trees are substantially lost or if the distance from the perch trees to open water substantially increases.

Swainson's Hawk

Swainson's hawks frequently nest in large cottonwoods or oaks found in riparian habitats. However, they generally forage in open habitats such as agricultural fields (Estep, 1989). Optimum habitat consists of suitable nesting trees near open foraging areas with high rodent populations (California Natural Diversity Data Base [CNDDB], 19930. In the project region, Swainson's hawks primarily nest along the Sacramento River (CNDDB, 1993; Corps, 1986). Foraging and nesting habitat, however, is available along the lower American River and around Lake Natoma and Folsom Reservoir (FWS, 1990a).

Currently, cottonwoods are declining along the lower American River due to changes in the timing of high flows and incision of the channel. If changes in the timing and intensity of high flows due to interim reoperation further diminish the regenerative capabilities of cottonwoods, suitable Swainson's hawk nesting habitat (large cottonwood trees) may be reduced. In addition, possible urban development undertaken as a result of flood protection provided by reoperation may adversely affect Swainson's hawk foraging habitat and reduce the suitability of the area for nesting.

WATER QUALITY

In April 1990, the SWRCB issued the 1990 Water Quality Assessment. That document is a statewide catalog of California water bodies, classified in one of four ways: (1) good - waters support and enhance the designated beneficial uses; (2) intermediate - waters usually support beneficial uses with an occasional degradation of water quality; (3) impaired - waters cannot reasonably be expected to attain or maintain applicable water-quality standards (an impaired condition may be obvious such as consistent and continued exceedence of adopted objectives or when beneficial uses are not protected); and (4) unknown - data concerning the condition of the water body are lacking.

In November 1993, the SWRCB issued a draft Water Quality Control Plan for the Sacramento and San Joaquin River basins. This document defines existing and potential beneficial uses of inland surface waters within the basins and presents draft water-quality objectives for inland surface waters and ground water, which include the potentially affected American and Sacramento River basins.

American River Basin

The American River's three major tributaries (the North, Middle, and South Forks) drain approximately 2,100 square miles of predominantly montane and foothill watershed. However, the final 30 miles of the river, between Folsom Reservoir and the Sacramento River, flows through densely populated portions of urban and suburban Sacramento County, including the City of Sacramento.

The variability of the watershed geography affects land uses and, ultimately, water quality. In the upper watershed, principal land uses include recreation, logging, and mining. Water-quality impacts are generally minor and limited to increased sediment loads. Along the lower American River, principal water-quality impacts, such as nutrient and trace metal loadings, result from stormwater runoff, treated sewage discharges, agricultural runoff, and other urban and agricultural land use practices. In addition, the operation of the complex system of water reservoirs, debris dams, and diversion structures affects flows and occasionally leads to unfavorable temperatures and dissolved oxygen concentrations in the lower American River.

Historically, water-quality parameters for the American River have generally been well within acceptable limits to achieve water-quality objectives and beneficial uses mandated by the Central Valley Regional Water Quality Control Board (CVRWQCB). The lower American River has periodically experienced high water temperatures that have jeopardized spawning and juvenile fish survival. These conditions generally occur in low water years when flows into the lower river are reduced.

In addition to periodic violations of hydrogen-ion concentrations and dissolved oxygen standards, taste and odor are problems in the domestic water supplies taken from Folsom Reservoir and the lower American River, primarily during the late summer. Taste and odor problems in water supplies from Folsom Reservoir are attributable primarily to blue-green algae which occasionally bloom in the reservoir as a result of elevated water temperatures. In the lower American River, similar problems are more frequent, but are the result of increased concentrations of an actinomycete microorganism which is also associated with elevated water temperatures. In both situations, control of the taste and odor problems may require increased treatment.

Water released from Folsom Reservoir is sometimes used to maintain water-quality standards in the Delta. The primary water-quality application is the use of Folsom Reservoir (and other CVP) water to offset the movement of saline water upstream.

Sacramento River Basin/Delta

The San Joaquin and Sacramento Rivers meet with the relatively minor flows of the Cosumnes and Mokelumne Rivers and merge their waters in the Delta. Water quality in the Delta is heavily influenced by a combination of environmental and institutional variables. This includes various water export facilities and agricultural activities internal to the Delta.

The two water-quality concerns in the Delta are salinity and water temperature. The principal source of salt is the Pacific Ocean via San Francisco Bay. An additional source of salt is upstream agricultural discharges to the San Joaquin River, which can sometimes create serious salinity problems in the south Delta.

Salinity intrusion into the Delta from the ocean is controlled by freshwater flows into the Delta from the Sacramento, San Joaquin, Mokelumne, Calaveras, and Cosumnes Rivers. Water development facilities upstream and within the Delta reduce winter and spring flows, so salinity levels are higher than they would be naturally. Also, during the summer and fall, water development facilities augment the natural flows into the Delta, so salinity levels are lower than they would be naturally, and the severe salinity intrusions that once were common every summer have been eliminated. In the past, salinity sometimes intruded upstream as far as the City of Sacramento on the Sacramento River and Stockton on the San Joaquin River.

Salinity requirements to protect various beneficial water uses in the Delta are set forth in SWRCB Water Rights Decision 1485 (D-1485). Municipal and industrial water uses from the Delta are protected by the 250 ppm (parts per million) level of chlorides measured at the

confluence of Old River and Rock Slough. A secondary 150-ppm standard was set at the same location for Contra Costa Canal industrial water users during a portion of the year, depending on water-year type. Agricultural water uses within the Delta are protected by an electrical conductivity standard of 0.45 mmhos (millimhos) (set at Emmaton on the Sacramento River and Jersey Point on the San Joaquin River) that is maintained for a varying number of days each year, depending on water-year type.

Salinity standards are still being reviewed for the protection of selected estuarine habitat. In addition, a variety of electrical conductivity standards have been suggested for the protection of fish, wildlife, and agriculture (SWRCB, 1992).

Water temperature in the Delta is an ongoing concern. In the summer, temperatures may range up to 70 °F, which is high for fish resources. The temperature of Delta waters is determined by a wide variety of factors that affect Delta water temperatures, including tributary inflow volume and temperature, climate and weather, extent of agricultural withdrawal or return water contributions, and riparian vegetation.

In October, 1994, California's major agricultural and urban water agencies presented a Joint Proposal for Comprehensive San Francisco Bay-Sacramento/San Joaquin Delta (Bay-Delta) Water Quality Standards to the State Water Resources Control Board (SWRCB). This proposal served as the basis for a comprehensive set of Bay-Delta standards developed in coordination with State-Federal agencies. In December, 1994, the Federal government, the State of California, water users, and environmental advocates signed a three-year agreement on new projections for the Bay-Delta entitled "Principles for Agreement on Bay-Delta Standards Between the State of California and the Federal Government" (Principles) (NMFS, 1995).

The purpose of the Principles is to provide a framework for representatives of State and Federal governments and urban agricultural and environmental interest to develop a coordinated and comprehensive program of ecosystem protection through the SWRCB. SWRCB has proposed fish and wildlife objectives for the Bay-Delta Estuary based on the Principles in a draft water-quality control plan. Full implementation of these objectives will occur when components have been apportioned to various water rights holders through the State's water rights process (NMFS, 1995).

In February, 1991, the National Marine Fisheries Service (NMFS) requested that the Bureau of Reclamation formally consult with NMFS pursuant to Section 7 of the Endangered Species Act to determine whether Reclamation's operation of the CVP jeopardized the continued existence of the threatened Sacramento River winter-run chinook salmon (NMFS, 1993).

To facilitate a better understanding of the many factors influencing the physical and institutional conditions and decisionmaking processes underlying the operation of the CVP, Reclamation prepared the "Central Valley Project Operations Criteria and Plan." The objectives of the plan include:

"Develop operational plan, including the identification of alternative operations, strategies, and criteria to meet legislative, legal regulatory, and agreement requirements. The near-term objective is to integrate Central Valley Project Water Management Program (NMFS, 1993)."

Reclamation and NMFS had intended to complete formal consultation covering long-term CVP operations under a range of hydrologic and storage conditions before 1992. However, late in 1991, NMFS and the Bureau agreed to separate the consultation regarding 1992 operations from the long-term consultation. NMFS issued a biological opinion and incidental take statement for 1992 operations that concluded that Reclamation's proposed operation of the CVP in 1992 was likely to jeopardize the continued existence of the Sacramento River winter-run chinook salmon and offered a reasonable and prudent alternative to avoid jeopardy (NMFS, 1993).

In September 1992, Reclamation requested initiation of formal consultation on the long-term operation of the CVP. Additionally, a companion assessment by DWR was transmitted to NMFS in November 1992. During consultation, NMFS developed biological criteria for the CVP facilities and operations that would protect Sacramento River winter-run chinook salmon. It was concluded that Reclamation was unable to meet the biological criteria for the winter-run chinook salmon under several operational scenarios. Additional modeling was completed to fully examine the ability of the existing CVP facilities to meet the winter-run chinook salmon biological criteria under all water-year types and storage conditions. In January 1993, NMFS and Reclamation used the results of this additional modeling to develop modified CVP operational plans (NMFS, 1993).

In December 1994, State and Federal agencies reached agreement on recommended water quality standards and related provisions that would remain in effect for 3 years. The agreement was based on a proposal developed by urban, agricultural, and environmental interests. Elements of the agreement include springtime export limits expressed as a percentage of Delta inflow, regulation of the salinity gradient in the estuary so that a salt concentration of 2 parts per thousand (X2) is positioned where it may be more beneficial to aquatic life, specified springtime flows on the lower San Joaquin River to benefit chinook salmon, and intermittent closure of the Delta cross channel gates to reduce entrainment of fish into the central Delta. A second category of provisions is intended to reconcile operational flexibility and compliance with the Federal Endangered Species Act (FESA). A third category of the provisions is intended to improve conditions in the Bay-Delta Estuary that are not directly related to Delta outflow (CALFED, 1995).

CULTURAL RESOURCES

This section focuses on cultural and paleontological resources within the study area. Specific locations of cultural and paleontological resources have been omitted in accordance with Federal and State confidentiality requirements.

