CHAPTER 3
AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND ENVIRONMENTAL COMMITMENTS

3.1 PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

On October 30, 1992, the President signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102-575) that included Title XXXIV, the Central Valley Project Improvement Act. The CVPIA amended the previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses and fish and wildlife enhancement as a project purpose equal to power generation. Through the CVPIA, the Department of Interior is developing policies and programs to improve environmental conditions that were affected by operations, management, and physical facilities of the CVP. The CVPIA also includes tools to facilitate larger efforts in California to improve environmental conditions in the Central Valley and the San Francisco Bay-Delta system. The PEIS addressed potential impacts and benefits implementing provisions of the CVPIA. The PEIS was prepared by Reclamation and the Service.

The analysis in the PEIS was intended to disclose the probable region-wide effects of implementing the CVPIA and provide a basis for selecting a decision among the alternatives. The PEIS was developed to allow subsequent environmental documents to incorporate PEIS analysis by reference and limit the need to re-evaluate the region-wide and cumulative impacts of CVPIA. In some cases, worst-case assumptions were used to maximize the utility of the analysis for tiering within the scope of the impacts analyzed in the PEIS.

As the project-specific actions are considered, the lead agencies must determine if the specific impacts were adequately analyzed in the PEIS. If the actions under consideration were previously evaluated and the impacts of such actions would not be greater than those analyzed in the PEIS or would not require additional mitigation

measures, the actions could be considered part of the overall program approved in the PEIS Record of Decision (ROD). In such a case, an administrative decision could be made that no further environmental documentation could be necessary. If a tiered document is appropriate, the tiered document may be an EIS or an EA. The tiered documents can use the PEIS by reference to avoid duplication and focus more narrowly on the new alternatives or more detailed site-specific effects. Therefore, only changes from the alternatives considered in the PEIS would be addressed in detail in the tiered documents.

3.1.1 Localized Impacts of PEIS on Preferred Alternative

The primary impact to CVP water service contractors, as described in the PEIS, is not due to contract provisions, but rather to the implementation of CVPIA. The re-allocation of CVP water to fish and wildlife purposes under CVPIA reduced average annual CVP water deliveries to water service contractors from 2,270,000 acre-feet/year under the PEIS No-Action Alternative to 1,933,000 acre-feet/year under all of the PEIS alternatives, including the Preferred Alternative. The reduction occurred differently for various classifications of users, as summarized below.

- Average Annual CVP Water Deliveries for Agricultural water service contractors located in the Sacramento Canals Unit decreased 12 percent from pre-CVPIA Affected Environment conditions.
- Average Annual CVP Water Deliveries for Municipal water service contractors located in the Sacramento Canals Unit decreased 4 percent from pre-CVPIA Affected Environment conditions.

3.2 AGRICULTURAL ECONOMICS

3.2.1 Affected Environment

Agricultural Water Cost, Land Use and Economics

The following provides a brief characterization of the cost of CVP water as well as land use for each of the Sacramento River Division contractors potentially impacted by contract renewal.

Table 3.2-1 presents the 1994 cost-of-service rates published by Reclamation for each contractor's/district's agricultural "contract water" to preserve consistency with the PEIS. While these rates change annually in response to adjustments for inflation, their magnitude relative to other costs, which are also inflating, remains essentially the same. Thus, use of these data does not affect the conclusions.

The table also shows the maximum amount of CVP water that can be delivered directly to each contractor under their CVP contracts.

Table 3.2-1
1994 Irrigation Contract Maximum and Cost of Service Rates (1994)

Contractors	Contract Maximum (Acre-Feet)	Cost-of-Service Rate 1994 ($/Acre-Foot)
Tehama-Colusa Canal		
Colusa County WD[a]	68,165	$24.51
County of Colusa[b]		
Cortina WD	1,700	$17.67
Four-M WD	5,700	$16.34
Glenn Valley WD	1,730	$17.15
Holthouse WD	2,450	$17.61
Myers Marsh Mutual Water Company	255	$21.01
Davis WD	4,000	$18.59
Dunnigan WD	19,000	$19.56
Glide WD	10,500	$17.35
Kanawha	45,000	$19.24
Kirkwood WD	2,100	$16.62
La Grande WD[c]	7,200	$17.82
Orland-Artois WD	53,000	$23.36
Westside WD[d]	65,000	$20.45
Corning Canal		
Corning WD	23,000 + 2,300	$27.74
Proberta WD	3,500 + 2,000	$24.11
Thomes Creek WD	6,400 + 2,000	$21.64

Source: Reclamation.

a. Colusa County WD is comprised of one contract for 62,200 acre-feet and a subcontract for 5,965 acre-feet under the County of Colusa's Contract -- See Footnote b.
b. County of Colusa Contract is subcontracted to the districts in italics. Not shown are subcontracts to Colusa County WD, La Grande WD and Westside WD; these contract amounts are included with the respective contracts -- See Footnotes a, c and d.
c. La Grande WD is comprised of one contract for 5,000 acre-feet and a subcontract for 2,200 acre-feet under the County of Colusa's Contract -- See Footnote b.
d. Westside WD is comprised of one contract for 25,000 acre-feet and a subcontract for 40,000 acre-feet under the County of Colusa's Contract -- See Footnote b.

Table 3.2-2 characterizes the cropping patterns in each of the potentially affected water districts as reported to Reclamation in 1996. The table reveals a fairly wide range of cropping patterns within and between the service areas. While many have a proportionally large share of their lands receiving CVP contract water in vegetable and fruit and nut crops, a number of service areas are planted predominantly to cereal and forage crops such as wheat, rice and sugar beets.

Table 3.2-3 presents the combined cropping pattern for lands served by CVP contract water delivered through the Tehama-Colusa and Corning Canals both in terms of acres and percentages. The table indicates that the cropping patterns for the two service areas have a fairly similar balance of cereal and fruit and nut crops, while they differ significantly with respect to forage, field and vegetable crops.

Table 3.2-4 presents a number of statistics drawn from the 1997 Census of Agriculture that help to characterize the agricultural economy and land use in the affected counties which comprise economic subregions 2 and 3b of the PEIS, referred to as the Region in this EA. The table reveals that Tehama County has almost as much land in farms as the region's two other affected counties combined. However, Tehama County also has substantially less than half the irrigated acreage and a significantly lower amount of harvested acreage than either of the two other counties. The average market value of agricultural products sold per harvested acre in Tehama County in 1997 is estimated at $1,726 compared to $1,072 for Glenn County and less than $1,000 for Colusa County.

A comparison of Tables 3.2-3 and 3.2-4 reveals that in 1997 the agricultural lands that received CVP water deliveries within the region under the Sacramento River Division CVP contracts (105,369 acres) represented less than 20 percent of the irrigated land within the three affected counties (582,368 acres).

Regional Economy

Colusa County

Colusa County's largest industrial sector is agriculture, accounting for almost 30 percent of recent employment in the county. The county's 2003 unemployment rate of 17.6 percent is quite high when compared to the statewide average of 5.3 percent for the same year (California Employment Development Department 2003). According to the California Employment Development Department, Colusa County's historically high rate of unemployment is largely the result of significant seasonal fluctuations in labor demand within the agricultural sector. In 2001, Colusa County ranked 45th out of California's 58 counties with respect to per-capita income (US Bureau of Economic Analysis 2002).

Glenn County

While Glenn County, like its neighbor to the south Colusa County, has a large agriculture sector, the economic dependence of Glenn County on agriculture is not as great. The government sector constitutes the largest employer in the county, and after

Table 3.2-2
Cropping Pattern Potentially Affected Districts (1996)

	Tehama-Colusa Canal Contractors												Corning Canal Contractors				
Crop	Colusa County WD	Cortina WD	Davis WD	Dunnigan WD	Glenn Four-M WD	Glenn Valley WD	Glide WD	Holthouse WD	Kanawha	Kirkwood WD	La Grande WD	Myers Marsh Mutual Water Company	Orland-Artois WD	Westside WD	Corning WD	Proberta WD	Thomes Creek WD
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Cereal Crops	3,269	130	215	1,683	190	142	4,466	43	8,234	0	775	40	10,188	3,421	848	783	770
Forage Crops	1,340	80	0	658	209	26	245	0	676	178	0	0	5,232	494	1,131	1,382	290
Field Crops	2,163	50	183	1,237	125	90	216	54	3,859	0	0	10	1,266	2,895	8	130	0
Vegetable Crops	3,018	0	489	1,148	485	200	39	265	207	0	0	70	182	3,310	0	0	0
Fruit and Nuts	19,764	343	0	1,353	0	0	165	48	325	150	0	0	9,748	2,118	2,676	243	293
Miscellaneous[1]	36	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	29,590	603	887	6,087	1,009	458	5,131	410	13,301	328	775	120	26,616	12,238	4,663	2,538	1,353
	Cropping Pattern																
Cereal Crops	11.0%	21.6%	24.2%	27.6%	18.8%	31.0%	87.0%	10.5%	61.9%	0.0%	100.0%	33.3%	38.3%	28.0%	18.2%	30.9%	56.9%
Forage Crops	4.5%	13.3%	0.0%	10.8%	20.7%	5.7%	4.8%	0.0%	5.1%	54.3%	0.0%	0.0%	19.7%	4.0%	24.3%	54.5%	21.4%
Field Crops	7.3%	8.3%	20.6%	20.3%	12.4%	19.7%	4.2%	13.2%	29.0%	0.0%	0.0%	8.3%	4.8%	23.7%	0.2%	5.1%	0.0%
Vegetable Crops	10.2%	0.0%	55.1%	18.9%	48.1%	43.7%	0.8%	64.6%	1.6%	0.0%	0.0%	58.3%	0.7%	27.0%	0.0%	0.0%	0.0%
Fruit and Nuts	66.8%	56.9%	0.0%	22.2%	0.0%	0.0%	3.2%	11.7%	2.4%	45.7%	0.0%	0.0%	36.6%	17.3%	57.4%	9.6%	21.7%
Miscellaneous[1]	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Sources: Reclamation 1996; Dornbusch & Company 2000.

1. Miscellaneous includes nursery and family gardens and orchards

Table 3.2-3
Summary of Cropping Pattern
Sacramento River Division Contractors (1996)

Crop	(a) Tehama-Colusa Canal	(b) Corning Canal	(a)+(b) Total
	(acres)	(acres)	(acres)
Cereal Crops	32,796	2,401	35,197
Forage Crops	9,138	2,803	11,941
Field Crops	12,148	138	12,286
Vegetable Crops	9,413	0	9,413
Fruit and Nuts	34,014	3,212	37,226
Miscellaneous[1]	44	0	44
Total	97,553	8,554	106,107
Cereal Crops	33.6%	28.1%	33.2%
Forage Crops	9.4%	32.8%	11.3%
Field Crops	12.5%	1.6%	11.6%
Vegetable Crops	9.6%	0.0%	8.9%
Fruit and Nuts	34.9%	37.5%	35.1%
Miscellaneous[1]	0.0%	0.0%	0.0%

Sources: Reclamation 1996; Dornbusch & Company 2000.

1. Miscellaneous includes nursery and family gardens and orchards

Table 3.2-4
Census of Agriculture Statistics (1997)

Statistic	Colusa County	Glenn County	Tehama County	Total Affected Region
Land in Farms (acres)	430,958	482,583	885,426	1,798,967
Average size of farm (acres)	532	406	650	535
Total Farms (No.)	810	1,189	1,362	3,361
Percent of Farms less than 9 acres (%)	7.0%	13.8%	18.4%	14.0%
Irrigated Land (acres)	276,562	220,235	85,571	582,368
Total Harvested Cropland (acres)	287,630	212,848	62,038	562,516
Total Market Value of Agricultural Products Sold ($000s)	$276,538	$228,221	$107,102	$611,861
Market Value of Agricultural Products Sold per Acre Harvested	$961	$1,072	$1,726	$1,088
Total Net Returns from Agricultural Sales ($000s)	$69,987	$54,117	$25,171	$149,275
Net Returns from Agricultural Sales per Acre Harvested	$243	$254	$406	$265

Sources: US Census Bureau 1997; Dornbusch & Company 2000.

agriculture, the county's largest non-governmental employment is concentrated in the retail trade and services sectors. In 2001, farm employment accounted for approximately 18.6 percent of total county employment compared to retail trade that accounted for about 15 percent of employment. Glenn County's unemployment rate in 2001 was 11.2 percent (California Economic Development Department 2002). In 2001, the county

ranked 56th out of California's 58 counties with respect to per capita income (US Bureau of Economic Analysis 2002).

Tehama County

Retail trade is the largest industrial sector in Tehama County, accounting for about 25.1 percent of the county's employment base in 2001, followed by services at 19.1 percent. In 2001, farm employment represented about 8 percent of the county's total employment base. The California Employment Development Department projects that the county's government services, and retail trade sectors are expected to account for almost 88 percent of total growth in employment from 1999 to 2006 (California Economic Development Department 2002). Tehama County's unemployment rate in 2001 was 6.4 percent, down sharply from early in the previous decade. Interestingly, Tehama County ranks between both Colusa and Glenn Counties in per capita income. In 2001, the County ranked 50th out of California's 58 counties with respect to per capita income (US Bureau of Economic Analysis 2002).

Affected Region

Table 3.2-5 summarizes 1991 industrial output, employment and Income by Place-of-Work for the entire affected region (Colusa, Glenn and Tehama Counties). Data from 1991 were used over more current information to be consistent with the temporal setting of the regional economic analysis presented in the PEIS for the CVPIA. California's Employment Development Department reported that the unemployment rate in 1991 for Colusa, Glenn and Tehama Counties was 17.5 percent, 14.3 percent and 11.1 percent, respectively.

Table 3.2-5
Estimated Output, Employment and Income by Place-of-Work Affected Region (1991)

Industrial Sector	Output ($Millions)	Employment (FTE Jobs)	Income POW ($Millions)
Agriculture	539.3	8,126	213.7
Mining	32.3	78	10.2
Construction	171.4	1,919	54.9
Manufacturing	764.0	4,511	218.6
Transportation	213.2	1,438	85.6
Trade	208.3	6,381	112.1
FIRE	220.8	1,938	129.9
Services	305.2	7,458	125.5
Government	159.4	6,313	153.3
Total	2,614.1	38,162	1,103.8

Sources: Minnesota Implan Group 1991; Dornbusch & Company 2000.
Notes:
FTE = full time equivalent
POW = place of work
FIRE = fire, insurance, real estate

3.2.2 Environmental Consequences

The estimated agricultural economic and land use impacts of the contract renewal alternatives are presented for the No Action Alternative and Alternatives 1 and 2.