Background

Prior to European contact, the Nisenan (Southern Maidu) Indians occupied the American River basin. Archeological excavations bear witness to their ancestry in this area for at least 4,000 to 5,000 years. The epidemics of 1833-36 and later the California gold rush of 1848, with its influx of settlers, were significant factors in the rapid demise of the Nisenan people. The Patwin Indians occupied portions of the study area within Yolo County. By the 1840's, Mexicans and Americans had overtaken their territory. Those who survived were either partially assimilated into the new American culture or were placed on small reservations by an Act of Congress. Today, the archeological remnants of these Native American cultures include village and campsites, rock art, seed- and acorn-grinding stations (bedrock mortars), hunting blinds, trails, and quarries (Johnson, 1978; Wilson and Towne, 1978).

One of the first Europeans to see the Central Valley was Pedro Fages on an expedition from Monterey in 1772. In 1827, Jedediah Smith is believed to have reached the American River, which he named "Wild River." Many other trappers, including several expeditions from the Hudson's Bay Company, explored the valley between the 1820's and 1840's. In 1837, California's Spanish Governor Juan Bautista Alvarado gave the wild river its current name, "Rio de los Americanos"—American River. John Sutter settled in Sacramento in 1839 and established Sutter's Fort. Much of our knowledge of the Sacramento Valley in the 1840's comes from the journals of Army Corps of Engineers officer John C. Fremont and his cartographer Charles Pruess (Woodward and Smith, 1977).

The lower American River area was included in the Del Paso land grant in 1844. Originally deeded to Eliab Grimes, the grant came into the hands of James Ben Ali Haggin and Lloyd Tevis in 1862. Haggin became famous for his horse breeding on the rancho, but the bottom lands along the river were used only for grazing.

The upper American River area experienced significant and rapid development as an outgrowth of the gold rush. Remnants of extensive mining activities still exist in the river canyons, in gulches, and along many gravel bars. The American River and other streams in the area were subjected to many reclamation and development projects after the gold rush (Kyle, 1990).

Unlike the Sacramento River, traffic up the American was usually limited to high-flow periods when steamers and other vessels could navigate a few miles upstream. To a lesser extent, lumbering, ranching, and limestone quarrying took place. The Great Depression witnessed a resurgence of gold mining and dredging. The miners of the 1930's often settled in structures or campsites originally constructed by the gold rush argonauts.

Surveys

Cultural resource surveys have been conducted along the Sacramento and American Rivers, including Folsom Reservoir, prior to the current study. These have resulted in the

identification of a number of prehistoric sites within the study area; however, the entire area has not been systematically investigated. Many of the surveys date from the 1950's or earlier, and the data from them are not considered reliable in accordance with current standards.

Previously, little attention has been paid to historic structures, historic archeological sites, and navigational features such as landings, piers, and moorings along the lower American River and lower Sacramento River. Future work must include an evaluation of these historic sites in accordance with Federal law and would increase the known inventory of cultural resources within the study area.

As a result, Dames & Moore, Inc., has conducted cultural resources studies associated with project activities of the lower American River and lower Sacramento River. These activities consist of archeological and historical investigations to provide inventory level data for this final SEIS/EIR. These studies were developed based on information provided in the Alternatives Report for the ARWP for the Maximum Objective Release Plan (Corps, 1994) and also included proposed borrow sites and staging areas.

Lower American River

The Area of Potential Effects for the lower American River segment was defined as direct impact areas relating to levee improvements or levee and floodwall construction (as delineated on plate 10) along a 23-mile-long corridor of the American River extending from Nimbus Dam to its confluence with the Sacramento River.

An archival records search for prehistoric and historic archeological sites was conducted for the lower American River segment in January 1995 by the North Central Information Center of the California Historical Resources File System at California State University, Sacramento. Both literature searches encompassed all project-related features, as well as a 1/4-mile-wide area adjoining each respective Area of Potential Effects. Records for the lower American River Area of Potential Effects identified 24 previously recorded prehistoric archeological sites.

Subsequent to the records search, a cultural resources inventory and site re-recordation program was initiated for the lower American River segment (Nilsson et al., 1995). This program included a pedestrian survey of 50 miles of existing and proposed levees and floodwalls, re-recordation of the 24 prehistoric archeological sites, and recordation of newly discovered sites. Potential staging areas and borrow site locations were also inventoried.

These efforts resulted in the identification and re-recordation of 42 sites, including 26 prehistoric, 13 historic, and 3 prehistoric/historic properties. The prehistoric sites include one extensive bedrock milling station and 25 habitation sites, 6 of which have been partially or completely destroyed by residential development. The historic archeological sites are comprised of four properties characterized by single concrete foundations, one historic

homestead remnant, one trash scatter, three segments of the Union Pacific or Southern Pacific Railroad, portions of the Folsom (American River) Mining District, portions of the Natomas East Main Drainage Canal levee, and both the southern and northern levee systems paralleling the American River. The three multicomponent archeological sites consist of prehistoric habitation sites overlain by historic era deposits.

A historic property survey within the lower American River (Dames & Moore, 1995a) resulted in the identification of several historic or potentially historic cultural properties. RD 1000 (Reclamation District 1000) Rural Historic Landscape District was determined eligible for the NRHP (National Register of Historic Places) in September 1994. A portion of the East Levee and the Natomas East Main Drainage Canal are within the project area. Also, a portion of the historic road alignment for the Garden Highway is located on top of the East Levee west of Northgate Boulevard. East Levee, the Natomas East Main Drainage Canal, Garden Highway, and Levee Road are contributors to the RD 1000 Rural Historic Landscape District. In addition, certain pre-1944 elements of the Sacramento River Flood Control Project, including certain levees within the project area, may be eligible for listing on the NRHP.

Four bridges within the project area were evaluated and two (Jibboom Street and Old Fair Oaks) were found eligible for listing. The H Street Bridge was evaluated and determined not eligible; however, Caltrans plans to reevaluate this bridge. Three potentially historic railroad bridges were identified—Northern Electric, the Western Pacific, and the Southern Pacific.

The tailings district just south of the Nimbus Dam in the American River Parkway is part of the Folsom (American River) Mining District (CA-SAC-308/H), and more research is required to determine NRHP eligibility as a Historic Mining Property. A ca. 1928 farm complex at 599 Garden Highway in Discovery Park includes a house, barn, and shed. This property must be evaluated for NRHP eligibility.

Several powerlines cross the parkway; at least one is older than 50 years. This property must be evaluated for NRHP eligibility.

The American River Parkway is a linear park between the north bank and south bank levees of the lower American River. It begins at the Nimbus Dam and continues to the river's confluence with the Sacramento River. The concept for a parkway along the American River dates back to 1915, although a master plan for the park was not adopted until 1960. The parkway and its associated park structures are less than 50 years old; however, more research is necessary to determine if the parkway qualifies for inclusion on the NRHP under Criterion Consideration G: Properties That Have Achieved Significance Within the Past 50 Years. A historic context of urban linear parkways in the 20th century, particularly those focused on rivers, is necessary to evaluate the parkway's significance.

Folsom Reservoir

Several surveys and studies have taken place since the construction of the dam. At least 123 prehistoric and approximately 52 historic era properties have been recorded. Primary archival and secondary sources suggest that more than 200 other potential sites or features may exist in the reservoir (Peak and Associates, 1990). These have not been verified in the field because of their inaccessibility below the reservoir pool. The Folsom Powerhouse received NRHP listing in 1973, but no archeological sites within Folsom Lake State Historic Park have been evaluated, declared eligible, or listed. The number of potential sites in these categories will not be known until a more reliable inventory is completed.

Upper American River

Studies prepared by the University of California, Davis, for Reclamation's authorized multipurpose dam project document 1,589 historic and 125 prehistoric sites in the Auburn area (True, 1980). These prehistoric sites include villages and camps, food-processing stations (bedrock mortars), quarry sites, artifact scatters, and isolated artifacts. At least 14 known ethnographic sites are also here.

Both the North and South Forks of the American River offer testimony to a profusion of historic activity stimulated by the gold rush. Identified historic features include settlements, structures, mines, mined areas, gravel bars, ditchline segments and remnants, isolated pits or trenches, isolated shafts and tunnels, check dams, trails, roads, bridges, wells, and unidentified ground disturbances (McCarthy, 1989).

The North Fork Dam, 5 miles above Auburn on the North Fork of the American River, was built by the Corps in 1938 to contain hydraulic mining debris. This dam, of single-arch design, is 155 feet high and 620 feet long (Hagwood, 1981). Now over 50 years old, the dam must be evaluated for NRHP eligibility.

The Highway 49 replacement would be near the concrete arch bridge at Auburn, known locally as Mountain Quarries Bridge, or the "No Hands" bridge. The bridge, constructed in 1911 just below the confluence of the North and Middle Forks of the American River, has been designated a Civil Engineering Landmark and is considered to be historically significant by numerous groups and individuals. However, as of August 1991 the SHPO (State Historic Preservation Office) had no record of a request for determination of NRHP eligibility or a completed nomination form for the bridge. Now over 50 years old, the bridge must be evaluated for NRHP eligibility. Five recorded archeological sites are also in the vicinity of the highway replacement.

Downstream From American River

The lower Sacramento River Area of Potential Effects was defined as portions of various levees west of the Sacramento River totaling 67 miles in eastern Yolo and northeastern Solano Counties. In January 1995, Dames & Moore researched records at the

Northwest Information Center at Sonoma State University, Rohnert Park, for the lower Sacramento River. Two prehistoric sites are known to exist within the Yolo Bypass (Bouey, 1991).

Archeological surveys of the levees on both the east and west sides of the Yolo Bypass have been completed from the Sacramento Bypass south to the south fork of Putah Creek as part of the Corps Sacramento Metropolitan Area study. No prehistoric or historic sites were found, and the potential for future impacts along the levees is minimal (Glover and Bouey, 1990). Additional studies have been completed as part of the Corps Yolo Basin Wetlands study. Surveys of the area between the Yolo Bypass and Willow Slough Bypass showed no sites (Bouey, 1994). A 180-acre parcel south of Interstate 80 was surveyed in 1995 by Corps archeologists, and no sites were found (Corps, 1995).

Additional archeological investigations undertaken within the area downstream from the American River, including a selection of levees and canals along the lower Sacramento River in Yolo and Solano Counties, resulted in the identification of one historic archeological site. This site is a 20th-century homestead in the vicinity of the Sacramento Weir and Sacramento Bypass. No prehistoric sites or isolated artifacts or features were encountered. The historic homestead site is subject to significant project-related impacts and will require NRHP evaluation (Hale et al., 1995).

A historic property survey within the same area resulted in the identification of numerous properties, including pre-1944 portions of the SRFCP comprising the Sacramento Weir and the Yolo Bypass. The Sacramento Weir was determined eligible for listing on the NRHP in 1976, and a study by Les in 1986 indicated that the Yolo Bypass appeared to be eligible for listing. In addition, the Sacramento Northern Railroad tracks were not part of the earlier evaluations of the Sacramento Weir, and more research on this structure is necessary. Other segments of the pre-1944 SRFCP within the project area include the Sacramento Bypass, Willow Slough Bypass, Cache Slough levees, Haas Slough levee, Lindsey Slough levees, and Miner Slough levee. More research is still necessary on certain aspects of these properties to determine their significance and integrity as elements of the portion of the pre-1944 SRFCP within the Yolo Basin. Other properties that may be eligible for the NRHP but that require more research include the Sacramento Northern Railroad Trestle; Conaway Ranch Complex; Southern Pacific Railroad Trestle; Shag Slough; and complexes on Liberty Island Road, Haas Slough, Cache Slough, and State Route 84 on the eastern side of Miner Slough.

AGRICULTURAL/PRIME AND UNIQUE FARMLANDS

Background

Agriculture. Historically, agriculture has played an important role in the development of the greater Sacramento area. During the late 19th and early 20th centuries, dryland farming allowed production of crops like wheat, hay, and some wine grapes. By the

1920's, gas engines and electric motors made it possible to pump ground water for irrigation, thereby increasing the amount of irrigated croplands. Technological improvements after World War II led to the conversion of large areas of land into irrigated pastures and fields for rice, corn, sorghum, strawberries, and grapes.

More recently, urbanization of the Sacramento metropolitan area has led to the loss of thousands of acres of productive agricultural land. This loss has generated substantial local concern, and agricultural preservation is an objective embraced in the general plans of all the local agencies controlling land use in the area. However, Sacramento remains subject to intense regional growth pressures, and the desire of the local land use agencies to respond constructively to these pressures forces agricultural preservation to compete with a host of other planning objectives related to urban development.

It is the responsibility of the NRCS (U.S. Natural Resource Conservation Service) to maintain and update inventories of farmlands. The Corps has coordinated with the NRCS regarding conversion of farmland in areas which were not evaluated in the 1991 ARWI EIS/EIR. The NRCS provided Farmland Conversion Impact Ratings for these new areas. From these ratings, the Corps determined (1) the total acreage of unique farmland to be converted by this project; (2) the farmland conversion impact rating (out of 260 possible points); (3) the relative value of the site as farmland (on a scale of zero to 100); and (4) the total points received (out of 160) according to the site assessment criteria set forth in the Farmland Protection Policy Act. Following are definitions of the different farmland categories:

Prime Farmlands - Lands with the best combination of physical and chemical features able to sustain long-term production of agricultural crops. The land must be supported by a developed irrigation water supply that is dependable and of adequate quality during the growing season.

Unique Farmland - Lands of lesser quality soils used for the production of the State's leading agricultural cash crops. These lands are usually irrigated, but may include nonirrigated orchards or vineyards as found in some climatic zones in California.

Farmlands of Statewide Importance - Lands similar to prime farmland but with minor shortcomings, such as greater slopes or with less ability to hold and store moisture. These lands have the same reliable source of adequate quality irrigation water available during the growing season as required for Prime Farmland.

Lower American River

Three main types of soil dominate this portion of the study area—the Rincon-Marvin-Tehama association, Sycamore-Tyndall association, and Capay-Sacramento association. These diverse soils support irrigated orchards, irrigated row crops, and field crops, among others. Tomatoes, corn, rice, and sugar beets are the major irrigated crops in Yolo County.

No significant agricultural lands remain in the flood plain portion of the lower American River.

Folsom Reservoir

There are no agricultural or prime and unique farmlands in the Folsom Reservoir area.

Upper American River

The upper American River area includes some agricultural lands, mostly irrigated pasture, orchards, and abandoned orchards. These lands cover some 600 scattered acres in the Cool, Pilot Hill, Lotus, Green Valley, and Greenwood areas. Also, a small plot of Christmas trees is commercially grown along Highway 49 near Cool. There are no farmlands designated as prime and unique in this portion of the project area.

Downstream From American River

Agriculture dominates the Sacramento and Yolo Bypass areas. Lands adjacent to the Sacramento Bypass are rated as prime farmland when drained. Land along the southern levee is developed. Agriculture surrounds the sloughs of the north Delta. The primary crops in the Yolo Bypass and north Delta areas include tomatoes, rice, wheat, corn, and sugarbeets.

Table 4-4 indicates the acreage in each county which may be affected by project features and the associated categories. NRCS did not differentiate between prime and unique farmlands in its evaluation of the areas.

TABLE 4-4

Existing Farmland Types
Downstream From the American River
(acres)

County	Project Area	Prime/ Unique	Statewide Importance
Solano	110	44	0
Yolo	545	375	61

Both the Yolo and Solano County NRCS field offices were coordinated with regarding conversion of farmland. The farmland to be converted in each county was evaluated, and the ratings are provided in table 4-5.

TABLE 4-5

Farmland Conversion Impact Rating
Yolo and Solano Counties

	Scale (points)	Rating	
		Solano	Yolo
Total acreage of unique farmland to be converted		110 acres	545 acres
Farmland conversion impact rating	0-260	158	148
Relative value of the site as farmland	0-100	73	60
Total points received according to site assessment criteria of Farmland Protection Policy Act of 1981 as amended in 1994.	0-160	85	88

In accordance with the Farmland Protection Policy Act of 1981 as amended in 1994, farmland receiving a farmland conversion impact rating less than a total of 160 need not be given further consideration for protection, and alternative sites do not need to be considered.

One step in assigning value to the farmland is through determining if any of the sites are subject to State, local, or private policies or programs which protect farmland. Construction sites which would affect farmland are almost all held under the California Land Conservation (Williamson) Act of 1965. This is a contract and is effective for a 10-year period during which time the property cannot be rezoned or developed for other than agricultural uses. Land with this distinction may be used for agriculture, recreation, or open space. It is the county's responsibility to make the determination of other "compatible uses" to which the land may be converted and maintain its Williamson Act eligibility. Should conversion of any agricultural land held under the Williamson Act render the land ineligible for continued protection under that law, the local sponsor would be responsible for compensating the landowners.

HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE SITES

Little is known about the impacts of flooding on stored toxic and hazardous waste substances. However, some important research is currently under way on the effects of natural disasters on sites where hazardous substances are present. Preliminary information shows that flooding causes significant releases of such substances into the environment (Showalter, 1991).

The significance of impacts to HTRW (hazardous, toxic, or radiologic waste) is based on both institutional and public recognition of potential public health risk if contaminants are introduced into the environment.

Lower American River

The literature review found over 1,430 hazardous or toxic waste sites within the flood plain area of the lower American River (Fugro-McClelland, October 1991). These sites are only those listed in the databases of State and Federal agencies involved in HTRW control. The list does not include some of the sites most vulnerable to flooding, such as small-scale aboveground chemical and petroleum storage facilities. Of the approximately 1,430 HTRW sites, about 334 could result in significant contamination if they were inundated. However, 175 of these 334 sites are considered a serious threat, regardless of potential inundation, and have been identified by Federal or State regulatory agencies for either cleanup or further monitoring. These sites are listed below by classification category. The number of sites in each category is given; however, because some sites are listed in more than one category, the totals do not add to 175. Ten of these are Federal Superfund sites in the lower American River and Natomas areas. No existing HTRW sites are in the proposed levee construction areas.

The classification categories are:

- The National Priority List. Sites in this category present a significant risk to human health and the environment and receive remedial funding under CERCLA. Two sites in this category are in the Sacramento area flood plain:

  Jibboom Junkyard
  240 Jibboom Street
  Sacramento, CA

  Aerojet General Corporation
  Highway 50 and Aerojet Road
  Rancho Cordova, CA

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Sites listed under this program may have a potential for releasing

hazardous substances into the environment. Fifteen sites in this category are in the Sacramento area flood plain.

- Federal facilities with known or suspected environmental problems included in the CERCLA database.

- California State Superfund sites as designated under the California Abandoned Sites Program Information System (ASPIS). This database is kept by the California Department of Health Services. Fifty-six sites in this category are in the Sacramento area flood plain.

- California's Cortese Act, which requires the California Office of Planning and Research to list several categories of potential and confirmed hazardous waste or substance sites. The categories on the Sacramento area flood plain are (a) leaking tanks, (b) abandoned hazardous waste sites, and (c) sites slated for cleanup over the next 5 years by the California Bond Expenditure Plan. One hundred and seventeen sites are in this category.

Landfills and solid waste transfer station sites could also cause contamination if inundated by major flooding. Six such sites in the Sacramento area flood plain are listed below.

- The Fruitridge Transfer Station at 8550 Fruitridge Road.

- The L & D Landfill Company at 8635 Fruitridge Road. This site is currently being monitored by the California Solid Waste Assessment Test Program. Sites monitored under this program contain hazardous wastes capable of escaping into the water, the air, or both. Assessment tests must be submitted to either the Regional Water Quality Control Board or the local Air Quality Management District (or Air Pollution Control District). In some instances, reports must be submitted to both agencies.

- The B & C Disposal Site at 8597 Jackson Road (Highway 16).

- The Ramona Avenue Landfill, located at Ramona Avenue and Power Inn Road. This site has been closed.

- Sacramento Waste Disposal at 360 North Street.

- The Disposal Site at 23rd and A Streets.

There are no known HTRW sites which would be affected by work at the dam or by reoperation of the reservoir.

Upper American River

Historically, the upper American River area was affected primarily by gold-mining activities. The gold mines in this area had their origins at or very near the beginning of the California gold rush, when miners moved from Coloma on the South Fork of the American River into the canyons of the Middle Fork. The earliest miners worked the surface and near-surface placers along the principal streams. However, before long most of the bigger mines used hydraulic methods to mine the older gravel formations for gold, and by the late 19th century, dredges were operating in several of the principal drainages. The Sliger Mine, located on the El Dorado County side of the Middle Fork above what is believed to be Spanish Bar, was hydraulically mined from 1922 (when it was reopened) to 1937. More than 80,000 tons of ore was produced during the 4-year period from 1932 through 1935.