Alternative 1 is ostensibly identical to the No Action Alternative framework with respect to those elements such as water rate setting and acreage limitations that may impact the socio-economies and land use within the affected region. All of the impacts of Alternative 2 are presented in terms of the incremental change relative to No Action conditions.

Methodology

The larger CVP contractors within the Sacramento River Division service area participating in, and therefore, potentially impacted by, the long-term contract-renewal process are agricultural water districts and do not require Municipal & Industrial (M&I) water. The contracts which do involve M&I water supply small amounts (<2,000 af) of water to small, very slowly growing communities and, like the other contractors, have no prospect for acquiring more water through the long-term contract renewal process. Accordingly, this section does not include a discussion of the methodology used to evaluate potential CVP M&I water-associated impacts.

The analysis of potential impacts on agricultural land use and economics of the Sacramento River Division CVP contract renewal is conducted at the level of the specific CVP contractors that would be affected. The analysis of potential regional economic impacts of the Sacramento River Division CVP contract renewal is conducted at a broader regional level. For the analysis, this region or "affected region" is defined as the three-county area including Tehama, Colusa and Glenn Counties. Some of the agricultural lands that would be directly affected by the Sacramento River Division CVP contract renewal lie within northern Yolo County. Yolo County, however, was not included in the affected region for the agricultural and regional economic impact components of analysis since the service areas of water districts within Yolo County receiving CVP water under the Sacramento River Division CVP contracts is relatively small compared to the irrigated land base of the county. Accordingly, the Sacramento River Division CVP contract water makes only a small contribution to the Yolo County agricultural and overall economy. Including Yolo County in the affected region would misleadingly dilute the indicated magnitude of the anticipated agricultural and regional impacts of the contract renewal alternatives. While certainly the secondary economic effects of the alternative CVP contract renewal proposals may extend outside of the three-county region, it is reasonable to anticipate that the majority of those impacts would be incurred within that region. Ultimately, it is the localized effects of contract renewal that is most relevant to local community plan evaluation.

Agricultural Water Cost, Land Use and Economic Impacts

The assessment of the demographic and agricultural water cost, land use and economic impacts under Alternatives 1 and 2 were based on the agricultural economic impact assessment models developed for the CVPIA PEIS (Reclamation 1999a). A detailed description of those models is presented in the Agricultural Economics and Land Use technical appendix in the PEIS. In summary, the PEIS agricultural economic and land use models were designed to estimate the potential direct impact of CVPIA-associated changes on agricultural water rates and supply/reliability on agricultural users, including

land use, water use, gross value of crop production and farmer net revenue from irrigation.

Agricultural economic and land use impacts identified in the PEIS resulted from the introduction of 80-10-10 tiered pricing, the addition of a restoration charge on each acre-foot of delivered water and the projected cost to individual CVP contractors to acquire alternative water supplies to mitigate water delivery reductions caused by CVPIA-mandated in-stream and refuge flows not offset through conservation. The PEIS agricultural economic impacts were obtained from the Central Valley Production Model (CVPM). The CVPM is a highly sophisticated tool that predicts farmer response to changes in the price and availability of resource inputs, particularly water. The types of response mechanisms built into the model include land fallowing, crop switching, changes in ground water pumping, etc. These responses ultimately have implications for the total value of crop production, land and water use and the net revenues to farmers subsequent to an event such as CVPIA implementation or contract renewal.

The CVPM as formatted for the PEIS produces output for each of 22 separate sub-regions within California's Central Valley (for reporting purposes in the PEIS, these sub-regions were aggregated into four larger regions). Almost all of the CVP contractor lands served by the Corning Canal are included in CVPM sub-region 2. CVP contractor lands served by the TCC comprise all of CVPM sub-region 3B. Accordingly, the output of the CVPM runs for sub-regions 2 and 3B were used to estimate the agricultural economic and land use implications for Sacramento River Division contractors under the No Action Alternative and Alternatives 1 and 2 for CVP contract renewal. Estimates of gross value of farm production derived from CVPM for these regions was combined with recent cropping-pattern information for the Sacramento River Division contractors to derive district-specific estimates of gross value of production under the alternative contract renewal proposals. However, due to the method of aggregation of the CVPM and associated model results developed for the PEIS it was not possible to accurately present the anticipated net revenue impacts of the contract renewal alternatives by individual water contractors served by the Sacramento River Division. Therefore, the net revenue impacts of contract renewal are derived for all the districts combined. This modeling constraint has no influence on the analysis of the potential regional economic effects of the contract alternatives since the regional analysis is conducted for all of the water districts combined to start with (as discussed in the next section).

As noted previously, Alternative 2 would increase the CVP agricultural acreage limitation from two to five acres. This change could cause some of the affected districts' agricultural users to lose their CVP agricultural designation, forcing them to purchase all of their water at M&I rates unless they can demonstrate they are indeed viable agricultural operations. For these users, Alternative 2 would have an additional impact to their cost of water beyond those generated by proposed CVP water rate-setting revisions alone. This potential impact is also addressed in the CVPM analysis, but is not a major issue within the Sacramento River Division service areas.

Regional Economic Impacts

The assessment of regional economic impacts under Alternatives 1 and 2 for CVP contract renewal applies the same data sources, models and model assumptions used for the regional economic impact analysis in the CVPIA PEIS. A detailed description of those data sources, models and model assumptions are presented in the Regional Economics technical appendix in the PEIS (Reclamation 1999a).

In summary, the PEIS regional economic impact model was designed to estimate the regional employment, output and income impacts that would result from anticipated changes in M&I, agricultural and recreation water use and cost due to CVPIA implementation. For this assessment the CVP project area was aggregated into seven sub-regions, which include both CVP and non-CVP lands. CVP contractors served by the Sacramento River Division were included in the PEIS Sacramento River Region, which accounts for about eighteen percent of the Central Valley's agricultural production on a dollar basis.

The input-output model IMPLAN (Impact Analysis for Planning) was the primary tool used to quantify the potential regional economic impacts of CVPIA implementation in the PEIS and accordingly, to assess regional economic impacts of CVP contract renewal. A detailed description of the IMPLAN model is provided in the IMPLAN Model Technical Appendix to the PEIS (Reclamation 1999a). Briefly, IMPLAN is used to quantify impacts from changes in policy and resource allocation. The model provides estimates of the total (or multiplied) economic effects that result from an initial stimulus to an industrial sector (e.g., construction, transportation & utilities, etc.). As in the current case, the stimulus might be a reduction in consumer spending in the retail sector due to escalation of household water bills.

IMPLAN is extremely useful for characterizing the economic interdependence of different sectors of an economy. Changes in the purchases and sales in one sector of an economy can affect numerous other sectors. Economists call the sum of these changes multiplier effects. There are many different kinds of economic multipliers. There are sales or output multipliers that are estimates of the effect on total private sector sales resulting from an initial change in sales. There are employment and income multipliers that are estimates of a change's effect on jobs and income in an area. There are also value-added multipliers. All of these multipliers provide estimates of the impacts on an economy from a change in output (or jobs or income) in one or more of its sectors. IMPLAN's multipliers are typically expressed for every $1 million of spending. For example, if the total employment multiplier in the construction sector for an area's economy were estimated to be 22, a $1 million drop in spending in that sector would be expected to result in the loss of 22 jobs (both directly in construction and secondarily in other sectors as a result of changes in construction-related spending). IMPLAN multipliers are derived from long-run average relationships between commercial sectors. Accordingly, the regional economic impacts of the contract renewal alternatives under consideration were evaluated only for the long-run average hydrologic condition (average hydrologic condition). Under the short-run drought condition scenario (dry hydrologic condition), it is likely that the economic impacts indicated by the IMPLAN

model would be overstated since short-run effects tend to be smaller than long-run effects (delayed response).

1991 Colusa, Glenn, and Tehama County IMPLAN data were used for this EA's analysis to be consistent with the PEIS (these were the most current available data at the time). As with the PEIS, the analysis focuses on three economic variables, industrial output, employment and Income by Place of Work (Income POW). Income POW is defined as the sum of employee compensation, proprietor's income and other property income. The Sacramento River Division contract renewal IMPLAN analysis is also aggregated into the same industrial sector groupings as reported in the PEIS.

Estimated regional economic impacts of Alternatives 1 and 2 are presented in terms of the incremental change from the No Action Alternative. The 1991 baseline IMPLAN data are the primary data used to characterize the affected economic environment (existing conditions) in the affected region. These data are also adjusted to account for the anticipated incremental regional economic impact of the Preferred Alternative for CVPIA implementation. This adjusted IMPLAN data serves as the No Action contract renewal economic conditions. All of the IMPLAN data are presented in 1991 dollars. Accordingly, while the estimated incremental cost impacts of Alternatives 1 and 2 are presented in 1999 dollars, those costs are converted to 1991 dollars for the regional economic impact analysis. In this manner, the magnitude of the potential economic impacts is evaluated in consistent 1991 dollars. The baseline data were used throughout the analysis because substantial changes to the structure of the affected region economy in 2030, independent of the contract renewals, are not anticipated and cannot be predicted without substantial speculation. This approach is consistent with the PEIS.

Agricultural Water-Cost-Related Regional Economic Impacts. If the cost of CVP water for the Sacramento River Division increases, it could affect the local economy in two ways. First, if those water cost increases result in changes to agricultural production, then local gross revenues from the sale of crops may also change (estimated using CVPM as discussed previously). The regional economic impacts of a change in gross crop revenues are estimated by inputting those projected revenue changes directly into the appropriate crop sector within the IMPLAN model (e.g., hay sector, rice sector, etc.). Second, irrespective of the impact on crop production, changes in the cost of water also affect farm income. When farm income changes, it affects farmer capital investment expenditures and the level of farmer household consumption expenditures. Consistent with the PEIS, it is assumed for the analysis of the Sacramento River Division contract renewal that any impacts to farm income anticipated to result from contract-renewal water cost escalation would be split between farm investment and household consumption. The estimated impact on farm investment spending changes is input directly into the IMPLAN sector for Farm Machinery. The estimated impact on consumer spending is input into the model based on recorded household allocation of spending across all industrial sectors of the economy (final demands).

No Action Alternative

Agricultural Water Cost, Land Use and Economics

Agricultural Water Cost. Table 3.2-6 presents the estimated 1999 CVP water rates by pricing tier for each of the potentially affected Sacramento River Division contractors. In 1999, these rates would have applied to 80-10-10 tiered pricing on CVP delivered water under the No Action Alternative for contract renewal. The table indicates that the Dunnigan and Orland-Artois water districts would have to pay the highest Full-Cost-Rate of any of the Sacramento River Division contractors if tiered pricing were to be applied under the No Action Alternative. It should be noted that the table does not account for the potential influence of the contractors' ability-to-pay relief status on the actual rates they would pay for CVP contract water under the No Action Alternative. This ability-to-pay relief is accounted for in the models used to estimate the potential economic effects of contract renewal under Alternative 2.

Agricultural Land Use

Average Hydrologic Conditions. Table 3.2-7 shows the projected year 2030 irrigated acres by the Sacramento River Division contractor and crop group under the No Action Alternative assuming average hydrologic conditions.

Table 3.2-6
1999 Irrigation Water Rates Under 80-10-10 Tiered Pricing
Sacramento River Division Contractors No Action Alternative

	Cost-of-Service Rate	Midpoint	Full-Cost-Rate
Tehama-Colusa Canal	1st tier (80%)	2nd tier (10%)	3rd tier (10%)
Colusa County WD	$26.66	$47.47	$68.28
Cortina WD	$17.99	$23.50	$29.00
Davis WD	$19.12	$24.07	$29.02
Dunnigan WD	$20.44	$58.94	$97.43
Four-M WD	$15.69	$21.97	$28.24
Glenn Valley WD	$17.67	$23.22	$28.77
Glide WD	$16.94	$21.81	$26.67
Holthouse WD	$17.53	$22.93	$28.32
Kanawha	$18.75	$25.33	$31.91
Kirkwood WD	$16.09	$21.90	$27.71
La Grande WD	$17.93	$23.18	$28.43
Myers Marsh Mutual Water Company	$23.26	$27.15	$31.03
Orland-Artois WD	$22.97	$60.80	$98.62
Westside WD	$21.20	$30.16	$39.11
Corning Canal			
Corning WD	$25.97	$39.69	$53.40
Proberta WD	$23.45	$27.99	$32.52
Thomes Creek WD	$19.75	$24.69	$29.63

Source: Reclamation 2000; Dornbusch & Company 2000.

Table 3.2-7
Irrigated Acres of Potentially Affected Contractors
No Action Alternative
AVERAGE Hydrologic Condition (2030)

	Tehama-Colusa Canal Contractors														Corning Canal Contractors		
Crop	Colusa County WD (acres)	Cortina WD (acres)	Davis WD (acres)	Dunnigan WD (acres)	Four-M WD (acres)	Glenn Valley WD (acres)	Glide WD (acres)	Holthouse WD (acres)	Kanawha (acres)	Kirkwood WD (acres)	La Grande WD (acres)	Myers Marsh Mutual Water Company (acres)	Orland-Artois WD (acres)	Westside WD (acres)	Corning WD (acres)	Proberta WD (acres)	Thomes Creek WD (acres)
Pasture	859	0	0	149	0	0	311	0	357	171	0	0	3,634	219	946	858	91
Alfalfa	1,684	140	0	1,036	365	0	190	0	908	49	0	0	5,082	645	87	91	173
Sugar Beets	815	0	0	0	0	0	0	0	3,823	0	0	0	962	0	0	0	0
Other Field Crops	2,261	58	211	1,429	144	134	249	62	3,346	87	0	12	2,029	3,377	7	431	0
Rice	71	0	0	161	0	31	2,008	0	1,450	0	754	0	4,164	960	687	395	0
Truck Crops	59	0	129	68	116	0	0	179	34	0	0	0	0	14	0	0	0
Tomatoes	2,052	0	246	748	253	139	27	54	119	0	0	49	126	2,288	0	0	0
Deciduous Orchards	15,832	275	0	1,084	0	0	132	38	260	120	0	0	7,462	1,697	2,443	222	268
Small Grain	1,154	47	78	551	69	40	915	16	2,467	0	18	14	2,231	901	87	320	703
Sub-Tropical Orchards[1]	0	0	0	0	0	0	0	0	0	0	0	0	1,000	0	0	0	0
Total	24,789	519	664	5,225	947	344	3,832	349	12,765	427	772	75	26,691	10,101	4,257	2,317	1,235

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

[1] Within the crop production reports submitted annually by the contractors to the Bureau of Reclamation, it appears that olives have been classified under the crop category "Deciduous Orchards," as opposed to "Sub-tropicals." This misclassification, however, has no material impact on the evaluation of the potential regional economic and associated social impacts of the CVP long-term contract renewal alternatives under consideration. Like olives, which are technically sub-tropical, apples, peaches, plums and other deciduous orchard crops are considered to be higher valued crops that display similar economic characteristics (in terms of average profitability, high investment cost, long-term maturity, cultural requirements, etc.). As a result, the production of those crops would be expected to be similarly affected by changes to water supply, reliability and cost irrespective of how they are broadly classified (e.g., deciduous orchard, sub-tropical, etc.).