The concern with such mining and dredging activities is that when pyrites in the rocks are exposed to air and water, sulfuric acid is created. However, because mineralization has occurred, there is no exposed pyrite or resulting sulfuric acid formation. This may be attributable to the fact that there is very little pyrite in the rocks of the upper American River canyon. The Sliger Mine is not considered an HTRW site.

At the present time, there are few remaining small operations, and none are regulated by the Central Valley RWQCB (Regional Water Quality Control Board). Hydraulic mining has been banned for decades because it was the source of significant sedimentation downstream. A review of the CVRWQCB's Listing of Dischargers and conversation with board staff revealed no problem active mine, abandoned mine, or tailings within the project area. No acid mine drainage problem had been documented in the past. (D. Fua, pers. comm., 1991).

No HTRW sites are listed at the damsite. However, two sites near the project area—the Auburn Sanitary Landfill and the Auburn State Recreation Area tank leak—are classified as hazardous waste sites on lists of the California Regional Water Quality Control Board and the California Hazardous Waste and Substances Sites. It is unlikely that other hazardous sites are in the area. Because of the steep terrain and heavy recreational use, illegal hazardous waste sites are unlikely in the upper American River.

Downstream From American River

The construction areas are in Yolo County, along the Sacramento Bypass and Yolo Bypass. The surrounding land uses are primarily agricultural, and there may be agricultural chemical residue or deposits along the Yolo Bypass levees. One known former dump site adjacent to the north levee of the Sacramento Bypass was used as a sanitary landfill by the City of West Sacramento. In April 1994, staffs of The Reclamation Board and State Water Resources Control Board conducted a reconnaissance field survey of the landfill and prepared a report outlining a general assessment of the potential for HTRW release and recommending preventive management action. Specifically, the State report recommended that if a future levee relocation results in excavation of the landfill area or subjects it to inundation by

floodwaters, the most desirable remedial action would be to relocate the landfill material to a different authorized site.

TRANSPORTATION

Background

This section describes the existing transportation system and traffic conditions in the study area. The major facilities include I-80 (Interstate 80), I-5 (Interstate 5), U.S. 50 (U.S. Highway 50), SR 99 (Highway 99), and B-80 (Business 80). Traversing the study area, I-80 provides an important transportation link between the San Francisco Bay area and Reno and other points east. U.S. 50 is an important commuter and recreational route between Sacramento and South Lake Tahoe and other points east.

Both I-5 and Highway 99 serve as vital north-south transportation spines for the State. The original I-80 route, B-80, passes through the central city area of Sacramento. Highway 49, from Oakhurst to Vinton, is a two-lane highway connecting the Auburn and Placerville vicinities in the upper American River portion of the study area. These highways connect residential locations with regional employment, commerce, and recreation areas. The central city area and the U.S. 50 and I-80 corridors are the primary employment centers. Many workers from throughout the region, including Placer and El Dorado Counties, travel to these centers during peak-commute periods, typically 7-9 a.m. and 4-6 p.m. weekdays.

Lower American River

The transportation network serving the lower American River area is radial with its major streets starting at, and then radiating outward from, the city's central business district. In the downtown area, the surface streets are laid out in a grid format. The most traveled corridors are served by one-way facilities. The areas away from downtown exhibit typical suburban roadway design with major arteries serving commercial-office-industrial corridors and providing access to the regional freeway network. A system of collector streets provides access from local residential areas to the arterial system.

The regional freeway network is dominated by four major systems: the I-5/Highway 99 system (north-south), the Highway 99/B-80 system (northeast-south), the B-80/Highway 99/U.S. 50 system (east-west), and the I-80 system (northeast-west). (See figure 4-1.) These freeways exhibit typical urban freeway characteristics, ranging from 4 to 10 lanes, with many segments elevated or depressed within the city. Certain portions of B-80 between the Cal Expo interchange and I-80 are considered substandard for Federal highway designation due to inadequate width and design.

The major streets in the Meadowview/Pocket area of the city are Freeport Boulevard, 24th Street, Meadowview Road, and Florin Road. North-south freeway service is provided by I-5, immediately west of the community with access at Meadowview Road, Florin Road,

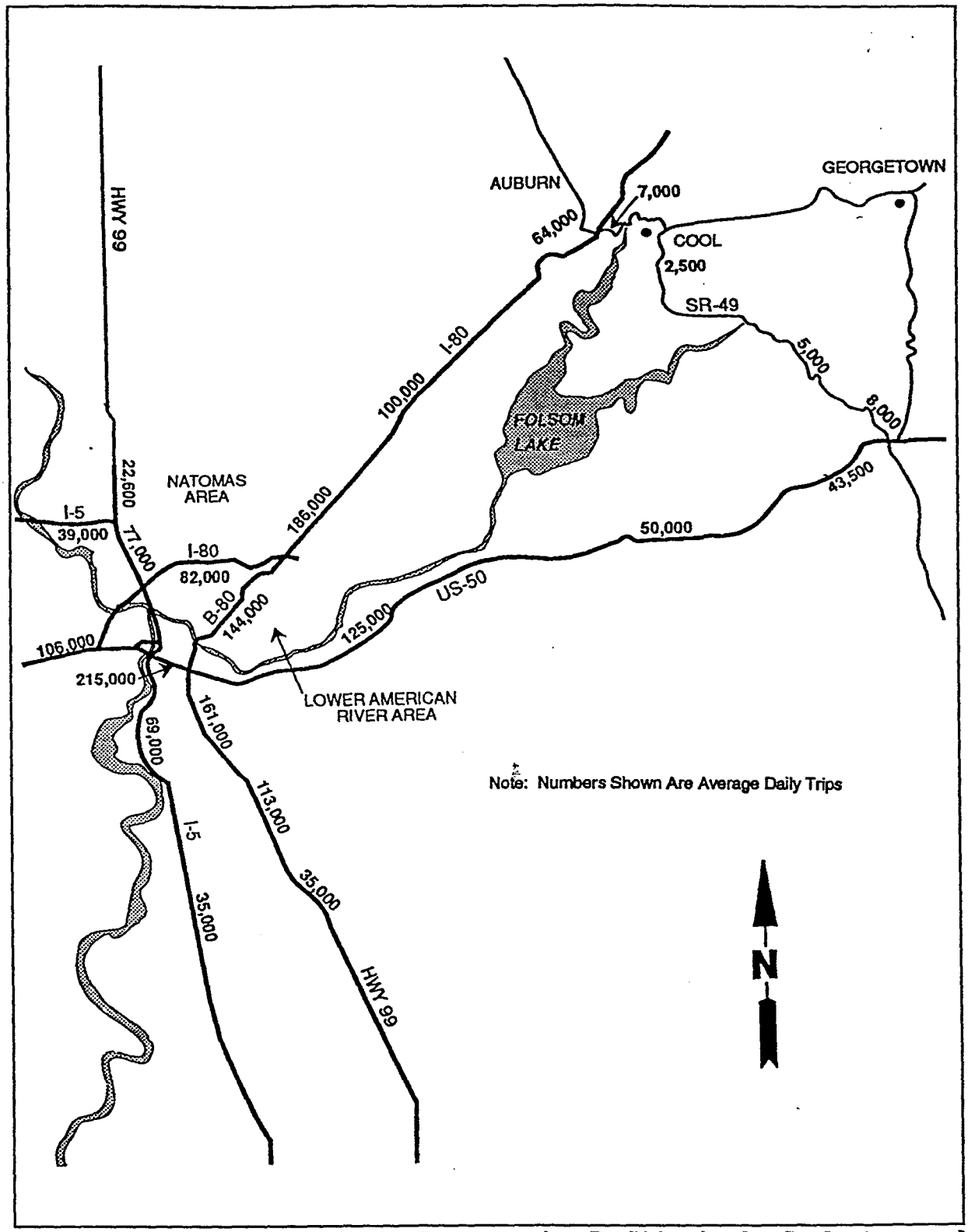


Figure 4-1. Sacramento Regional Transportation Facilities in the Study Area and Existing Traffic Volumes.

and Blair Street/43rd Avenue. The major streets in the Pocket area are Florin Road, Riverside Boulevard, Pocket Road, and 43rd Avenue. Secondary roads that provide important circulation include South Land Park Drive, Gloria Drive, and Greenhaven Drive. North-south freeway service is provided by I-5 with interchanges at Florin Road, Pocket/Meadowview, and 43rd Avenue. These roadways and their existing volumes are shown in figure 4-2.

Upper American River

The Auburn area is partially urbanized with heavy traffic volumes passing along I-80 and north to Grass Valley and Nevada City by way of Highway 49, which conveys about 7,000 vehicles daily through the study area (figure 4-3).

Access to the damsite is available from numerous dirt roads constructed to accommodate reconnaissance investigations for the previously authorized Bureau of Reclamation's Auburn Dam project. These roads are gated, unimproved, infrequently used, and carry correspondingly low traffic volumes.

Highway 49 descends and ascends the North Fork canyon by a slow, circuitous route. The highway is occasionally subject to closure by winter weather. Recreation-related traffic causes congestion in summer and winter.

The I-80/Foresthill interchange cannot handle the current recreation-related travel demand. Recognizing this, Placer County has included this interchange in its Regional Transportation Improvement Program for study by Caltrans and possible right-of-way purchase.

AIR QUALITY

This section addresses existing air pollution conditions in the study area and evaluates the region's conformance to applicable Federal and State air-quality standards.

Background

The Sacramento Valley air basin is in the northern portion of the Great Valley and extends into the neighboring mountain ranges. It is bounded on the west by the Coast Range and on the north and east by the Cascade and the Sierra Nevada Ranges. To the south is the San Joaquin Valley air basin. The Sacramento basin covers a region which, because of similar meteorological and geographical conditions, shares the same air and hence the same air pollution problems as the San Joaquin Valley basin. The concept of air basins recognizes that winds carry air pollutants throughout large areas and that topography and temperature inversions influence such transport. An air basin is not a precise physical division like a watershed, but a linkage of political districts established for dealing with air pollution that crosses municipal boundaries.

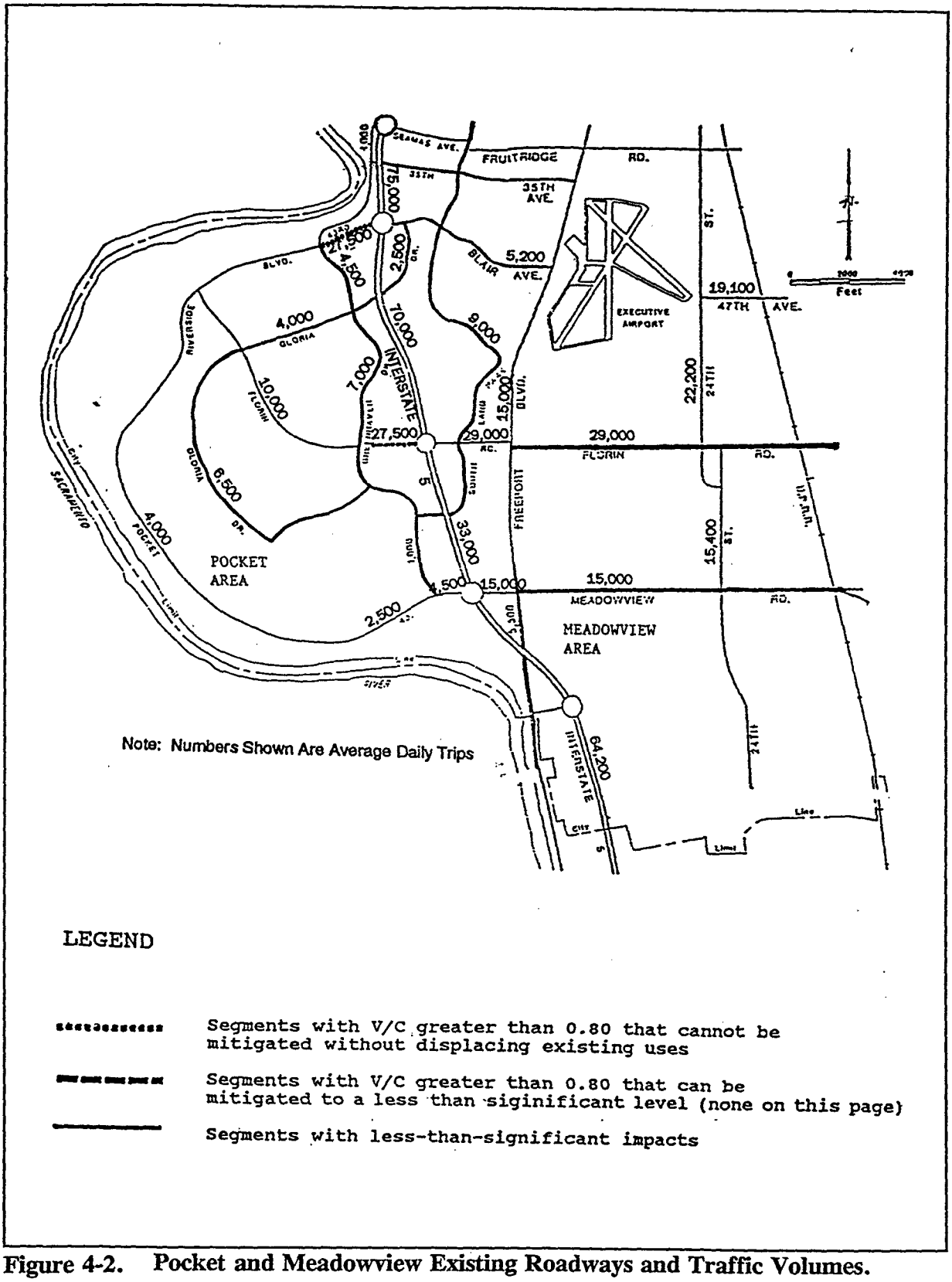


Figure 4-2. Pocket and Meadowview Existing Roadways and Traffic Volumes.

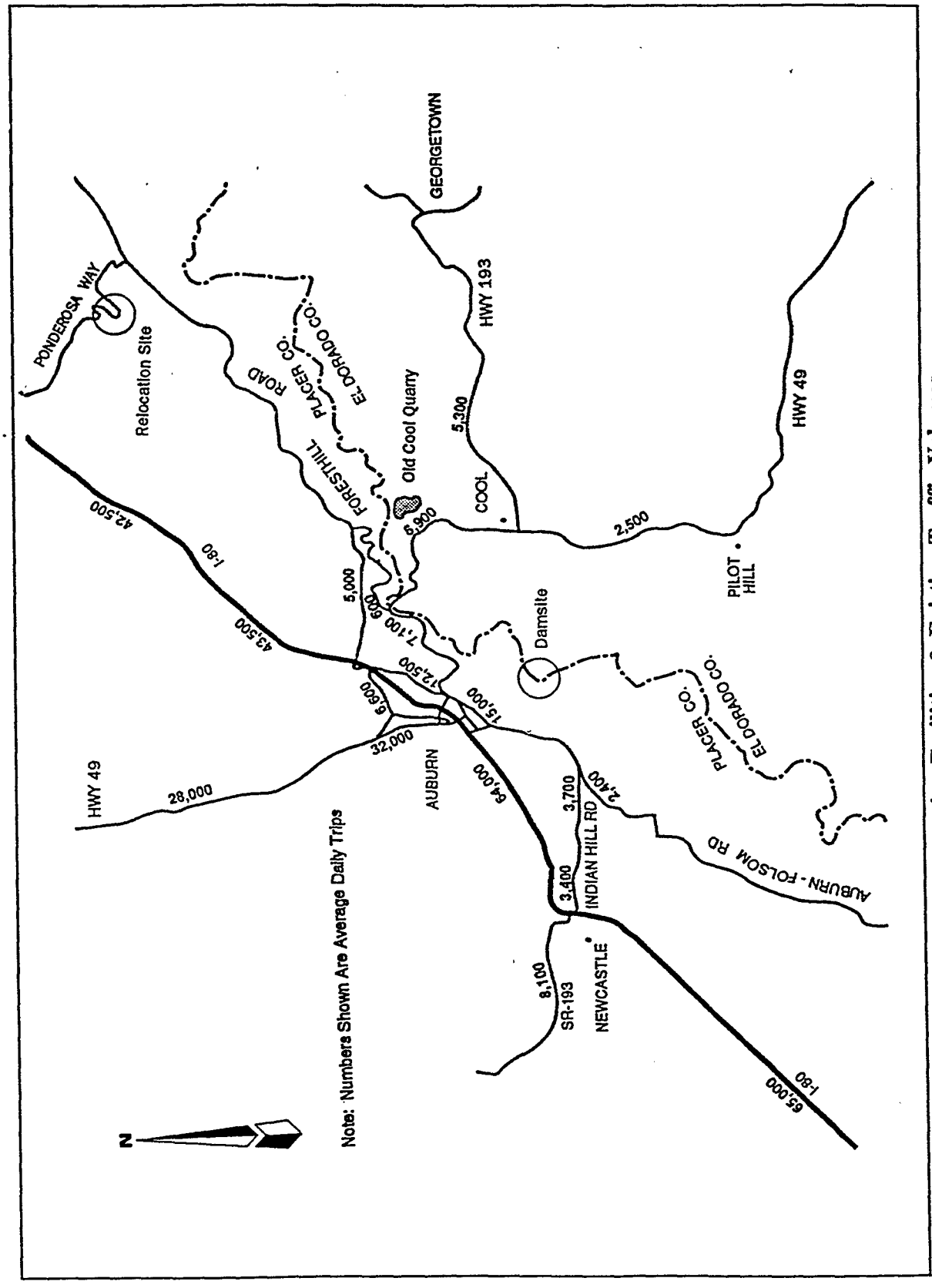


Figure 4-3. Auburn-Cool Area Transportation Facilities & Existing Traffic Volumes.

The principal air pollutant concern to the Sacramento basin is ozone, the main constituent of photochemical smog. Ozone is not released directly into the atmosphere; rather, it is a secondary pollutant resulting from a complex series of photochemical reactions. These reactions occur when precursor compounds, such as hydrocarbons and nitrogen oxides (NO_X), are mixed by light winds and heated by the sun. Hydrocarbon emissions represent a compound of reactive organic gases (ROG's), which result from evaporation of petroleum products.

Nitrogen oxide emissions result from combustion of petroleum products. ROG's and NO_X, measured in tons per day, are emitted into the air from a variety of sources. These sources are generally grouped into two main categories: stationary and mobile. Stationary sources consist of major industrial, manufacturing, and processing plants (point sources) and commercial/industrial facilities which individually emit only small quantities of pollutants but collectively result in significant emissions (area sources). Mobile sources consist of onroad motor vehicles, including automobiles, trucks, and buses, and offroad vehicles such as construction equipment, farm tractors, trains, ships, and aircraft.

The health effects of ozone include respiratory illnesses, chronic heart and lung disorders, and some anemias. Concentrations of ozone found regularly in various parts of the State can also harm normal, healthy adults. The effects often include nausea, headaches, eye irritation, dizziness, throat pain, breathing difficulty, and coughing. The health effects caused by combined concentrations of certain sulfur oxides and ozone are more severe than those caused by greater concentrations of either pollutant alone.

CO (carbon monoxide) is another, though less pervasive, pollutant emitted directly into the atmosphere and generally dispersed from the emission source and diluted through mixing. CO problems are usually localized and result from a combination of high traffic volumes and significant traffic congestion. CO pollution is most often a problem in winter as a result of radiation inversion, which occurs when air near the ground cools in the evening while the air aloft remains warm.

The inversions, coupled with calm conditions, cause "hot spots" near the emission source due to poor dispersion during winter nights. These inversions usually burn off in the morning. CO levels are a public health concern because the CO molecule has a greater affinity to bind with hemoglobin than with oxygen (O_2) molecules, resulting in reduced oxygen in the blood. State and national standards were established to keep the carbon monoxide-hemoglobin concentration below levels that will harm cardiovascular and central nervous systems.

As mandated by the Clean Air Act of 1977 Amendments, the EPA (Environmental Protection Agency) established National Ambient Air Quality Standards for a variety of pollutants, including ozone and CO. These standards are designed to protect people most susceptible to respiratory distress, such as the acutely and/or chronically ill, young children, the elderly, and persons engaged in strenuous work. The Federal Clean Air Act requires

each State to develop a SIP (State Implementation Plan) detailing the pollution control measures necessary to attain the standards. Areas that do not meet these standards for any or all constituents are designated as "nonattainment" areas.

State air-quality standards have been established in California by the Air Resources Board (ARB). As indicated in table 4-6, these standards are generally more stringent than those established by EPA. Under the California Clean Air Act of 1988 (Sher bill), the ARB is required to establish criteria for identifying air basins which have not attained State air-quality standards. EPA has not adopted the SIP submitted in November 1994 by the ARB. A Federal Executive Order suspended implementation of a FIP (Federal Implementation Plan) in 1995. Construction activities would be coordinated with local air-quality management districts.