Table 3.2-8 summarizes the data presented in Table 3.2-7. Specifically, the table shows by crop group and canal the acres of land projected to receive CVP contract water in 2030 under the No Action Alternative assuming average hydrologic conditions. The table indicates that the total irrigated acreage within the Sacramento River Division CVP service area is projected to be approximately 95,000 acres in 2030 under average hydrologic conditions.

Dry Hydrologic Conditions. Table 3.2-9 shows projected 2030 irrigated acres by Sacramento River Division contractor and crop group under the No Action Alternative assuming dry hydrologic conditions.

Table 3.2-10 summarizes the data presented in Table 3.2-9. Specifically, the table shows by crop group and canal the acres of land projected to receive CVP contract water in 2030 under the No Action Alternative and assuming dry hydrologic conditions. The table indicates that the total irrigated acreage within the Sacramento River Division service area is projected to be approximately 82,000 acres in 2030 under dry hydrologic conditions.

Table 3.2-8
Irrigated Acres of Sacramento River Division Contractors
Average Hydrologic Condition
SUMMARY
No Action Alternative (2030)

Crop	(a) Tehama-Colusa Canal (acres)	(b) Corning Canal (acres)	(a)+(b) Total (acres)
Pasture	5,700	1,895	7,595
Alfalfa	10,100	351	10,451
Sugar Beets	5,600	0	5,600
Other Field Crops	13,400	438	13,838
Rice	9,600	1,083	10,683
Truck Crops	600	0	600
Tomatoes	6,100	0	6,100
Deciduous Orchards	26,900	2,933	29,833
Small Grain	8,500	1,109	9,609
Sub-Tropical Orchards	1,000	0	1,000
Total	87,500	7,810	95,310

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-9
Irrigated Acres of Potentially Affected Contractors
No Action Alternative
DRY Hydrologic Condition (2030)

	Tehama-Colusa Canal Contractors														Corning Canal Contractors		
Crop	Colusa County WD	Cortina WD	Davis WD	Dunnigan WD	Four-M WD	Glenn Valley WD	Glide WD	Holthouse WD	Kanawha WD	Kirkwood WD	La Grande WD	Myers Marsh Mutual Water Company	Orland-Artois WD	Westside WD	Corning WD	Proberta WD	Thomes Creek WD
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Pasture	648	0	0	112	0	0	234	0	269	129	0	0	2,741	166	918	833	89
Alfalfa	1,267	105	0	780	275	0	143	0	684	37	0	0	3,824	485	86	90	172
Sugar Beets	742	0	0	0	0	0	0	0	3,482	0	0	0	876	0	0	0	0
Other Field Crops	1,755	45	164	1,109	112	104	194	48	2,597	67	0	9	1,575	2,621	7	426	0
Rice	46	0	0	104	0	20	1,297	0	937	0	487	0	2,689	620	687	395	0
Truck Crops	59	0	129	68	116	0	0	179	34	0	0	0	0	14	0	0	0
Tomatoes	1,918	0	230	699	236	130	25	51	111	0	0	45	118	2,138	0	0	0
Deciduous Orchards	15,832	275	0	1,084	0	0	132	38	260	120	0	0	7,462	1,697	2,443	222	268
Small Grain	842	34	57	402	50	29	667	11	1,799	0	13	11	1,627	657	85	313	688
Sub-Tropical Orchards	0	0	0	0	0	0	0	0	0	0	0	0	1,000	0	0	0	0
Total	23,110	459	579	4,357	789	283	2,693	328	10,173	354	500	65	21,913	8,398	4,227	2,279	1,216

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-10
Irrigated Acres of Sacramento River Division Contractors
DRY Hydrologic Condition
SUMMARY
No Action Alternative (2030)

Crop	(a) Tehama -Colusa Canal (acres)	(b) Corning Canal (acres)	(a)+(b) Total (acres)
Pasture	4,300	1,840	6,140
Alfalfa	7,600	348	7,948
Sugar Beets	5,100	0	5,100
Other Field Crops	10,400	433	10,833
Rice	6,200	1,083	7,283
Truck Crops	600	0	600
Tomatoes	5,700	0	5,700
Deciduous Orchards	26,900	2,933	29,833
Small Grain	6,200	1,086	7,286
Sub-Tropical Orchards	1,000	0	1,000
Total	74,000	7,722	81,722

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Agricultural Economics

Average Hydrologic Condition. Table 3.2-11 shows the projected year 2030 gross value of production by the Sacramento River Division contractor and crop group under the No Action Alternative and assuming average hydrologic conditions.

Table 3.2-12 summarizes the data presented in Table 3.2-11. Specifically, the table shows by crop group and canal the projected gross value of farm production on lands receiving CVP contract water in 2030 under the No Action Alternative and assuming average hydrologic conditions. The table indicates that the total Gross Value of Production within the Sacramento River Division service area is projected to be approximately $73 million dollars in 2030 under average hydrologic conditions (in year 1999 dollars).

Dry Hydrologic Conditions. Table 3.2-13 shows the projected 2030 gross value by the Sacramento River Division contractor and crop group under the No Action Alternative and assuming dry hydrologic conditions.

Table 3.2-11
Gross Value of Production of Potentially Affected Contractors
No Action Alternative
AVERAGE Hydrologic Condition (Year 2030 in 1999 Dollars)

	Tehama-Colusa Canal Contractors												Corning Canal Contractors				
Crop	Colusa County WD ($000s)	Cortina WD ($000s)	Davis WD ($000s)	Dunnigan WD ($000s)	Four-M WD ($000s)	Glenn Valley WD ($000s)	Glide WD ($000s)	Holthouse WD ($000s)	Kanawha ($000s)	Kirkwood WD ($000s)	La Grande WD ($000s)	Myers Marsh Mutual Water Company ($000s)	Orland-Artois WD ($000s)	Westside WD ($000s)	Corning WD ($000s)	Proberta WD ($000s)	Thomes Creek WD ($000s)
Pasture	$131	$0	$0	$23	$0	$0	$47	$0	$54	$26	$0	$0	$552	$33	$144	$130	$14
Alfalfa	966	80	0	594	209	0	109	0	521	28	0	0	2,914	370	50	52	99
Sugar Beets	635	0	0	0	0	0	0	0	2,981	0	0	0	750	0	0	0	0
Other Field Crops	1,096	28	102	693	70	65	121	30	1,622	42	0	6	984	1,637	4	209	0
Rice	64	0	0	147	0	28	1,825	0	1,318	0	685	0	3,785	873	625	359	0
Truck Crops	219	0	476	250	427	0	0	660	127	0	0	0	0	53	0	0	0
Tomatoes	1,602	0	192	584	197	108	21	42	93	0	0	38	99	1,786	0	0	0
Deciduous Orchards	18,000	312	0	1,232	0	0	150	44	296	137	0	0	8,483	1,929	2,778	252	304
Small Grain	351	14	24	168	21	12	278	5	750	0	5	4	678	274	26	97	214
Sub-Tropical Orchards	0	0	0	0	0	0	0	0	0	0	0	0	1,515	0	0	0	0
Total	$23,064	$435	$794	$3,690	$924	$214	$2,552	$780	$7,762	$233	$691	$48	$19,760	$6,955	$3,626	$1,100	$631

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-12
Gross Value of Production of Potentially Affected Contractors
AVERAGE Hydrologic Condition
SUMMARY
No Action Alternative (Year 2030 in 1999 Dollars)

Crop	(a) Tehama-Colusa Canal ($000s)	(b) Corning Canal ($000s)	(a)+(b) Total ($000s)
Pasture	$866	$288	$1,154
Alfalfa	5,791	202	5,992
Sugar Beets	4,366	0	4,366
Other Field Crops	6,497	212	6,709
Rice	8,725	984	9,709
Truck Crops	2,211	0	2,211
Tomatoes	4,762	0	4,762
Deciduous Orchards	30,583	3,334	33,917
Small Grain	2,584	337	2,921
Sub-Tropical Orchards	1,515	0	1,515
Total	$67,900	$5,357	$73,257

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-13
Gross Value of Production of Potentially Affected Contractors No Action Alternative
DRY Hydrologic Condition (Year 2030 in 1999 Dollars)

	Tehama-Colusa Canal Contractors												Corning Canal Contractors				
Crop	Colusa County WD ($000s)	Cortina WD ($000s)	Davis WD ($000s)	Dunnigan WD ($000s)	Four-M WD ($000s)	Glenn Valley WD ($000s)	Glide WD ($000s)	Holthouse WD ($000s)	Kanawha ($000s)	Kirkwood WD ($000s)	La Grande WD ($000s)	Myers Marsh Mutual Water Company ($000s)	Orland-Artois WD ($000s)	Westside WD ($000s)	Corning WD ($000s)	Proberta WD ($000s)	Thomes Creek WD ($000s)
Pasture	$99	$0	$0	$17	$0	$0	$36	$0	$41	$20	$0	$0	$418	$25	$140	$127	$13
Alfalfa	729	60	0	448	158	0	82	0	393	21	0	0	2,200	279	49	52	98
Sugar Beets	580	0	0	0	0	0	0	0	2,723	0	0	0	685	0	0	0	0
Other Field Crops	854	22	80	539	54	51	94	24	1,263	33	0	4	766	1,275	4	207	0
Rice	42	0	0	95	0	18	1,182	0	854	0	444	0	2,452	565	625	359	0
Truck Crops	219	0	478	251	428	0	0	662	127	0	0	0	0	53	0	0	0
Tomatoes	1,502	0	180	547	185	102	20	40	87	0	0	36	92	1,674	0	0	0
Deciduous Orchards	18,057	313	0	1,236	0	0	151	44	297	137	0	0	8,510	1,935	2,778	252	304
Small Grain	257	10	17	123	15	9	203	3	549	0	4	3	496	200	26	95	209
Sub-Tropical Orchards	0	0	0	0	0	0	0	0	0	0	0	0	1,520	0	0	0	0
Total	$22,338	$406	$755	$3,257	$841	$180	$1,769	$772	$6,334	$211	$448	$43	$17,140	$6,007	$3,621	$1,091	$625

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-14 summarizes the data presented in Table 3.2-13. Specifically, the table shows by crop group and canal the projected gross value of farm production on lands receiving CVP contract water in 2030 under the No Action Alternative and assuming dry hydrologic conditions. The table indicates that the total Gross Value of Production within the Sacramento River Division service area is projected to be about $66 million dollars in 2030 under dry hydrologic conditions (in year 1999 dollars).

Table 3.2-14
Gross Value of Production of Sacramento River Division Contractors
DRY Hydrologic Condition
SUMMARY
No Action Alternative (Year 2030 in 1999 Dollars)

Crop	(a) Tehama-Colusa Canal ($000s)	(b) Corning Canal ($000s)	(a)+(b) Total ($000s)
Pasture	$656	$280	$935
Alfalfa	4,371	199	4,571
Sugar Beets	3,989	0	3,989
Other Field Crops	5,058	210	5,268
Rice	5,653	984	6,637
Truck Crops	2,218	0	2,218
Tomatoes	4,464	0	4,464
Deciduous Orchards	30,681	3,334	34,015
Small Grain	1,891	330	2,220
Sub-Tropical Orchards	1,520	0	1,520
Total	$60,500	$5,337	$65,837

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Regional Economy

Table 3.2-15 summarizes projected year 2030 industrial output, employment and Income by Place-of-Work for the entire affected region (Colusa, Glenn, and Tehama Counties) under the No Action Alternative. Consistent with the PEIS, the figures are presented in 1991 terms.

Alternative 1

Agricultural Water Cost, Land Use and Economics

Alternative 1 is assumed to have similar effects on agricultural water costs, land use, and economics within the affected region as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Table 3.2-15
Estimated Output, Employment and Income by Place-of-Work
Affected Region (1991)
No-Action Alternative

Industrial Sector	Output ($Millions)	Employment (FTE Jobs)	Income POW ($Millions)
Agriculture	$550.1	8,218	$215.6
Mining	32.5	80	10.3
Construction	171.5	1,920	54.9
Manufacturing	770.8	4,569	222.2
Transportation	212.7	1,434	85.4
Trade	208.6	6,384	112.3
FIRE	221.5	1,944	130.3
Services	305.6	7,462	125.7
Government	159.5	6,313	153.4
Total	$2,632.7	38,322	$1,110.0

Source: Minnesota Implan Group 1991; Dornbusch & Company 2000.

Regional Economy

Alternative 1 is assumed to have similar effects on the regional economy within the affected region as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Alternative 2

The discussion of the economic impacts from Alternative 2 primarily focuses on the worst-case scenario of an average hydrologic year following five dry hydrologic years. However this scenario is only one of nine possible scenarios, and is not considered to be the most likely outcome.

Agricultural Water Cost, Land Use and Economics

Table 3.2-16 presents the incremental impact on Sacramento River Division contractors CVP water rates relative to rates under the No Action Alternative. Table 3.2-17 presents the data in Table 3.2-16 converted to percentage terms. This table indicates that the largest dollar increases in rates would occur in Davis and Kirkwood WDs on the TCC, and Corning Water District on the Corning Canal. It should be noted that the table does not account for the potential influence of the contractors' ability-to-pay relief status on the actual rates they would necessarily pay for CVP contract water under Alternative 2. However, the models used to assess the impacts of water rate changes under Alternative 2 on agricultural production and land use assume that existing ability to pay-relief for Sacramento River Division contractors would remain in effect.

Agricultural Land Use. Table 3.2-18 shows the estimated incremental impacts of Alternative 2 relative to the Average Hydrologic conditions under the No Action Alternative on irrigated acreage within the potentially affected Sacramento River Division.

Table 3.2-16
1999 Proposed Irrigation Water Rates
Incremental Increase Relative to No Action Alternative
Sacramento River Division Contractors
Alternative 2

	Cost-of-Service Rate	Midpoint	Full-Cost-Rate
Tehama-Colusa Canal	1st tier (80%)	2nd tier (10%)	3rd tier (10%)
Colusa County WD	$6.61	$10.69	$14.76
Cortina WD	$1.72	$2.43	$3.13
Davis WD	$10.59	$14.44	$18.28
Dunnigan WD	$5.33	$8.50	$11.67
Four-M WD	$6.91	$12.79	$18.67
Glenn Valley WD	$7.58	$11.61	$15.63
Glide WD	$1.44	$2.35	$3.26
Holthouse WD	$5.01	$7.57	$10.12
Kanawha	$3.15	$5.39	$7.63
Kirkwood WD	$10.32	$17.92	$25.52
La Grande WD	$4.81	$7.06	$9.31
Myers Marsh Mutual Water Company	$3.19	$3.28	$3.37
Orland-Artois WD	$2.95	$4.74	$6.53
Westside WD	$6.38	$10.53	$14.68
Corning Canal			
Corning WD	$10.63	$16.35	$22.06
Proberta WD	$2.47	$3.30	$4.12
Thomes Creek WD	$8.30	$12.20	$16.10

Source: Reclamation 1999b; Dornbusch & Company 2000.

An average hydrologic year follows five dry hydrologic years in the CVP contractor service areas. An average hydrologic year following five dry years could have a substantial impact on irrigated acreage in the region, possibly resulting in as many as 65,000 acres being taken out of production. It is not anticipated that Alternative 2 would have any incremental impacts in an average hydrologic year following five average or wet hydrologic years despite the incremental increase in CVP water rates proposed under Alternative 2 (see Table 3.2-17). It is also not anticipated that Alternative 2 would have any incremental impacts on irrigated acreage within the affected districts in a dry year following five years of either dry, average or wet hydrologic conditions when compared to projected land use under the No Action Alternative in a year of dry hydrologic conditions.

Table 3.2-19 summarizes the data presented in Table 3.2-18. Specifically, the table shows by crop group and canal the incremental impact of Alternative 2 compared to the No Action Alternative on the acres of land under irrigated crop production projected to receive CVP contract water in 2030 in an average hydrologic year following

Table 3.2-17
1999 Proposed Irrigation Water Rates
Incremental Percentage Increase Relative to No Action Alternative
Sacramento River Division Contractors
Alternative 2

	Cost-of-Service Rate	Midpoint	Full-Cost-Rate
Tehama-Colusa Canal	1st tier (80%)	2nd tier (10%)	3rd tier (10%)
Colusa County WD	25%	23%	22%
Cortina WD	10%	10%	11%
Davis WD	55%	60%	63%
Dunnigan WD	26%	14%	12%
Four-M WD	44%	58%	66%
Glenn Valley WD	43%	50%	54%
Glide WD	9%	11%	12%
Holthouse WD	29%	33%	36%
Kanawha	17%	21%	24%
Kirkwood WD	64%	82%	92%
La Grande WD	27%	30%	33%
Myers Marsh Mutual Water Company	14%	12%	11%
Orland-Artois WD	13%	8%	7%
Westside WD	30%	35%	38%
Corning Canal			
Corning WD	41%	41%	41%
Proberta WD	11%	12%	13%
Thomes Creek WD	42%	49%	54%

Source: Reclamation 1999b; Dornbusch & Company 2000.

Table 3.2-18
Incremental Impacts on Irrigated Acres of Sacramento River Division Lands
Average Hydrologic Condition Following 5-Years Dry Condition
Alternative 2 (2030)

	Change Compared to Average No Action																
	Tehama-Colusa Canal Contractors												Corning Canal Contractors				
Crop	Colusa County WD (acres)	Cortina WD (acres)	Davis WD (acres)	Dunnigan WD (acres)	Four-M WD (acres)	Glenn Valley WD (acres)	Glide WD (acres)	Holthouse WD (acres)	Kanawha	Kirkwood WD (acres)	La Grande WD (acres)	Myers Marsh Mutual Water Company (acres)	Orland-Artois WD (acres)	Westside WD (acres)	Corning WD (acres)	Proberta WD (acres)	Thomes Creek WD (acres)
Pasture	-859	0	0	-149	0	0	-311	0	-357	-171	0	0	-3,634	-219	-946	-858	-91
Alfalfa	-1,684	-140	0	-1,036	-365	0	-190	0	-908	-49	0	0	-5,082	-645	-87	-91	-173
Sugar Beets	-771	0	0	0	0	0	0	0	-3,619	0	0	0	-910	0	0	0	0
Other Field Crops	-2,261	-58	-211	-1,429	-144	-134	-249	-62	-3,346	-87	0	-12	-2,029	-3,377	-7	-431	0
Rice	-71	0	0	-161	0	-31	-2,008	0	-1,450	0	-754	0	-4,164	-960	-687	-395	0
Truck Crops	-10	0	-22	-11	-19	0	0	-30	-6	0	0	0	0	-2	0	0	0
Tomatoes	-1,278	0	-153	-466	-157	-87	-17	-34	-74	0	0	-30	-79	-1,425	0	0	0
Deciduous Orchards	-1,942	-34	0	-133	0	0	-16	-5	-32	-15	0	0	-915	-208	-300	-27	-33
Small Grain	-1,154	-47	-78	-551	-69	-40	-915	-16	-2,467	0	-18	-14	-2,231	-901	-87	-320	-703
Sub-Tropical Orchards[1]	0	0	0	0	0	0	0	0	0	0	0	0	-100	0	0	0	0
Total	-10,032	-278	-464	-3,936	-755	-292	-3,706	-146	-12,258	-322	-772	-56	-19,145	-7,738	-2,114	-2,123	-1,001

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

[1] Within the crop production reports submitted annually by the contractors to the Bureau of Reclamation, it appears that olives have been classified under the crop category "Deciduous Orchards," as opposed to "Sub-tropicals." This misclassification, however, has no material impact on the evaluation of the potential regional economic and associated social impacts of the CVP long-term contract renewal alternatives under consideration. Like olives, which are technically sub-tropical, apples, peaches, plums and other deciduous orchard crops are considered to be higher valued crops that display similar economic characteristics (in terms of average profitability, high investment cost, long-term maturity, cultural requirements, etc.). As a result, the production of those crops would be expected to be similarly affected by changes to water supply, reliability and cost irrespective of how they are broadly classified (e.g., deciduous orchard, sub-tropical, etc.).

Table 3.2-19
Incremental Impacts on Irrigated Acres of Sacramento River Division Lands
Average Hydrologic Condition Following 5-Years Dry Condition
SUMMARY
Alternative 2 (2030)

Crop	(a) Tehama-Colusa Canal		(b) Corning Canal		(a)+(b) Total	
	No-Action Average (acres)	Alt. 2 Incremental Change (acres)	No-Action Average (acres)	Alt. 2 Incremental Change (acres)	No-Action Average (acres)	Alt. 2 Incremental Change (acres)
Pasture	5,700	-5,700	1,895	-1,895	7,595	-7,595
Alfalfa	10,100	-10,100	351	-351	10,451	-10,451
Sugar Beets	5,600	-5,300	0	0	5,600	-5,300
Other Field Crops	13,400	-13,400	438	-438	13,838	-13,838
Rice	9,600	-9,600	1,083	-1,083	10,683	-10,683
Truck Crops	600	-100	0	0	600	-100
Tomatoes	6,100	-3,800	0	0	6,100	-3,800
Deciduous Orchards	26,900	-3,300	2,933	-360	29,833	-3,660
Small Grain	8,500	-8,500	1,109	-1,109	9,609	-9,609
Sub-Tropical Orchards	1,000	-100	0	0	1,000	-100
Total	87,500	-59,900	7,810	-5,237	95,310	-65,137

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

five dry hydrologic years. The table indicates that of the total of about 95,000 acres of irrigated land within the Sacramento River Division service area directly affected by long-term CVP contract renewal, about 65,000 acres or approximately 68% is projected to be fallowed in an average hydrologic year following five dry hydrologic years. This would constitute a substantial effect on agricultural use.

Agricultural Economics. Table 3.2-20 shows the projected 2030 incremental change in gross value of production by Sacramento River Division contractors and crop groups under Alternative 2. Alternative 2 could result in a significant reduction of production within the affected service areas in an average hydrologic year following five dry years. This would result in a total reduction of gross production value in the affected service areas of approximately $40,000,000. This would constitute a substantial effect on agricultural economics. It is not anticipated that Alternative 2 would have any incremental impacts in an average hydrologic year following five average or wet hydrologic years despite the fairly large incremental increase in CVP water rates proposed under Alternative 2. It is also not anticipated that Alternative 2 would have any incremental impacts on gross value of production within the affected service areas in a dry year following five years of either dry, average, or wet hydrologic conditions relative to land use under the No Action Alternative in a year of dry hydrologic conditions.

Table 3.2-20
Incremental Impacts on Gross Value of Production of Potentially Affected Service Areas
Average Hydrologic Condition Following 5-Years Dry Condition
Alternative 2
(Year 2030 in 1999 Dollars)

	Tehama-Colusa Canal Contractors														Corning Canal Contractors		
Crop	Colusa County WD	Cortina WD	Davis WD	Dunnigan WD	Four-M WD	Glenn Valley WD	Glide WD	Holthouse WD	Kanawha	Kirkwood WD	La Grande WD	Myers Marsh Mutual Water Company	Orland-Artois WD	Westside WD	Corning WD	Proberta WD	Thomes Creek WD
	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)
Pasture	-$131	$0	$0	-$23	$0	$0	-$47	$0	-$54	-$26	$0	$0	-$552	-$33	-$144	-$130	-$14
Alfalfa	-966	-80	0	-594	-209	0	-109	0	-521	-28	0	0	-2,914	-370	-50	-52	-99
Sugar Beets	-601	0	0	0	0	0	0	0	-2,821	0	0	0	-710	0	0	0	0
Other Field Crops	-1,096	-28	-102	-693	-70	-65	-121	-30	-1,622	-42	0	-6	-984	-1,637	-4	-209	0
Rice	-64	0	0	-147	0	-28	-1,825	0	-1,318	0	-685	0	-3,785	-873	-625	-359	0
Truck Crops	-36	0	-79	-42	-71	0	0	-110	-21	0	0	0	0	-9	0	0	0
Tomatoes	-998	0	-120	-364	-123	-68	-13	-26	-58	0	0	-24	-61	-1,113	0	0	0
Deciduous Orchards	-2,424	-42	0	-166	0	0	-20	-6	-40	-18	0	0	-1,143	-260	-341	-34	-37
Small Grain	-351	-14	-24	-168	-21	-12	-278	-5	-750	0	-5	-4	-678	-274	-26	-97	-214
Sub-Tropical Orchards	0	0	0	0	0	0	0	0	0	0	0	0	-151	0	0	0	0
Total	-$6,668	-$164	-$325	-$2,195	-$494	-$173	-$2,414	-$177	-$7,205	-$114	-$691	-$34	-$10,978	-$4,568	-$1,189	-$882	-$364

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-21
Incremental Impacts on Gross Value of Production of Potentially Affected Contractors
Average Hydrologic Condition Following 5-Years Dry Condition
SUMMARY
Alternative 2
(Year 2030 in 1999 Dollars)

Crop	(a) Tehama-Colusa Canal		(b) Corning Canal		(a)+(b) Total	
	No Action Average ($000s)	Alt. 2 Incremental Change ($000s)	No Action Average ($000s)	Alt. 2 Incremental Change ($000s)	No Action Average ($000s)	Alt. 2 Incremental Change ($000s)
Pasture	$866	-$866	$288	-$288	$1,154	-$1,154
Alfalfa	5,791	-5,791	202	-202	5,992	-5,992
Sugar Beets	4,366	-4,132	0	0	4,366	-4,132
Other Field Crops	6,497	-6,497	212	-212	6,709	-6,709
Rice	8,725	-8,725	984	-984	9,709	-9,709
Truck Crops	2,211	-369	0	0	2,211	-369
Tomatoes	4,762	-2,967	0	0	4,762	-2,967
Deciduous Orchards	30,583	-4,119	3,334	-409	33,917	-4,528
Small Grain	2,584	-2,584	337	-337	2,921	-2,921
Sub-Tropical Orchards	1,515	-151	0	0	1,515	-151
Total	$67,900	-$36,200	$5,357	-$2,432	$73,257	-$38,632

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

Table 3.2-21 summarizes the data presented in Table 3.2-20. Specifically, the table shows by crop group and canal service area grouping, the incremental impact of Alternative 2 compared to the No Action Alternative on the gross value of crop production projected to receive CVP contract water in 2030 in an average hydrologic year following five dry hydrologic years. The table indicates that under this hydrologic scenario, about $40 million, or almost 55% of the area's total projected gross value of production of about $73 million dollars would be lost (in 1999 dollar terms). Under this scenario, production of pasture, alfalfa, rice, other field crops, and small grains would cease entirely among the Sacramento River Division contractors.

In addition to changes to the gross value of production anticipated under Alternative 2, the fallowing of land and increased cost of CVP water would also impact net farm income (or revenues). Table 3.2-22 summarizes the incremental net revenue impacts anticipated under Alternative 2 in an average hydrologic year following five dry condition years. This scenario would result in the greatest economic effects under Alternative 2. The table shows that the total decline in net farm revenue of about $2.7 million is the result of approximately $6.4 million related to fallowing irrigated land offset by avoided CVP water costs of about $3.7 million. It is anticipated that Alternative 2 would have much smaller incremental impacts on net farm revenues in an average hydrologic year following five average or wet hydrologic years. These impacts would be derived entirely from increased CVP water rates relative to the No Action Alternative.

Table 3.2-22
Estimated Net Farm Revenue Impacts
Average Hydrologic Condition Following 5-Years Dry Condition
Affected Region
(1999)

Cause of Net Revenue Change	Average Hydrologic Year Following Five Dry Years ($millions)
Fallowed Land	-$6.4
Groundwater Pumping Cost	0.0
Irrigation Cost	0.0
CVP Water Cost	3.7
Higher Crop Prices	0.0
Total	-$2.7

Sources: Reclamation 1996-1999, 1997, 1999a; Dornbusch & Company 2000; CH2M Hill 2000.

It is also anticipated that Alternative 2 would have a negative incremental impact on net farm revenues within the affected water service areas in a dry year following five years of dry hydrologic conditions relative to the No Action Alternative in a year of dry hydrologic conditions. These impacts would be derived entirely from increased CVP water rates relative to the No Action Alternative and are estimated at about $400,000. Alternative 2 is not projected to have any impact on net farm revenues within the affected service areas in a dry year following five years of average or wet hydrologic conditions relative to the No Action Alternative in a year of dry hydrologic conditions.