Coordination includes completing conformity determinations and notifying the appropriate agencies. The process is described here.

The Federal general conformity rule contains both draft and final reporting requirements. For draft conformity determinations, the Federal agency making the determination must notify affected agencies of the proposed action and include the Federal agency's draft conformity determination on that action. Agencies to be notified include the appropriate EPA regional office, State and local air-quality agencies, and, where applicable, affected Federal land managers and the metropolitan planning organization.

For the American River Watershed Project, the first reporting requirement under general conformity would be issued after project authorization but prior to construction.

The second reporting requirement is that the Federal agency making the conformity determination notify the same agencies 30 days after making a final conformity determination. This final conformity determination cannot be issued until all mitigation measures and emission offsets have been secured.

The conformity rule also contains specific public participation requirements, consisting of draft and final noticing provisions. Those provisions require that, upon request by any person, the responsible Federal agency make the draft conformity determination available for public review. The Federal agency must make public its draft conformity determination by providing 30 days for written public comment before taking any formal action on the draft determination.

The Federal agency must document all responses to comments received on its draft conformity determination and make those comments and responses available, upon request by any person, within 30 days of the final conformity determination. The final conformity determination must be made public by advertisement in a local daily newspaper.

TABLE 4-6

Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		National Standards[2]		
		Concentration[3]	Method[4]	Primary[5,6]	Secondary[3,4,6]	Method[7]
Ozone	1 Hour	0.09 ppm (180 µg/m3)	Ultraviolet Photometry	0.12 ppm (235 µg/m3)	Same as Primary Std.	Ethylene Chemiluminescence
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/m3)	Nondispersive infrared Spectroscopy (NDIR)	9.0 ppm (10 mg/m3)		Nondispersive infrared Spectroscopy (NDIR)
	1 Hour	20 ppm (23 mg/m3)		35 ppm (40 mg/m3)		
Nitrogen Dioxide	Annual Average	---	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m3)	Same as Primary Std.	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 µg/m3)		---		
Sulfur Dioxide	Annual Average	---	Ultraviolet Fluorescence	80 µg/m3 (0.03 ppm)	---	Pararosoaniline
	24 Hour	0.05 ppm[8] (131 µg/m3)		365 µg/m3 (0.14 ppm)	---	
	3 Hour	---		---	1300 µg/m3 (0.5 ppm)	
	1 Hour	0.25 ppm (655 µg/m3)		---	---	
Suspended Particulate Matter (PM_{10})	Annual Geometric Mean	30 µg/m3	Size Selective Inlet High Volume Sampler and Gravimetric Analysis	---	---	---
	24 Hour	50 µg/m3		150 µg/m3	Same as Primary Stds.	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	---	---	50 µg/m3		
Sulfates	24 Hour	25 µg/m3	Turbidimetric Barium Sulfate	---	---	---
Lead	30 Day Average	1.5 µg/m3	Atomic Absorption	---	---	Atomic Absorption
	Calendar Quarter	---		1.5 µg/m3	Same as Primary Std.	
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m3)	Cadmium Hydroxide Stractan	---	---	---
Vinyl Chloride (chloro-ethane)	24 Hour	0.010 ppm (26 µg/m3)	Tedlar Bag Collection, Gas Chromatography	---	---	---
Visibility Reducing Particles[9]	8 Hour (10 a.m.-6 p.m. PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particulates when the relative humidity is less than 70 percent. Measurement in accordance with ARB method V.		---	---	---

[FOOTNOTES ON NEXT PAGE]

NOTES:

[1] California standards for ozone, carbon monoxide, sulfur dioxide (1 hour), nitrogen dioxide, suspended particulate matter - PM_{10}, and visibility-reducing particulates are values not to be exceeded. The sulfur dioxide (24-hour), sulfates, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

[2] National standards, other than ozone 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 expected number of days per calendar year with maximum hourly average concentration above the standard is equal to or less than one.

[3] Concentration is expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 °C and a reference pressure of 760 mm of mercury.

All measurements of air quality are to be corrected to a reference temperature of 25 °C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant permole of gas.

[4] Any equivalent procedure which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air-quality standard may be used.

[5] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each State must attain the primary standards no later than 3 years after the SIP is approved by the EPA.

[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. Each State must attain the secondary standards within a "reasonable time" after the implementation plan is approved by the EPA.

[7] Reference method as described by the EPA. An "equivalent method" of measurement may be used, but must have a "consistent relationship to the reference method" and must be approved by the EPA.

[8] At locations where the State standards for ozone and/or total suspended particulate matter are violated. National standards apply elsewhere.

[9] This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70 percent.

Lower American River

This project is in the south-central portion of the Sacramento basin. Yolo County, Sacramento County, southwest Placer county, and northern Solano County currently comprise the Sacramento Metropolitan Air Quality Maintenance Area. As depicted in figure 4-4, the Maintenance Area has been designated as a nonattainment area for ozone. In addition, a portion of the area lying within Sacramento County has been designated as a nonattainment area for carbon monoxide.

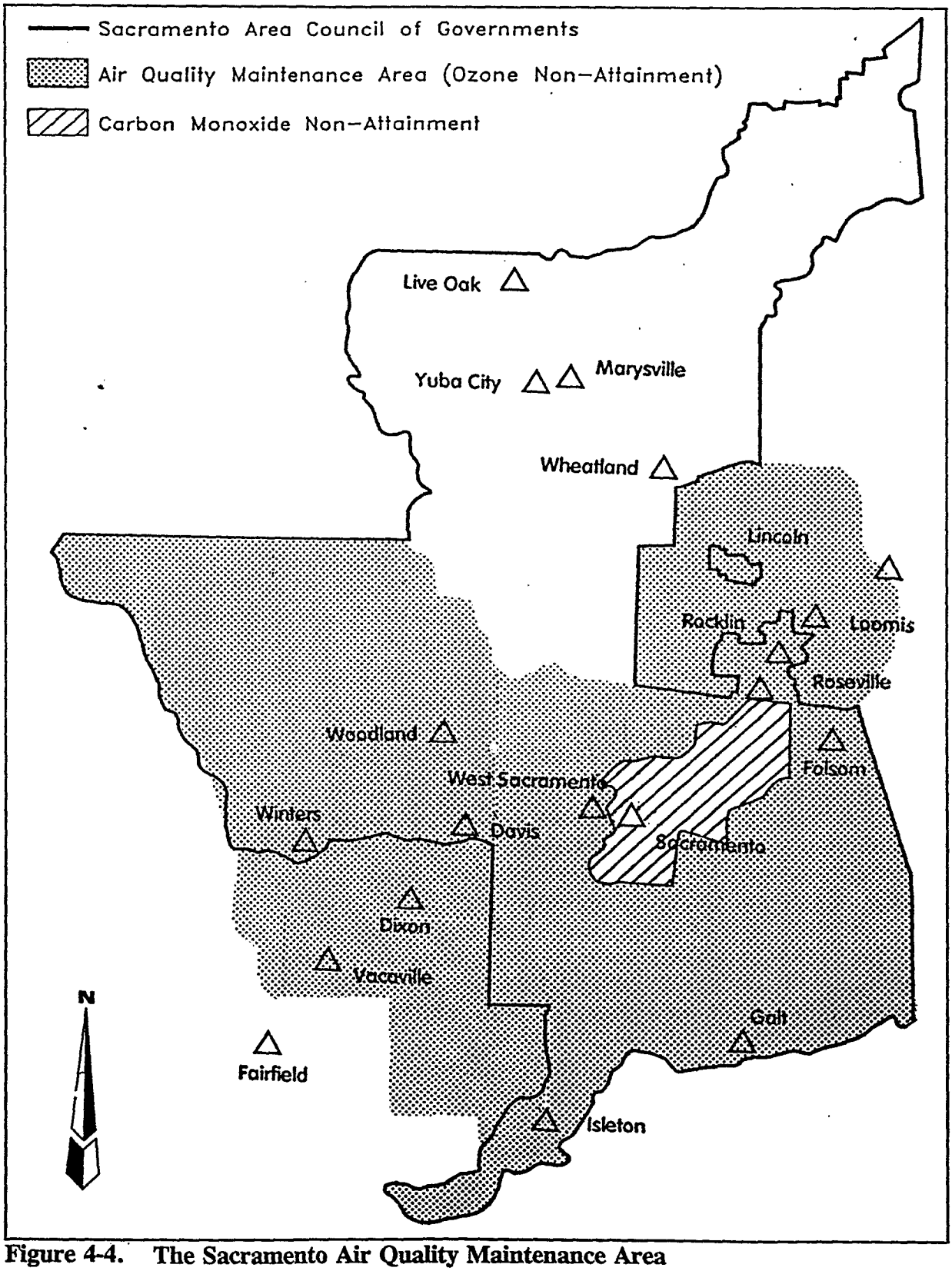


Figure 4-4. The Sacramento Air Quality Maintenance Area

Upper American River

The western portion of this project area is in the Mountain Counties air basin, under the jurisdiction of the Placer County Air Pollution Control District. Although western Placer (just west of the City of Auburn) is within the boundaries of the Sacramento Maintenance Area, the project area proper is outside the Maintenance Area. All of Placer County, except that segment in the Lake Tahoe air basin, has been designated as a nonattainment area for ozone and unclassified for PM_{10}. EPA also has proposed to redesignate the county under the Federal Clean Air Act.