Regional Economy

Table 3.2-23 summarizes the sector-specific and total anticipated incremental impacts on industrial output within the affected region under Alternative 2 assuming average hydrologic conditions following five years of dry hydrologic conditions. These impacts would result from the escalation of CVP agricultural water rates and increased CVP acreage limitations, and the associated changes in farmer net income and gross value of agricultural production within the affected water service areas. The table indicates that Alternative 2 would directly result in a decrease of the agricultural output in Colusa, Glenn, and Tehama Counties by about 5 percent from baseline No Action levels (or by more than $27 million in 1991 dollars). At the same time, overall industrial output in the region would be expected to decrease by about 3.2 percent if Alternative 2 were implemented.

Table 3.2-24 summarizes the sector-specific and total anticipated incremental impacts on employment within the affected region under Alternative 2 assuming average hydrologic conditions following five years of dry hydrologic conditions. The table indicates that agricultural employment in Colusa, Glenn, and Tehama Counties, consistent with output, could decrease by about 6.4 percent from baseline No Action levels under Alternative 2 (or a loss of almost 523 jobs). At the same time, overall employment in the region would be expected to decrease by about 2.6 percent if Alternative 2 were implemented.

Table 3.2-23
Affected Region Output Impacts – Alternative 2
(1991 Comparative Basis)

Industrial Sector	No Action Average Condition ($Millions)	Alternative 2 Incremental Change from No Action ($Millions)	Alternative 2 Incremental Change from No Action (%)
Agriculture	$550.1	-$27.4	-5.0%
Mining	32.5	-0.4	-1.2%
Construction	171.5	-0.6	-0.3%
Manufacturing	770.8	-33.4	-4.3%
Transportation	212.7	-6.5	-3.1%
Trade	208.6	-4.7	-2.3%
Finance, Insurance & Real Estate	221.5	-5.2	-2.3%
Services	305.6	-6.1	-2.0%
Government	159.5	-1.3	-0.8%
Total	$2,632.7	-$85.5	-3.2%

Sources: Minnesota Implan Group 1991; Dornbusch & Company 2000.

Table 3.2-24
Affected Region Employment Impacts – Alternative 2
(1991 Comparative Basis)

Industrial Sector	No Action Average Condition (FTE Jobs)	Alternative 2 Incremental Change from No Action (FTE Jobs)	Alternative 2 Incremental Change from No Action (FTE Jobs)
Agriculture	8,218	-523	-6.4%
Mining	80	0	0.0%
Construction	1,920	-9	-0.5%
Manufacturing	4,569	-132	-2.9%
Transportation	1,434	-46	-3.2%
Trade	6,384	-106	-1.7%
Finance, Insurance & Real Estate	1,944	-46	-2.4%
Services	7,462	-134	-1.8%
Government	6,313	-9	-0.1%
Total	38,322	-1,004	-2.6%

Source: Minnesota Implan Group 1991; Dornbusch & Company 2000.

Table 3.2-25 summarizes the sector-specific and total anticipated incremental impacts on income by place-of-work[1] within the affected region under Alternative 2 assuming average hydrologic conditions following five years of dry hydrologic conditions. The table indicates that the region's agricultural income by place-of-work could decrease by about 8 percent from baseline No Action levels under Alternative 2 (or by over $17 million in 1991 dollars). At the same time, overall income by place-of-work in the region would be expected to decrease by about 3.8 percent if Alternative 2 were implemented.

3.2.3 Cumulative Impacts

While shifts in cropping patterns, changes in the number of irrigated acres, and increased water conservation are expected due to impacts on water usage under all alternatives, the alternatives are not expected to contribute substantially to cumulative impacts on regional agricultural economics, but there could be substantial local impacts.

Table 3.2-25
Affected Region Income by Place-of-Work Impacts – Alternative 2
(1991 Comparative Basis)

		Alternative 2	
Industrial Sector	**No Action Average Condition ($Millions)**	**Incremental Change from No Action ($Millions)**	**Incremental Change from No Action ($Millions)**
Agriculture	$215.6	-17.24	-8.0%
Mining	10.3	-0.16	-1.6%
Construction	54.9	-0.23	-0.4%
Manufacturing	222.2	-9.93	-4.5%
Transportation	85.4	-3.17	-3.7%
Trade	112.3	-3.10	-2.8%
Finance, Insurance & Real Estate	130.3	-3.73	-2.9%
Services	125.7	-3.08	-2.5%
Government	153.4	-1.48	-1.0%
Total	$1,110.0	-42.12	-3.8%

Sources: Minnesota Implan Group 1991; Dornbusch & Company 2000.

[1] Income by place-of-work includes employee earnings, proprietor's income and other property income.

3.3 WATER RESOURCES

3.3.1 Affected Environment

Agricultural Land Use

The study area consists of land areas and water bodies influenced by water diversions or return flow of irrigation water served by the Sacramento River Division of the CVP. The Sacramento River Division was added to the CVP in 1950 and includes the Red Bluff Diversion Dam (completed in 1964), the Corning Canal (built in 1959), and the Tehama-Colusa Canal (completed in 1980). Black Butte Dam, which was completed by the US Army Corps of Engineers in 1963, was included in the Sacramento River Division in 1970. Black Butte Dam was designed primarily for flood control, but also supplies surplus water to the Sacramento River Division and the Orland Project for irrigation (Stene 1994).

Before construction of the Sacramento River Division, about 45,000 acres in the Division's future service area received irrigation. By 1989, Tehama-Colusa and Corning Canals were supplying water to irrigate 100,019 acres, as well as 20,000 acres of wildlife refuges (Stene 1994).

The service area of the Corning Canal lies within the Sacramento-Lower Thomes watershed (Hydrologic Unit No. 18020103). The service area of the Tehama-Colusa Canal lies within the Sacramento-Stone Corral watershed (Hydrologic Unit No. 18020104). Both of these watersheds are classified by the State of California as Category I (Impaired) Non-Priority Watersheds (SWRCB 2000). The classification was made by the State Water Resources Control Board (SWRCB) based on evaluation of available data and public comments. Category I watersheds are considered to be candidates for increased restoration activities due to impaired water quality, presence of endangered aquatic species, and/or because they are considered to contain impaired aquatic or terrestrial habitat. Most of the watersheds in the state are considered to be Category I watersheds. As of January 2000, 44 watersheds had been identified as "priority watersheds," due to a combination of high value, high risk, and high opportunity for improvement. Non-priority watersheds have lower priority for receiving restoration funds.

The Red Bluff Diversion Dam diverts water from the Sacramento River into the TCC. The TCC has an initial capacity of 2,530 cubic feet per second (cfs), including water for discontinued salmon mitigation and enhancement facilities, diminishing to 1,700 cfs at its terminus near the junction of Interstate Highway 505 and Interstate 5, in Yolo County.

The Corning Canal diverts water from the TCC, about one-half mile below the Red Bluff Diversion Dam. The Corning Canal is designed to convey water to lands that are too high in elevation to be served from the TCC. The initial capacity of the Corning Canal is 500 cfs.

Figure 3.3-1 shows the amount of water that Sacramento River Division contractors have diverted since 1976, as a percentage of their total contract amounts. Also plotted is the combined unimpeded runoff from the four major tributaries to the Sacramento River below Shasta Dam. A combined unimpeded runoff of 17.9 million acre-feet is defined as "average." The shading pattern in the bar graph on Figure 3.3-1 indicates the type of water year as classified by the State of California. Although the water year classification has regulatory significance, the water year types are presented here to help illustrate the variability in annual runoff within the Sacramento Valley. As can be seen in the figure, deliveries rose steadily as the TCC was being completed, and then fell rapidly in response to the dry years beginning in 1987. Due to increased overall demand for water, changes in water management, (including more stringent requirements for maintaining Delta outflow and instream flows for anadromous fish), and greater cooperation between the state and federal water projects, water contractors were able to divert only about 50 to 75 percent of their contract amounts during the past five years, in spite of relatively high runoff.

Corning Canal Contractors. The Corning Canal currently serves three water districts. The amount of land irrigated by the districts has varied widely in past years, as has the amount of water delivered to the districts. However, the historical data suggest that cropping patterns have not been highly correlated with short-term availability of water, but instead may be related to conditions occurring over several years. For example, 1995 was the first in a sequence of five wet or above normal runoff years, but it followed a sequence of low runoff years that began in 1987. In 1995, the districts diverted on average about 40 percent of their contract water, and had about 54 percent of their acreage under irrigation. During the next four years, as hydrologic conditions improved, the districts responded in different ways. Farmers in the Proberta Water District planted a larger percentage of acres in more water-intensive crops, such as rice. Farmers in the Thomes Creek Water District, which already had much of its irrigated land in permanent crops, did not make a similar shift. In addition, water deliveries served by the Corning Canal decreased in 1997 and 1998, in spite of the fact that these continued to be high runoff years, as some districts dropped out during this period due to the costs of water. Average diversions in 1995, 1996 and 1999 were about half of the contract amount, but average diversions in 1997 and 1998 were about 34 percent and 26 percent of contract quantities, respectively. Table 3.3-1 summarizes average water use data during this period for the three Corning Canal districts.

TCC Contractors. The water contractors served by the TCC, with the exception of the Kirkwood Water District, lie south of Stony Creek, below the Black Butte Reservoir, and west of the Glenn-Colusa Canal and the Colusa Basin Drain. The TCC is the most westerly canal, and therefore supplies water to lands with the highest elevations in the area.

Between the contractors served by the TCC and the Sacramento River are the Glenn-Colusa Irrigation District and several other Sacramento River Settlement Contractors

Figure 3.3-1
Comparison of Natural Runoff (Basis for Sacramento River Index) and Water Delivered to Sacramento River Division Contractors as Percent of Contract Amount (Tehama-Colusa and Corning Canal Contractors Combined)

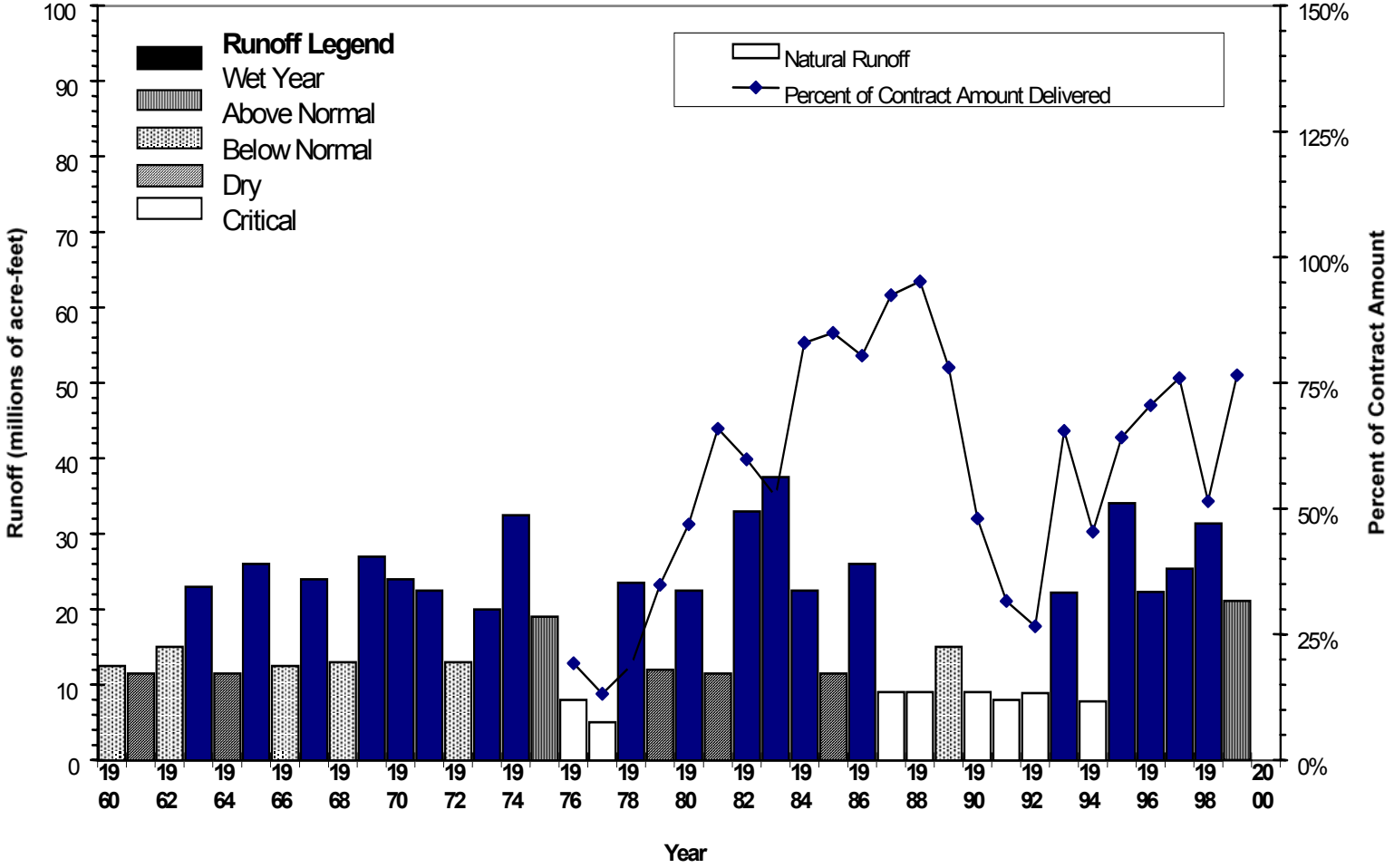


Table 3.3-1
Water Use Summary for Corning Canal Water Districts (1995-1999)

District	Contract Quantity (1) (acre-feet)	Average Deliveries (acre-feet)	Deliveries as Percent of Contract Amount	Total Acres in District	Irrigated Acres (percent of total acres)	Percent of Irrigated Acres in Rice	Percent of Total Acres Planted in Permanent Crops (fruits and nuts)	Percent of Irrigated Acres in Permanent Crops
Proberta	5,500	2,446	44%	2,438	90%	16%	10%	11%
Thomes Creek	8,400	2,296	33%	2,030	59%	5%	51%	86%
Corning	25,300	9,860	39%	10,913	45%	11%	25%	55%
Combined Districts	39,200	15,082	38.5%	15,381	54%	6%	26%	47%

(1) Quantities are for prior to 1998. In 1998 Reclamation purchased water from the Corning Canal Contractors. Since 1998, the contract quantities are: Proberta WD 3,500 AFY; Thomes Creek WD 6,400 AFY; Corning WD 23,000 AFY; combined districts 32,900 AFY.

Source: Reclamation 2000

that occupy lower land. Some of the water applied as irrigation on the uplands recharges the groundwater and flows east into these lower lands. This recharge represents water that is potentially recoverable for irrigation of lands to the east of the study area. Table 3.3-2 summarizes water use data for the past five years for the principal water contractors served by the TCC. The water contractors are listed in the table from north to south.