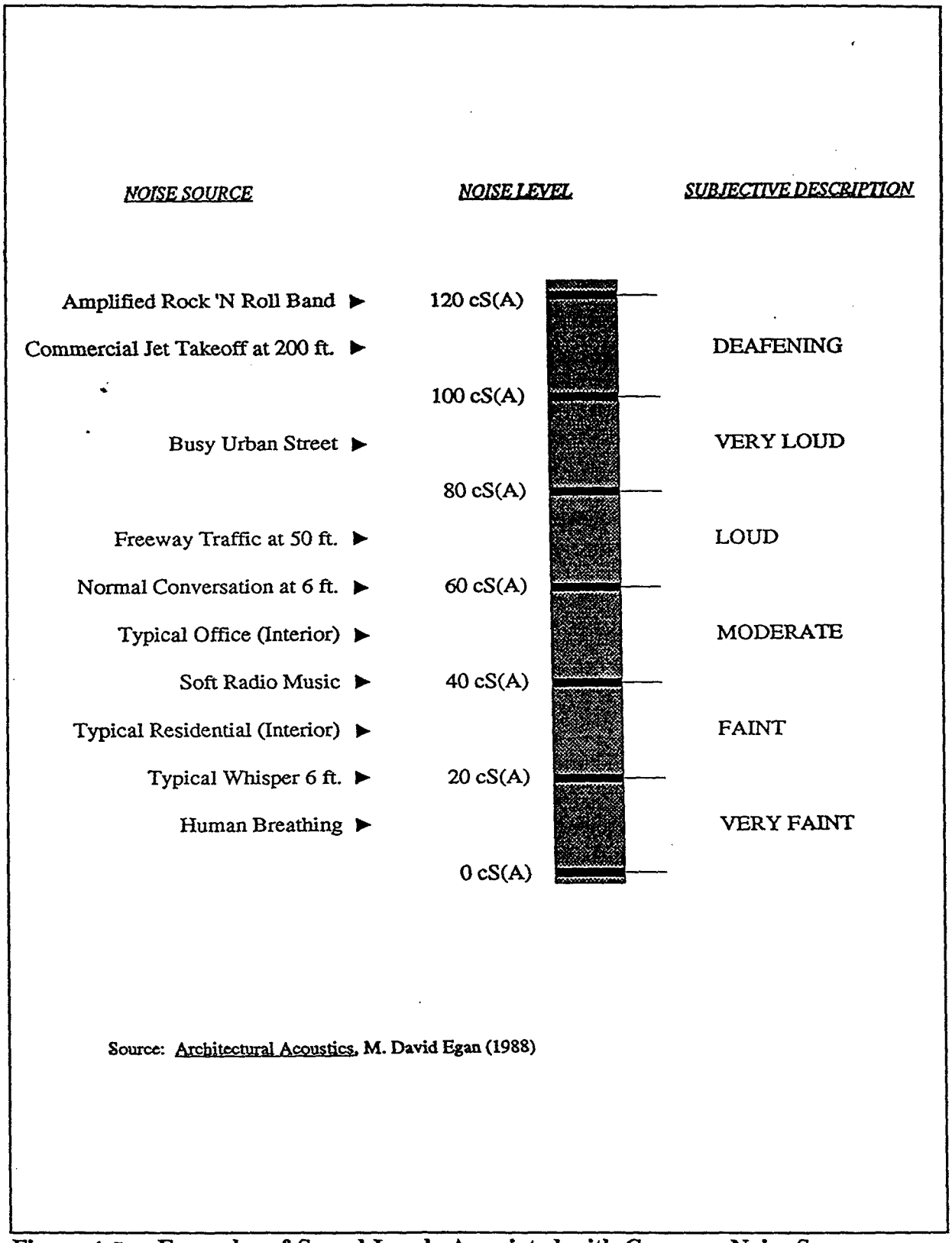
Because of the direction of prevailing air currents and the action of the Sierra Range as a climatological barrier, the Auburn area is subject to heavy influence from air contaminants originating in the Sacramento area, as well as from agricultural burning in the valley. Local industries and traffic on I-80 and Highway 49 also are significant sources of air pollution. Air contaminants are concentrated most often when the atmosphere is stable and winds are light for long periods of time.

NOISE

Background

Noise is often defined simply as unwanted sound, which is a subjective reaction to the characteristics of a physical phenomenon. The unit of sound-level measurement is the Db (decibel). A-weighted sound levels (expressed as dBA) are very well correlated with community reactions to noise and are used throughout this analysis unless otherwise indicated. Statistical descriptors such as the day-night average level (L_{dn}) represent variations in sound levels over time. Figure 4-5 provides examples of sound levels associated with common noise sources.

Noise levels and impacts must be interpreted in relation to the noise standards and criteria applicable in each local jurisdiction affected by the project. The criteria applicable in this case are primarily for noise-sensitive residential uses and are intended to provide a suitable environment for indoor communication and sleep. Draft noise standards for Sacramento County establish maximum exterior sound levels of 50-70 dBA during the day and 45-65 dBA at night. Standards for the City of Sacramento and Placer and El Dorado Counties are 60 dB L_{dn}. Exterior noise exceeding this level is allowed only after detailed acoustical analysis of construction requirements and adoption of noise abatement features.



Source: Architectural Acoustics, M. David Egan (1988)

Figure 4-5. Examples of Sound Levels Associated with Common Noise Sources.

Lower American River

A 56.2 Leq ambient noise measurement was recorded in Natomas. Primary noise sources include traffic on the Garden Highway and aircraft from Sacramento Metropolitan Airport.

Noise at levee improvement sites in the lower American River area would be similar to noise reported for the urbanized areas of Natomas. The lower American River improvement sites are in the southwest end of the American River Parkway. Levees along the edge of the parkway have recreational uses on the waterside and commercial, industrial, and residential uses on the landside. This setting is similar to that described for the NEMDC south of I-80 in the Natomas area. Consequently, noise levels in the lower American River area are assumed to be similar to noise levels reported for the NEMDC; ambient background levels ranged from 51.1 to 61.6 dBA.

Upper American River

Noise levels in El Dorado and Placer Counties where dam construction and Highway 49 replacement are proposed are also assumed to be relatively low. Noise levels in nearby communities are typical of low-density urban areas and are primarily traffic related.

VISUAL RESOURCES

An area's visual character is determined by the variety of the visual features, the quality of those features, and the scope and scale of the scene. The visual components of a particular area included landforms, vegetation, manmade structures, and land use patterns. The quality of these features depends on the relationship between them and their scale in the overall scene.

Visual analysis involves a degree of subjective evaluation based on the perception of the observer. Variety in a particular landscape and the relative value of the feature components will differ according to the perceptions of the individual observer. For example, areas with the greatest variety of features (steep slopes; large, sharp exposed ridges; varied vegetation; a large variety of water forms) are commonly considered to have the highest relative value among observers.

In assessing the visual resource impacts of a project, the visual sensitivity of the site must be considered. Areas of high visual sensitivity are those highly visible to the general public. Scenic highways, tourist routes, and recreation areas generate sensory reactions and evaluations by the observer. The evaluations of a particular scene will vary depending on the perceptions and values of the observer.

For analysis, the visual resources of the area covered by the project have been divided into the four subareas where the proposed action and alternatives would alter existing viewscapes: (1) lower American River, (2) Folsom Reservoir, (3) upper American River, and (4) downstream from American River.

Lower American River

The lower American River between Folsom Lake and the confluence with the Sacramento River flows through the core of the urbanized Sacramento area. Lake Natoma, immediately downstream from Folsom Dam, functions as a reregulating reservoir and is controlled by Nimbus Dam. High, steep natural banks confine the upper portions of the river, while the lower half (downstream from Goethe Park) is contained between levees. The river and its environs are natural in appearance and provide free-flowing water, gravel bars, deep pools, riparian forests, meadowlands, and parklands. (See figure 4-6.)

The American River Parkway, which runs 30 miles along this corridor from Discovery Park to Folsom Lake, is part of the State Wild and Scenic River System. It has "recreational" status under that system. Since most of the levees are set back from the river and vegetated with grasses and shrubs, few of the structural flood control features are visible to parkway users.

Figure 4-6. View of the Lower American River

The vegetation within the American River corridor gradually changes from low foothill to valley floor species and represents a rich and diverse mosaic. The structure, composition, and successional stages are directly related to channel dynamics, topography, elevation, distance from the river, and frequency of inundation (Watson, 1985; Strahan, 1984).

The valley floor community is characterized by a diverse mix of exclusively deciduous trees including cottonwood, willow, valley oak, alder, box-elder, Oregon ash, and a few sycamore. Moving away from the river toward the uplands, the riparian forest typically gives way to woodland and grassland habitats. In the lower 12 miles of the American River Parkway, vegetation is confined to a narrow band between the river and the levees and comprises a significant visual feature. The vegetation in the upper 11 miles of the river occupies a broader expanse within the floodway. The variation of topography supports evergreen hardwoods such as canyon and interior live oaks and digger pine.

This variety of native plant communities greatly enhances the visual quality of the parkway and heightens the interest of parkway users in their natural surroundings. Because it is heavily used, the parkway is a visually sensitive resource; any degradation of the visual quality of the area will affect large numbers of parkway users.

The lower American River provides a variety of visual experiences, which include steep bluffs, terraces, islands, backwater areas, and riparian vegetation. The natural environment is a refreshing contrast to the urban development of the surrounding Sacramento areas.

The lower American River can be divided into three visual units: (1) from Nimbus Dam to the Gristmill Dam Recreation Area, approximately 2 miles upstream from the Watt Avenue Bridge; (2) from the Gristmill Dam Recreation Area to CSUS, just below the Howe Avenue Bridge; and (3) from CSUS to the confluence with the Sacramento River.

The first unit is the most visually interesting, has the greatest visual variety, and is considered to be the most sensitive visual unit. It is the area with the most water-oriented recreation visitor days, is viewed most by passing motorists at bridge crossings, and has the shallowest average water depth. The second unit has less visual variety than the upper section of the river, but it still maintains a fairly interesting viewscape. The area is commonly viewed by travelers over the Howe and Watt Avenue bridges and represents a well-known view. There are some riffles and ponds within the third unit, but artificial bank protection has degraded the visual attractiveness of the area. The visual corridor along the river is still a fairly complex environment displaying variety both within the river and along the riverbank. Immediately above the mouth, the river's character changes. The river becomes slow moving, and the river substrate changes from cobble to sand.

Folsom Reservoir

Although it is not known for its visual appeal, this large manmade water body is a significant visual entity that contrasts sharply with the nearby foothill landscape and creates a vivid landscape. As summer progresses, the reservoir levels are drawn down an average of 24 feet, so a ring of bare soil is created along the water's edge. In dry years, this ring becomes a dominant negative visual feature that affects the visual quality of the area.

Folsom Reservoir, lying within a landscape of rolling wooded foothills, provides a pleasing visual setting for numerous recreational uses, especially when reservoir levels are high. However, during drawdown periods, the visual values of the reservoir are diminished by the denuded shoreline. Figure 4-7 shows the dam and reservoir.