Table 3.3-2 shows that there are significant differences between contractors in the amounts of land devoted to different classes of crops. For example, the percentage of irrigated land planted in rice ranges from none to 73 percent, with the average overall being about 10 percent. Rice is a water intensive crop, and requires about 4 acre-feet or more per acre per year. The LaGrande Water District had the largest percentage of acres in rice during the period. Similarly, districts had widely different percentages of land planted in permanent crops (orchards and vineyards). Colusa and Orland-Artois water districts each had large numbers of acres and a large percentage of their irrigated lands planted in these crops. As a result, even though some contractors have almost no lands planted in permanent crops, the combined water contractors have about 40 percent of their irrigated acres planted in permanent crops.

Regulations and Agreements That Affect CVP Operations

The following summary, taken from the CVPIA PEIS, describes the regulatory decisions and agreements that affect the distribution of CVP water in the study area (Reclamation 1999a).

Prior to the passage of CVPIA, the operation of the CVP was affected by SWRCB Decisions 1422 and 1485, and the Coordinated Operations Agreement (COA). Decisions 1422 and 1485 identify minimum water flow and water quality conditions at specified locations, which are to be maintained in part through the operation of the CVP. The COA specifies the responsibilities shared by the CVP and SWP for meeting the requirements of Decision 1485.

Beginning in 1987, a series of actions by the SWRCB, US Environmental Protection Agency (EPA), the National Marine Fisheries Services (NMFS, now NOAA Fisheries), and the Service affected interim water flow and water quality standards in the Delta. However, at the time CVPIA was enacted (October 1992), the water quality standard in the Delta remained D-1485, and the CVP and SWP were operated in accordance with the COA to maintain this requirement.

In December 1994, representatives of the Federal and State governments and urban, agricultural and environmental interests agreed to the implementation of a Bay-Delta protection plan through the SWRCB, to provide ecosystem protection for the Bay-Delta Estuary. Shortly thereafter, SWRCB Order 95-06 superseded D-1485. The coordinated operations of the CVP and SWP continue to be based on the COA, but modified as needed on an annual basis.

Table 3.3-2
Water Use Summary for TCC Water Contractors (1995-1999)

District	Contract Quantity (acre-feet)	Average Deliveries (acre-feet)	Deliveries as Percent of Contract Amount	Total Acres in District	Irrigated Acres (percent of total acres)	Percent of Irrigated Acres in Rice	Percent of Total Acres Planted in Permanent Crops (fruits and nuts)	Percent of Irrigated Acres in Permanent Crops
Colusa County	68,165	38,559	37%	40,661	70%	2%	52%	
Cortina WD	1,700	1,098	65%	575	94%	0%	6%	
Davis WD	4,000	1,887	47%	965	91%	0%	0%	
Dunnigan WD	19,000	12,389	65%	9,937	63%	1%	16%	
4-M WD	7,700	2,104	37%	1,649	60%	0%	3%	
Glenn Valley WD	1,730	870	50%	770	43%	18%	4%	
Glide WD	10,500	10,290	98%	7,929	62%	40%	3%	
Holthouse WD	2,450	1,326	54%	1,720	26%	7%	6%	
Kanawha WD	45,000	32,234	72%	14,733	86%	11%	5%	
Kirkwood WD	2,100	661	31%	1,016	32%	0%	15%	45%
LaGrande WD	7,200	4,673	65%	1,392	89%	73%	0%	
Myers Marsh MWD	255	163	64%	264	38%	0%	0%	
Orland-Artois WD	53,000	48,761	92%	26,918	91%	14%	38%	42%
Westside WD	65,000	48,566	75%	15,453	82%	8%	17%	21%
Combined Districts	285,800	203,478	71%	122,966	77%	10%	30%	39%

CVP Water Contracts

Before construction of the CVP, many irrigators on the west side of the Sacramento Valley and elsewhere relied primarily on groundwater. With the completion of CVP facilities in these areas, the irrigators signed agreements with Reclamation for the delivery of CVP water as a full or supplemental supply. Several municipalities also have similar contracts.

These contracts are based on the CVP water rights, many of which originated from applications filed by the state in 1927 and 1938 to advance the California Water Plan. After the Federal Government was authorized to build the CVP, those water rights were transferred to Reclamation, which made applications for the additional water rights needed for the CVP.

During development of the CVP, the United States entered into long-term contracts with many of the major water rights holders in the Central Valley. In part, the CVP is operated to satisfy downstream water rights, meet the obligations of the water rights contracts, and deliver project water to CVP water service contractors. Within the study area, most districts are Water Service Contractors.

CVP water service contracts are between the United States and individual water users or contractors/districts and provide for an allocated supply of CVP water to be applied for beneficial use. In addition to CVP water supply, a water service contract can include a supply of water that recognizes a previous water right. The purposes of a water service contract are to stipulate provisions under which a water supply is provided, to produce revenues sufficient to recover an appropriate share of capital investment, and to pay the annual operations and maintenance costs of the project.

Water availability for delivery to CVP water service contractors during periods of insufficient water supply is determined based on a combination of operational objectives, hydrologic conditions, and reservoir storage conditions. Reclamation is required to allocate shortages among water service contractors within the same service area, as individual contracts and CVP operational capabilities permit.

Groundwater

Sacramento Valley Basin. The northern third of the Central Valley regional aquifer system is located in the Sacramento River Region. This region extends from Redding in the north to the Delta in the south. DWR identifies this portion of the Central Valley Aquifer as the Sacramento Valley and Redding basins, which cover over 5,500 square miles. This discussion refers to these basins collectively as the Sacramento Valley Groundwater Basin.

In the Sacramento Valley Groundwater Basin, a long-term dynamic link between the groundwater and surface water system has been maintained on a regional basis. The greatest gains to streams from groundwater occurred during the 1940s when groundwater storage was highest in the Sacramento Valley Groundwater Basin. Discharge to streams was lowest during and immediately following the 1976 to 1977

drought and during the 1987 to 1992 drought periods. In some areas of the southern portion of the Sacramento Valley Region where groundwater levels have continued to decline, such as in parts of Yolo and Sacramento counties, streams that formerly gained flow from the subsurface now lose flow through seepage to adjacent groundwater systems.

Aquifer recharge to the Sacramento Valley Groundwater Basin has historically occurred from deep percolation of rainfall, the infiltration from streambeds, and subsurface inflow along the basin boundaries. Most of the recharge for the Central Valley occurs in the northern and eastern sides of the valley where the precipitation is greater. With the introduction of agriculture to the region, aquifer recharge was augmented by deep percolation of applied agricultural water and seepage from irrigation distribution and drainage canals. Groundwater accounts for about 30 percent of the basin's water supply. The basin has an estimated perennial yield of 2.4 million acre-feet. Groundwater pumping in the Sacramento Valley Groundwater Basin is estimated to be near the perennial yield in average years, but exceeds it by about one million acre-feet in drought years (DWR 1998). Currently, groundwater withdrawals exceed the perennial yield by more than 33 thousand acre-feet per year (about 1.4 percent of the perennial yield). Overdraft conditions are expected to nearly triple in the basin, to about 85 thousand acre-feet, by 2020. Most of the overdraft is expected to occur in the Sacramento, Placer, and El Dorado County areas (DWR 1998).

Land subsidence due to groundwater level declines has been identified in the southwestern part of the Sacramento River Region, near Davis and Zamora. By 1973 land subsidence in this area had exceeded approximately 1 foot, and was reported to be approximately 2 feet in the area east of Zamora and west of Arbuckle (Lofgren and Ireland 1973). Localized land subsidence was reported in the Davis-Zamora area during the 1988-1992 drought period (Yolo County 2000b). Land subsidence monitoring has continued since 1973 (Yolo County 2000b). Groundwater quality is generally excellent; however, areas of local groundwater contamination or pollution exist.

High water tables contribute to subsurface drainage problems in several areas of the Sacramento Valley Groundwater Basin. High water tables in portions of Colusa County, particularly along the Sacramento River, periodically impair subsurface drainage functions of the Colusa Basin Drain and other local drainage facilities. In many reaches of the Sacramento River, flows are confined to a broad, shallow man-made channel with stream bottom elevations higher than adjacent ground surface elevations. During extended periods of high streamflows, seepage-induced water logging can occur on adjoining farmlands, particularly in areas where local groundwater is in contact with the river.

Most of the water districts served by the Sacramento River Division lie within the Sacramento Valley Groundwater Basin. The western margin of the groundwater basin in the area north of Stony Creek and Black Butte Reservoir, served by the Corning Canal, is at an elevation of about 600 to 800 feet mean sea level (msl). South of Black Butte Reservoir the basin margin is at an elevation of about 250 feet msl. South of Stony

Creek, the TCC closely follows the basin margin. The canal terminates in the Dunnigan Water District, near the eastern edge of the Dunnigan Hills, at an elevation of about 100 feet msl. Thus, some of the lands in the study area lie outside of the Sacramento Valley Groundwater Basin. For example, the western portion of the Kanawha Water District, most of the lands within the 4-M Water District, and the western part of the Westside Water District are outside the Sacramento Valley Groundwater Basin.

Precipitation on the west side of the Sacramento Valley is relatively low, averaging about 15 to 20 inches per year. Near, or outside of, the basin margin well yields are relatively low. Many water districts do not operate wells, although individual landowners may pump groundwater to supplement their project water. Historical groundwater use ranges widely by district. In 1989, which was a year of below normal runoff to the Sacramento Valley preceded by two critical low runoff years, the amounts of groundwater pumping to supplement project water deliveries were reported by several water districts. The Corning and Thomes Creek water districts pumped 1,000 acre-feet and 2,500 acre-feet, respectively. This was equivalent to 4.5 percent of the water received from the CVP by the Corning Water District, and 48 percent of the water received by the Thomes Creek Water District in those years. The Proberta Water District, however, did not report any groundwater use that year.

The Colusa County Water District reported pumping 22,039 acre-feet of groundwater in 1989, which was equivalent to 36 percent of the water deliveries received from the CVP that year. Spread over the number of acres reportedly irrigated in 1989, this amounted to an average of 0.5 acre-feet per acre from groundwater. The Colusa County Water District lies entirely within the Sacramento Valley basin. The groundwater quantities noted here are from data reported in the most recent water conservation plans submitted by the districts. Equivalent data are lacking from water districts that were exempt from the requirement to prepare a water conservation plan. The Dunnigan Water District, also entirely within the Sacramento Valley basin, reported pumping 2,700 acre-feet of groundwater in 1989, representing about 20 percent of the water they received from the CVP. Kanahwa Water District pumped a small amount (174 acre-feet) of groundwater in 1989. Orland-Artois Water District pumped 12,104 acre-feet of groundwater, or about 30 percent of the water delivered from the CVP. As with the Colusa County Water District, this amounted to about 0.5 acre-feet per acre of land irrigated that year. The other large water district, Westside, did not report pumping any groundwater. The district does not own any wells, although individual landowners operate private wells.

3.3.2 Environmental Consequences

No Action Alternative

Surface Water

Water Deliveries. Under the No Action Alternative, Reclamation would negotiate contract water quantities with the contractors based on the water needs assessment prepared by Reclamation (Reclamation 2000b). Table 3.3-3 summarizes the results of

the water needs assessment for each of the Sacramento River Division contractors. The subcontracted water of the Colusa County Water District and the Westside Water District are combined in the table with the water directly contracted by these two districts.

Table 3.3-3
Summary of Water Needs Assessment Quantities
(all quantities are 2030 values)

District	Contract Amount (ac-ft)	Ground water Supply (ac-ft)	Net Transfers (ac-ft)	Total Water Supply (ac-ft)	Net Total Agr. Demand (ac-ft)	Unmet Demand (ac-ft)	Average Irrigated Acres (acres)	Average Water Required per acre
Corning WD	23,000	5,800	0	28,800	34,061	5,261	10,170	3.30
Proberta WD	3,500	1,000	0	4,500	7,696	3,196	2,405	3.20
Thomes Creek WD	6,400	700	0	7,100	6,332	-768	1,827	3.40
Subtotal Corning Canal Contractors	**32,900**	**7,500**	**0**	**40,400**	**48,089**	**7,689**	**14,402**	**3.30**
Colusa County	68,165	22,000	0	90,165	136,029	45,864	38,832	3.40
Dunnigan WD	19,000	6,500	0	25,500	31,844	6,344	9,848	3.20
Glide WD	10,500	0	0	10,500	33,316	22,816	8,329	4.00
Kanawha WD	45,000	174	0	45,174	56,893	11,719	16,255	3.50
Orland Artois WD	53,000	13,700	0	66,700	100,964	34,264	32,569	3.10
Westside WD	65,000	0	0	65,000	60,937	-4,063	17,621	3.20
Total Non-Exempt TCC Contractors	**260,665**	**42,374**	**0**	**303,039**	**419,983**	**116,944**	**123,454**	**3.33**

Source: Reclamation 2000b

Model results, described in the economic analysis in Section 3.2, indicate that under the No Action alternative dry hydrologic conditions could result in a reduction on the order of about 15 percent in irrigated acreage throughout the study area overall. Such a reduction would not necessarily affect all water contractors in the same way. Among the ways in which a reduction in irrigated acres might occur is that higher value permanent crops would continue to be irrigated, while marginally productive lands are shifted to crops that require minimal or no water (e.g., dry pasture or wheat). It is possible, therefore, that in some districts, the amount of water delivered might remain similar to existing conditions in spite of hydrologic conditions and reductions in irrigated acreage. More likely, there would be permanent shifts from low value, high water consuming crops, such as rice, smaller reductions in permanent crops, and temporary fluctuations in the amount of acres planted in higher value seasonal crops, depending on hydrologic conditions. This scenario would result in minimal changes in average water use over time, with short-term fluctuations greater in magnitude than the long-term change.

Groundwater

The CVPM assumes that there would be no groundwater use in the TCC service areas. However, although groundwater is not considered a viable long-term substitute for CVP water, some contractors are able to supplement their CVP water deliveries with

groundwater, which helps them soften the impacts of dry years. In the Corning Canal districts, groundwater is generally more plentiful than in the TCC districts. Groundwater use, however, is increasingly subject to regional management, as local agencies are formed under AB3030 or other authorities. In general, groundwater management will probably take the form of defining the sustainable yield of the local groundwater resources, requiring permits to extract groundwater, conserving riparian habitat, and generally limiting the amount of groundwater available as a supplement to CVP deliveries.