Upper American River

The American River is one of the largest tributaries to the Sacramento River. Two of its three forks join the river above the proposed damsite, and the South Fork joins at Folsom Reservoir. The proposed damsite is on the North Fork, east of the city of Auburn.

This area is characterized by steep canyons covered with broadleaf and coniferous forests and chaparral vegetation. Steep terrain has deterred human development, thereby preserving the natural environment. These strong feature components create a bold landscape of high visual diversity and quality. (See figure 4-8.)

The Auburn Dam site is characterized by large grading cuts in the canyon walls, gravel excavation sites, and a network of dirt roads used for the construction of the former cofferdam. The construction zone significantly affects the natural integrity and visual quality of the canyon (figure 4-9). Although it is below the city of Auburn, the construction zone is not visible from Auburn.

Downstream From American River

The Sacramento River flows through the core of the urbanized Sacramento area. The stretch of the river which could potentially be affected under the plans presented in this report is from Verona to the confluence with the American River. The visual resource values of the Sacramento River system are varied and represent a complex setting of geographic landscapes, vegetative communities, and open and confined waterways. The river below Verona and throughout the project area is subject to intensive levee management. The system can provide a quality visual experience for those who visit the banks of the river and its sloughs. This quality is enjoyed by those who go to enjoy the natural beauty, those who go for recreational reasons, and those on their way to another destination. (Figure 4-10 shows Lindsey Slough, which is typical of areas downstream.)

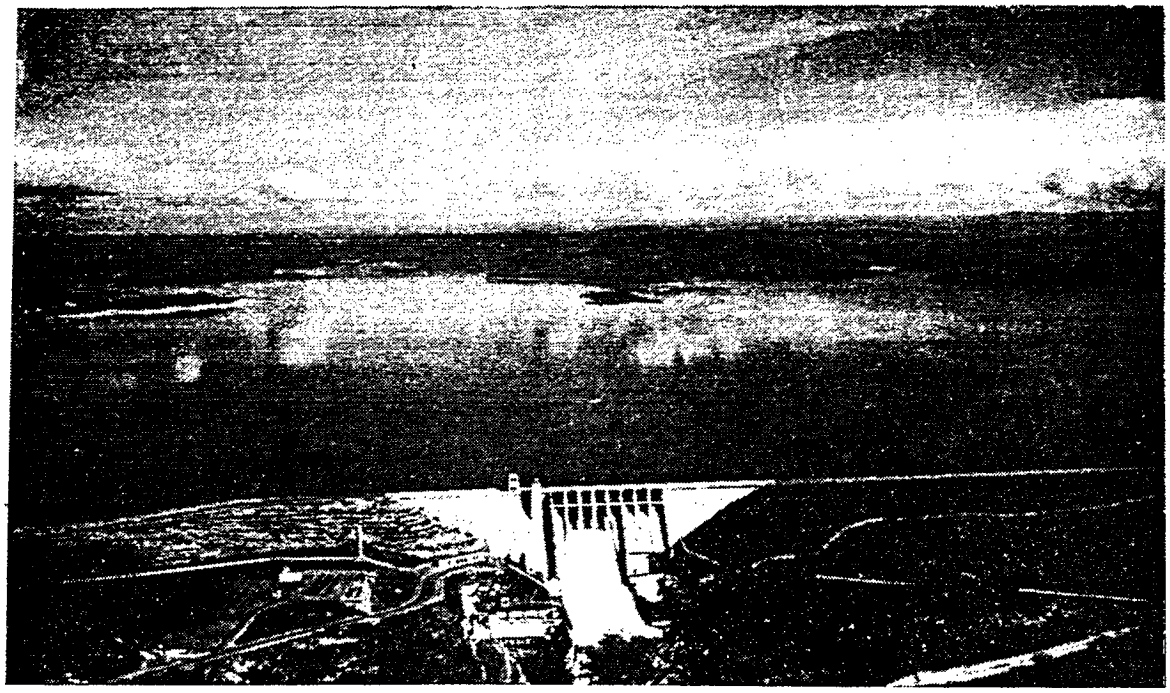


Figure 4-7. Folsom Lake and Dam.

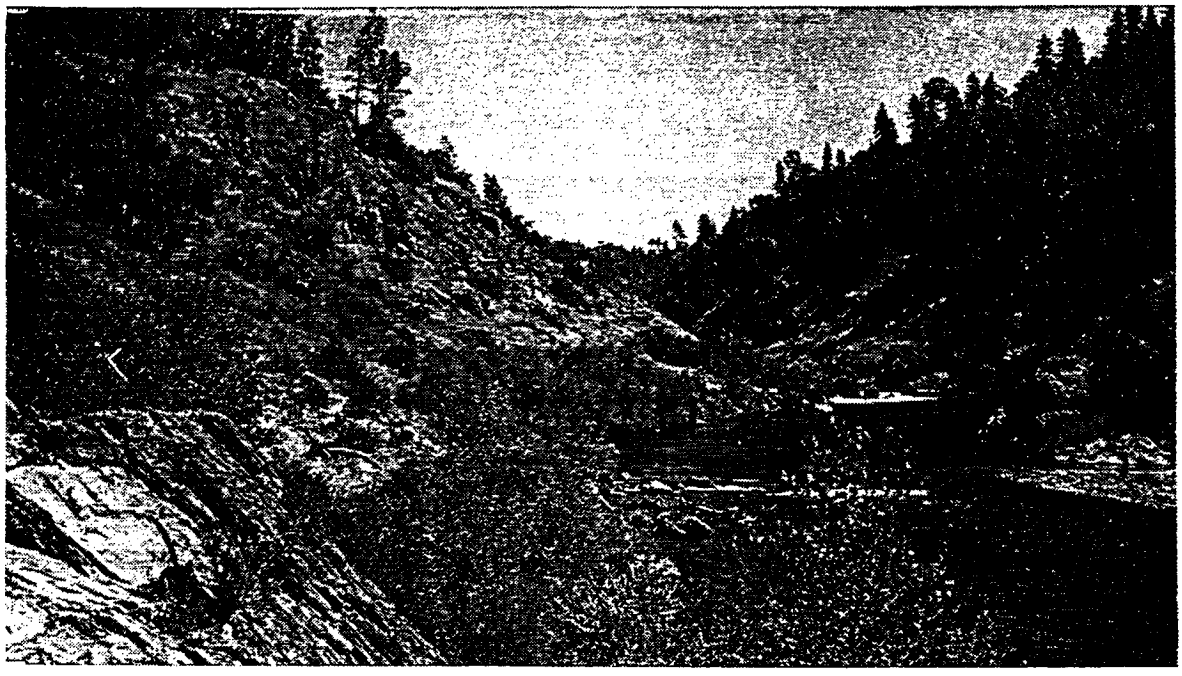


Figure 4-8. View of the Middle Fork American River.

Figure 4-9. Aerial View of the Damsite Area.

Figure 4-10. Typical view of the Hydraulic Mitigation Area (Lindsey Slough).

INDIAN TRUST ASSETS

Indian Trust Assets are legal interests in assets held in trust by the Federal Government for Indian tribes or individual Indians. There is not a comprehensive listing of these assets for tribes and individual Indians, although there may be such listings for some tribes (Reclamation, 1994). The Office of American Indian Trust plans to compile inventory listings of all assets for all tribes, but as of February 1994 lacked funding to begin this effort.

Recent conversations with Reclamation consultants conducting the survey and analyses of Indian Trust Assets for the programmatic EIS for Title 34 of Public Law 102-575 indicate that the best information identifying assets is very general with respect to the land areas covered. Specific assets have not yet been identified for the project area (P. Welch, pers. comm., 1996).

WILD AND SCENIC RIVER STATUS

Lower American River

The American River from Nimbus Dam to its confluence with the Sacramento River is designated a component of the California Wild and Scenic Rivers system (PRC section 5093.54 subd [e]), and also is classified as recreational (PRC section 5093.545 subd [h]. Section 5093.56 of the California Wild and Scenic Rivers Act states that:

> "No department or agency of the state shall assist or cooperate, whether by loan, grant, license, or otherwise, with any department of the Federal, State, or local government, in the planning or construction of any dam, reservoir, diversion, or other water impoundment facility that could have an adverse effect on the free-flowing condition and natural character of the river and segments thereof designated in Section 5093.54 as included in the system . . . ."

In January 1981, the Department of the Interior designated the lower reaches of the American River as a component of the National Wild and Scenic Rivers System. It was designated as a recreational river to acknowledge its unique urban recreational opportunities. The Wild and Scenic Rivers Act prohibits Federal agencies from constructing, assisting with, or licensing water resources projects which would adversely affect the values for which the river segment was included in the system. Federal land management agencies are to reassess management policies, plans, regulations, and contracts on lands adjacent to designated segments for their conformance with the protection purposes of the act.

Upper American River

In September 1992, Reclamation completed the technical team inventory and recommendation phase of the Wild and Scenic River Eligibility and Preliminary

Classification study conducted for its American River Water Resources Investigation. This study evaluated the Middle Fork American River from the confluence to Oxbow Dam, the North Fork from the Colfax-Iowa Hill Bridge to the upper end of Lake Clementine, and from the North Fork Debris Dam to the intake of the diversion tunnel. For a river or a section of a river to be eligible for wild and scenic status, it must be determined to be "outstandingly remarkable" based upon one or more of the following criteria: scenic, recreational, geological, fish and wildlife, historical, cultural, and ecological values.

The study concluded that the North and Middle Forks of the American River are unique river segments in several ways and contain at least one "outstandingly remarkable value" in each of the reaches. This finding was based on the analysis of eight resource categories by representatives from several Federal and State resource agencies. This finding will be processed and submitted to Congress. The Regional Director of the Bureau of Reclamation has concurred with this including. This finding will examine the technical, economic, and practical aspects of including these segments of the American River into the Wild and Scenic Rivers System.

The BLM (Bureau of Land Management) was authorized by Congress in 1989 to undertake a study of the American River watershed ". . . for the purpose of determining the feasibility and desirability of designating a National Recreation Area within the American River watershed in association with a flood control or multipurpose dam located at or near the site of the Auburn Dam." The BLM determined that the American River watershed fully meets all the National Recreation Area eligibility criteria of being sufficiently spacious, having an abundance of outstanding natural and cultural features, offering a wide variety of recreation opportunities, and being adjacent to a fast-growing metropolitan area of more than a million people. The BLM, however, was unable to draw any conclusions regarding desirability and recommended that the issue be readdressed once the issue of the dam is resolved.