In the absence of enforceable groundwater management programs, reductions in CVP deliveries are likely to lead to local, short-term increases in groundwater use. Reductions in irrigation are also likely to result in reductions in groundwater recharge, affecting down gradient farmers. In the worst case, groundwater pumping by downgradient users, including those outside the study area, may slow the regional movement of groundwater toward the Sacramento River. By increasing the residence time of the groundwater, and recirculating it through irrigation recharge, the quality of the groundwater may decline. The amount of degradation, while impossible to quantify, is likely to be minor.

Alternative 1

Surface Water

Alternative 1 does not differ substantially from the No Action alternative in terms of the amount of surface water used or the way in which the water is used. Therefore, no impact is expected relative to No Action as a result of implementing Alternative 1.

Groundwater

Since water use would be the same under Alternative 1 as under the No Action alternative, no impact on groundwater resources is expected relative to result from Alternative 1.

Alternative 2

Surface Water

Model results indicate that large reductions in water purchases would occur, compared to the No Action alternative, as a result of Alternative 2. The reductions occur in the model because the model assumes that water users would not buy high-priced water. If they opt not to buy the amount of water available in good years, then the average quantity delivered would gradually decrease relative to the No Action alternative.

If water users were able to absorb the higher cost of water, and decided to purchase all of the water available each year in spite of the higher cost, then water deliveries under Alternative 2 would be the same as under the No Action alternative. Water users can be expected to have different abilities to pay, and therefore some water users would not be as highly affected by price as others. Farmers who can pass on the costs to consumers, who can spread costs over a long time period, who cannot afford to reduce their water use (for example because they have investments in permanent crops such as orchards),

or who can afford reduced profits, might continue to purchase as much water as is available. If so, then cropping patterns might be expected to shift toward high value and permanent crops, and away from low value and water intensive crops. As discussed in Section 3.2, the CVPM shows that when a sequence of dry years is followed by an average year, water purchases by the Sacramento River Division contractors overall could be greatly reduced. Such an impact might be severe enough to drive some contractors out of business, leaving a smaller base across which to spread operating costs. This could lead to further price increases, possible loss of additional water users, and possible threats to the viability of the Tehama Colusa Canal Authority (TCCA). This would be a substantial impact on surface water resource management relative to the No Action alternative.

Groundwater

Any substantial reduction in CVP water deliveries such as described above would put pressure on districts and individual farmers to find alternative sources of water to meet their demands for water. Groundwater is one of the alternative sources that might be exploited. Some districts have negligible groundwater resources, while others have substantial groundwater resources. Moreover, the degree to which districts could share groundwater would be limited by local ordinances designed to prohibit mining of groundwater.

It is unlikely that groundwater could supply a substantial portion of the total demand in any district over the long term. Therefore, if surface water deliveries are substantially and permanently reduced under Alternative 2, it is unlikely that groundwater would be substituted. Groundwater use would be localized in areas with substantial groundwater resources, such as on alluvial fans or in small isolated groundwater basins. Reliance on groundwater resources in the absence of a groundwater management program could result in substantial local impacts on groundwater resources.

3.3.3 Cumulative Impacts

The following projects have been identified within the study area. Potential cumulative impacts are discussed under each project. While shifts in cropping patterns, number of irrigated acres, and increased water conservation are expected due to impacts on water usage under all three alternatives, the alternatives are not expected to contribute significantly to cumulative impacts on water resources.

Integrated Resources Management Program for Flood Control in the Colusa Basin. A 1995 study by the Colusa Basin Drainage District identified projects to meet six objectives: protect against flood and drainage damages, preserve and enhance agricultural production, capture surface or storm water for increased water supplies, facilitate groundwater recharge to help reduce overdraft and land subsidence, improve and enhance wetland and riparian habitat, and improve water quality. A Draft Programmatic Environmental Impact Statement/Draft Programmatic Environmental Impact Report (DEIS/DEIR) for the proposed Resources Management Program for Flood Control in the Colusa Basin was released on June 2, 2000 for public comment.

Some projects selected for feasibility and preliminary design studies have potential water supply benefits, including two small onstream reservoirs and one groundwater recharge project (DWR 1999). The Colusa Basin Drainage District has investigated the potential to construct two small reservoirs as part of its integrated watershed management project--a 2.2 thousand acre-feet (taf) Wilson Creek Reservoir west of Orland in Glenn County, and a 16.9 taf Golden Gate Reservoir on Funks Creek near Maxwell in Colusa County. The estimated average annual runoff at the Wilson Creek site is 2.4 taf. The construction cost is estimated at $3.3 million. The primary purpose of the proposed reservoir would be flood control, although it offers limited water supply benefits. Golden Gate Reservoir would be formed by a 76-foot high, earthfill dam; this dam site is also a component of the Sites/Colusa Reservoir, a CALFED storage option. The estimated average annual runoff at the Golden Gate Dam site is 8.6 taf and the construction cost estimate for the dam and reservoir is $2.5 million. According to DWR, these reservoirs proposed by the Colusa Basin Drainage District are too small to provide enough carryover storage to significantly increase local drought year water supply reliability.

Potential Impacts. Much of the present supply for agricultural water users in the Colusa Basin comes from return flows from CVP water contractors. These irrigation return flows have become an increasingly unreliable supply for Colusa Basin Drain diverters as a result of increased water conservation measures by upstream water users. To the extent that changes in cropping patterns, greater irrigation efficiency, or reduction in irrigated acreage may result from the project, this may result in further reductions in groundwater recharge and return flows from lands served by the Sacramento River Division.

Lower Stony Creek Watershed Management. Reclamation, under a SWRCB permit condition, developed a Task Force and Technical Team to develop a fish, wildlife, and water use management plan for lower Stony Creek. This Plan was prepared in 1998 (Reclamation, 1998).

Glenn County received funding in 2000 for forming a landowner group to discuss problems along lower Stony Creek and to recommend land management practices to address them. Glenn County is seeking funding to continue planning a lower Stony Creek watershed restoration program to address the recommendations and findings from both the Plan and from the landowner group. (UC Davis 2000)

Potential Impacts. With reduction in irrigation as a result of changes in pricing incentives, some land may be converted to range, dryland agriculture, or may be fallowed. Cultivated soils typically lose some of the structure and profile characteristics that resist erosion in natural soils. It may take years for vegetative cover to become established on land that has previously supported only a limited range of crop plant types, and during the conversion period, the land may be more susceptible to wind erosion in the dry season, and to erosion by storm runoff in the wet season. The result could be a loss of soil and gullying. Agriculture provides an economic incentive to manage the land and prevent erosion, which may be abruptly reduced when the land is

no longer as productive. Watershed restoration efforts would help to reduce these impacts.

Tehama County Groundwater Management Planning. In 1992, the Tehama County Board of Supervisors amended its county code to enact urgency ordinances prohibiting groundwater mining within the county and extraction of groundwater for export without a permit from the board. In 1996, the Tehama County Flood Control and Water Conservation District adopted a resolution of intent to develop a countywide AB 3030 plan and prepared a draft plan to serve as the basis for developing agreements with groundwater users.

Potential Impacts. Groundwater management would probably reduce the potential for long-term groundwater impacts associated with potential shifts to either greater reliance on groundwater or reductions in groundwater recharge that may be associated with long-term contract renewal alternatives.

Glenn County Groundwater Management Planning. Glenn County enacted a groundwater ordinance in 1977. This ordinance required a permit to export groundwater outside the county. A permit can be issued only if it is found that export will not result in overdraft, adverse impacts to water levels, or water quality degradation. The Board of Supervisors may impose permit conditions.

Potential Impacts. Groundwater management would probably reduce the potential for long-term groundwater impacts associated with potential shifts in reliance on groundwater or reductions in groundwater recharge that may be associated with long-term contract renewal alternatives.

Sites Reservoir Offstream Storage Project. In August 2000, the Glenn-Colusa Irrigation District and the Tehama-Colusa Canal Authority entered into a joint planning Memorandum of Understanding (MOU) with other Calfed agencies to proceed with the review and planning of the Sites Reservoir (Calfed 2000). The MOU set August 2004 as the deadline for completing all environmental documentation of the project.

The proposed location of Sites Reservoir is about 10 miles west of Maxwell, in the Antelope Valley, and is two to three miles west of the TCC. Sites Reservoir is proposed to be filled primarily by pumped diversions from the Sacramento River during peak flow periods in winter months. To minimize potential impacts of existing diversions on Sacramento River fisheries, Sites would release water back into valley conveyance systems (such as the Glenn -Colusa Irrigation District Canal and TCC) in exchange for water that would otherwise have been diverted from the Sacramento River. This undiverted summer water could become available for other downstream uses in the Bay-Delta (NCA 2001), relieving demand for instream environmental uses that might otherwise have to be made up by reductions in deliveries of contract water. The proposed reservoir would have a capacity of 1.9 million acre-feet or more (NCA 2001; DWR 1998b). A Feasibility Study is under preparation to evaluate various project options.

As a related project, Calfed is considering enlargement of the TCC between the Red Bluff Diversion Dam and Funks Reservoir (Calfed 1997a). Calfed has also considered increasing the capacity of the TCC from Funks Reservoir to Bird Creek in Yolo County, and extending the canal to a proposed conveyance facility in an enlarged Lake Berryessa, in Yolo County (Calfed 1997b).

***Potential Impacts**:* The MOU of August 2000 states that "specific allocations of water to meet project purposes, including those allocations necessary to meet the needs of local interests," will be addressed in future planning agreements. Thus, the water supply benefits of the proposed Sites Reservoir project to local water users have not yet been quantified. The proposed project is expected to make more water available during average and dry years to local municipal and agricultural water users, as well as making increasing water supplies available in other parts of the state. The project could also provide local flood control benefits. The project would inundate Antelope Valley, eliminating existing demand for water there. However, this is not expected to have a significant impact on water resources, since no project water is currently delivered to Antelope Valley.

Storage of water in the proposed Sites Reservoir could adversely impact its chemical composition. Minerals, organic matter, and human-introduced contaminants present in Antelope Valley rock and soils could dissolve in or be mobilized by the stored water and would then be released during average or dry years when this water would potentially represent a large proportion of the water delivered to local water users. Future studies will further identify the potential for these impacts. However, at this stage of the planning process, the impacts are not expected to be significant because the resultant concentrations of dissolved minerals are expected to be small, and the delivered water would be required to meet primary drinking water standards.

3.4 LAND USE

3.4.1 Affected Environment

Agricultural Land Use

Introduction

The affected environment discussion for agricultural resources includes farmland classifications and agricultural land use. Although the potential impact on agricultural land use would be limited to the Sacramento River Division contractors, this discussion addresses all of Tehama, Colusa, Glenn, and Yolo counties because the economic effects resulting from impacts to agriculture would extend throughout the region.

Farmland Classifications

Important Farmland Map Categories. The Natural Resource Conservation Service (NRCS) is responsible for maintaining an inventory of the nation's farmlands. In order to map these lands, the NRCS designates four basic types of important farmland: prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance. Prime farmland and farmland of statewide importance may be used for crops, pasture, range, forestry, or other uses but may not be used for urban or water uses. The California Department of Conservation Farmland Mapping and Monitoring Program provides biennial mapping of California's important farmlands.

Prime farmland is available land best suited for producing food, feed, forage, fiber, and oilseed crops. Prime farmland has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops when treated and managed (including water management) according to current farming methods.

Farmland of statewide importance is land other than prime farmland that has a good combination of physical and chemical characteristics for producing crops. These lands differ from prime farmland in that they may have minor shortcomings, such as greater slope or less ability to store soil moisture.

Unique farmland does not meet the criteria for prime farmland or farmland of statewide importance but is used for producing specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to modern farming methods. Examples of such crops are citrus, olives, avocados, rice, grapes, and cut flowers.

Farmland of local importance is land other than prime, statewide, or unique that is producing crops or that has the capability of producing crops and may be important to the local economy. These lands are identified by a local committee made up of concerned agencies that review the lands under this category at least every five years.

Interim Farmland Map Categories. Interim farmland maps are prepared for specific agricultural counties lacking modern soil surveys; this includes Colusa County. The

farmland categories used do not depend on modern soil survey information. Two categories of interim farmland are mapped in lieu of the important farmland categories—irrigated farmland and nonirrigated farmland. Irrigated farmland is cropped land with a developed irrigation water supply that is dependable and of adequate quality. Nonirrigated farmland is land on which agricultural commodities are produced on a continuing or cyclic basis using stored soil moisture.

Farmland Protection Act. The Farmland Protection Act (Pub. L. 97-98) of 1981 requires all federal agencies to consider the effect of programs on farmland. Federal agencies are required to develop criteria to evaluate the effect of federal programs on the conversion of agricultural lands to nonagricultural uses. Federal agencies must, to the extent practicable, consider alternatives or mitigation that lessen the impact on farmland conversion.

Williamson Act. The California Land Conservation Act of 1965 (Williamson Act) established a voluntary tax incentive program for preserving agricultural and open space land. To be eligible for the Williamson Act program, land must be within a county-designated agricultural preserve. Lands under Williamson Act contracts are restricted to agricultural use, and the property owner is taxed according to the income that the land is capable of generating in agriculture. Williamson Act contracts extend for ten years and are automatically renewed unless a notice of nonrenewal is issued or an application for cancellation of the contract is approved. Cancellation of the contract requires that the purpose be consistent with the Williamson Act or that it be in the public interest.

County Land Use Designations

Tehama County. Unincorporated lands in Tehama County are composed primarily of non-urban land uses. The Tehama County General Plan functions as the official county policy in the allocation and distribution of different land uses in the unincorporated areas. The land use maps attached to the plan show the spatial or geographic application of the Tehama County General Plan land use policies. According to the Tehama County Planning Area Mapping System for the Central I-5 and South I-5 Areas, the majority of land within the Proberta, Thomes Creek, and Corning water districts is designated as Cropland (10 - 40-acre minimum parcel size). Other land use designations in the vicinity of these districts include General Industrial and General Commercial along portions of the I-5 corridor (Tehama County 1983).

Glenn County. The Glenn County General Plan Land Use Diagram functions as the official county policy in the allocation and distribution of different land uses in the unincorporated areas. According to the Glenn County General Plan Land Use Diagram, most land within the Orland-Artois, Glide, and Kanawha water districts is designated as Intensive Agriculture (40-acre minimum). The 4-E and Stony Creek water districts and the US Forest Service, Whitney Construction, and Stonyford contractors, are designated Foothill Agriculture/Forestry, which is used to preserve foothill areas of the county by providing for areas of intensive and extensive agricultural uses.

The Intensive Agriculture classification is used to identify areas suitable for commercial agriculture, which provide a major segment of the county's economic base. Additional objectives of this land use designation are to protect the agricultural community from encroachment of unrelated land uses, which, by their nature, would be injurious to the physical and economic well-being of the agricultural community, to accommodate lands under Williamson Act contracts, and to encourage preservation of agricultural land that contains state-designated Important Farmlands or Locally Significant Farmlands. Examples of permitted uses considered appropriate under this classification include, but are not limited to, growing and harvesting field crops, grain and hay crops, growing and harvesting fruit and nut trees, vines and vegetables, pasture and grazing land, and animal raising operations. The minimum parcel size is 40 acres and maximum building intensity is one residential unit per 40 acres (Glenn County 1993b).

Colusa County. Most existing land uses in the applicable Colusa County water districts consist of general agriculture, orchards, and rangeland. The Colusa County Generalized Land Use Plan functions as the official county policy in the allocation and distribution of different land uses in the unincorporated areas. According to the Colusa County Generalized Land Use Plan, most of land within the Four-M, Glenn Valley, Holthouse, LaGrande, Cortina, Westside, Colusa County, and Davis water districts and the Myers March Mutual Water Company are designated agriculture-general (A-G) or agriculture-upland (A-U).

The A-G designation is generally used for orchard and crop production. Residences in these areas are related to agricultural operations. County-wide, residential densities in A-G areas average one family per 100 to 400 acres. However, densities are considerably higher in the orchard areas near Arbuckle and Williams and along the Sacramento River. The A-G areas presently are zoned as Exclusive Agriculture and are subject to 10-acre minimum lot size requirements. The A-G designation has been applied to 419,000 acres in Colusa County, encompassing most of the Sacramento valley floor; this represents a little over half (57 percent) of the county's total land area (Colusa County 1989).

Lands designated A-U are used for cattle and sheep grazing, and are intermixed with undeveloped, uninhabited forests, chaparral, and grasslands. Soils are generally fair to poor and are not conducive to crop production. Residential densities presently average less than one family per 1,000 acres. The A-U designation has been applied to 183,000 acres in Colusa County, encompassing most of the Coast Range foothills; this represents about a quarter of the county's total land area (Colusa County 1989).

Yolo County. The Yolo County General Plan functions as the official county policy in the allocation and distribution of different land uses in the unincorporated areas. The general plan integrates a number of community area plans, including the Dunnigan Area General Plan, which includes portions of the Dunnigan Water District in northern Yolo County (Yolo County 1981). According to the Dunnigan Vicinity General Plan Map of the County of Yolo (Yolo County 2000), most of land within the Colusa County Water District (far southern portions) and the Dunnigan Water District is designated either Agriculture General (A-G) or Agriculture Exclusive (A-E). The A-G designation is

suitable for those parcels of land in agricultural production but not under the protection of the Williamson Act. The A-E designation indicates areas under Williamson Act contract provisions (Yolo County 1981).

County Agricultural Land Use Patterns

Tehama County. In 1998, there were approximately 952,500 acres of agricultural land in Tehama County, slightly decreased from approximately 953,150 acres in 1992. In 1998, there were approximately 77,600 acres of prime farmland, 19,400 acres of farmland of statewide importance, 19,500 acres of unique farmland, 129,700 acres of farmland of local importance, and 706,300 acres of grazing land. The total amount of irrigated farmland (defined as prime farmland, farmland of statewide importance, and unique farmland) slightly increased during this period, from approximately 116,400 acres to 116,500 acres (California Department of Conservation 2000b).

According to the Department of Conservation, approximately 113 acres of farmland in Tehama County were taken out of cultivation between 1996 and 1998. Of that total, 20 acres (17.7 percent) were converted to urban use. Land taken out of cultivation but not urbanized can be farmed in the future (California Department of Conservation 2000b). Additionally, 5,065 acres of farmland in Tehama County were committed to nonagricultural use. Typically, this is fallowed, wooded, or range land undergoing sanitary sewer installation or land for which bonds or assessments have been issued for public utilities.

Glenn County. In 1998, there were approximately 584,450 acres of agricultural land in Glenn County, slightly decreased from approximately 586,200 acres in 1992. In 1998, there were approximately 168,450 acres of prime farmland, 88,600 acres of farmland of statewide importance, 11,100 acres of unique farmland, 140,000 acres of farmland of local importance, and 176,300 acres of grazing land. The total amount of irrigated farmland (defined as prime farmland, farmland of statewide importance, and unique farmland) also decreased about 3 percent during this six-year period, from approximately 276,000 acres to 268,150 acres (California Department of Conservation 2000b).

According to the Department of Conservation, approximately 775 acres of farmland in Glenn County were taken out of cultivation between 1996 and 1998. Of that total, 53 acres (6.8 percent) were converted to urban use. Land taken out of cultivation but not urbanized can be farmed in the future (California Department of Conservation 2000b). Additionally, 2,450 acres of farmland in Glenn County were committed to nonagricultural use. Typically, this is fallowed land on the outskirts of communities that is undergoing sanitary sewer installation or land for which bonds or assessments have been issued for public utilities.

Colusa County. In 1998, there were approximately 575,400 acres of agricultural land in Colusa County, slightly decreased from approximately 577,000 acres in 1992. In 1998, there were approximately 329,000 acres of irrigated farmland, 11,500 acres of nonirrigated farmland, and 234,900 acres of grazing land. The total amount of irrigated

farmland decreased only slightly from the 1992 total of 329,750. According to the Department of Conservation, approximately 440 acres of farmland in Colusa County were put into cultivation between 1996 and 1998.

Yolo County. In 1998, there was approximately 557,000 acres of agricultural land in Yolo County, slightly decreased from approximately 565,200 acres in 1992. In 1998, there were approximately 265,900 acres of prime farmland, 18,200 acres of farmland of statewide importance, 55,250 acres of unique farmland, 74,300 acres of farmland of local importance, and 143,350 acres of grazing land. The total amount of irrigated farmland (defined as prime farmland, farmland of statewide importance, and unique farmland) also decreased during this period, from approximately 351,100 acres to 339,350 acres (California Department of Conservation 2000b).

According to the Department of Conservation, approximately 7,105 acres of farmland in Yolo County were taken out of cultivation between 1996 and 1998. Of that total, 1,042 acres (14.6 percent) were converted to urban use. Land taken out of cultivation but not urbanized can be farmed in the future (California Department of Conservation 2000b). Additionally, 2,400 acres of farmland in Yolo County were committed to nonagricultural use. Typically, this is land undergoing sanitary sewer installation or land for which bonds or assessments have been issued for public utilities.

Yolo County ranks second of all California counties in tomato and safflower production. Farmland in Yolo County is expected to face continuing development pressure. The California Department of Finance projects that the population of Yolo County will grow from 172,500 in July 2000 to 262,400 in July 2020. The Farmland Mapping and Monitoring Program survey found that land conversion in Yolo County was occurring in the following areas: warehouse and industrial complexes along I-5 in eastern Woodland, large houses near the municipal golf course and the "Wildhorse" community in Davis, including an 18-hole golf course on a former orchard, new houses along I-505 in Winters, and warehousing on prime land west of I-80 and south of the California Highway Patrol Academy in West Sacramento (California Department of Conservation 2000a).

Agricultural Land Use for the TCC and Corning Canal Contractors

Table 3.2-2 in Section 3.2, Agricultural Economics, characterizes the cropping patterns in each of the potentially affected water districts as reported to the Bureau of Reclamation in 1996. The table reveals a fairly wide range of cropping patterns within and between districts. As stated in Section 3.2, while many districts have a proportionally large share of their lands receiving CVP contract water in vegetable and fruit and nut crops, a number of districts are planted predominantly to cereal and forage crops such as wheat, rice, and sugar beets.

Municipal and Industrial Land Use

No major M&I contractors are part of the Sacramento River Division contractors; however, Colusa County, Corning, Dunnigan,, Stony Creek, Stonyford, the US Forest

Service, and Whitney Construction west of the TCC receive minor amounts of CVP water for M&I use.

3.4.2 Environmental Consequences

Impacts to land use depend primarily on changes that may affect agricultural productivity and conflict with applicable land use plans of the county where the districts are located.

No Action Alternative

Under the No Action Alternative, total irrigated acreage within the service area is projected to be approximately 95,300 acres in 2030 under average hydrologic conditions. The largest single crop type would be deciduous orchards (29,833 acres), followed by rice (10,683 acres) and alfalfa (10,451 acres).

Alternative 1

Alternative 1 is assumed to have similar agricultural land use patterns as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Alternative 2

Implementing Alternative 2 would not have a direct effect on land uses for the Sacramento River Division contractors. Renewing long-term water contracts under Alternative 2 would not involve constructing facilities that would alter current land uses nor would it involve installing structures that would conflict with existing land use plans.

Under Alternative 2, of the approximately 95,300 acres of irrigated land within the service area directly affected by long-term CVP contract renewal, about 65,000 acres or approximately 68 percent is projected to be fallowed in an average hydrologic year following five dry hydrologic years (see Section 3.2, Agricultural Economics). This represents an indirect substantial land use change compared to the No Action Alternative.

3.4.3 Cumulative Impacts

Implementation of Alternatives 1 or 2 would not contribute significantly to cumulative impacts to land use.

3.5 BIOLOGICAL RESOURCES

The Sacramento River Division includes 18 water contractors served primarily by the Corning and Tehama-Colusa Canals in Tehama, Glenn, Colusa, and Yolo counties (Corning Canal and Tehama-Colusa Canal Units). The majority of these service areas are west of Interstate 5; however, a few service areas straddle the interstate. The Stony Creek Water District in the Black Butte Unit is located in Glenn County.

3.5.1 Affected Environment

Vegetation/Habitat

Figures 3.5-1, 3.5-2, and 3.5-3 show the service area boundaries overlaid on the habitat and vegetation cover maps created by the California GAP Analysis Program. Table 3.5-1 gives acreages of these habitat types within each district. The agricultural acres may not correspond exactly with the total irrigated acreage data provided in the most recent water needs assessments submitted to Reclamation.

The contractors within the Sacramento River Division project area primarily use the contract water for agricultural irrigation. In fact, the majority of the land within and surrounding the service areas in the Sacramento Valley floor is classified as agricultural land and nonnative grassland. Pockets of riparian areas, coastal/valley freshwater marsh, permanently flooded lacustrine, and blue and valley oak woodland punctuate the project area. The following descriptions of these habitat types have been prepared from the CVPIA PEIS.

Agricultural

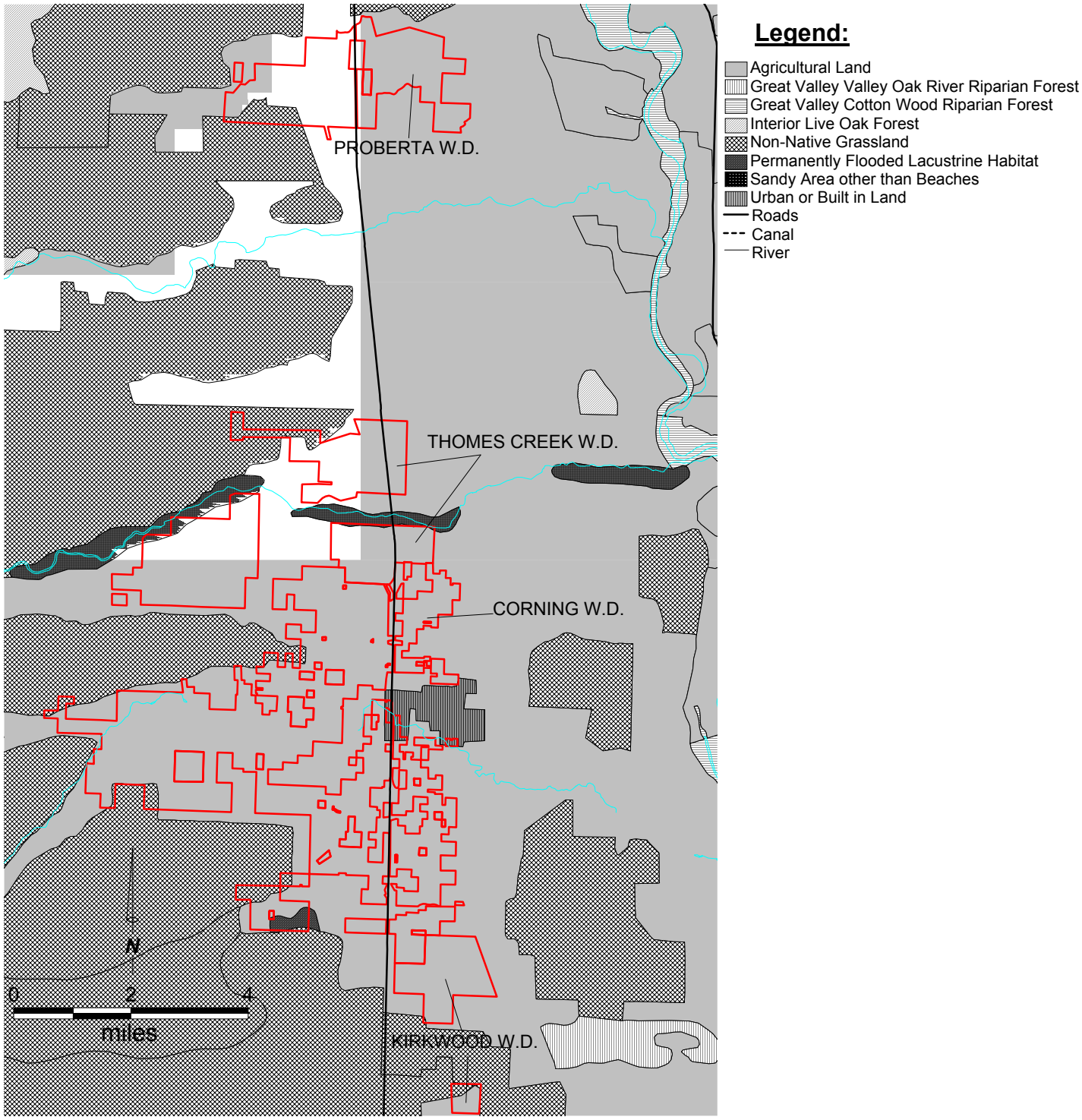
Agricultural production in the project area consists of row crops, pasture, grains, rice, orchards and vineyards. Representative acres of crop types in each service area for 1999 are shown in Table 3.5-1.

Orchard-Vineyard

Orchards of fruit or nut-bearing trees and grape vines are planted in a uniform pattern with little understory and are intensively managed. Wildlife species associated with vineyards include the deer mouse *(Peromyscus maniculatus),* mourning dove *(Zenaida macroura),* and black-tailed hare *(Lepus californicus).* American crows *(Corvus brachyrhynchos),* western scrub jay *(Aphelocoma californica),* northern flicker *(Colaptes auratus),* Lewis' woodpecker *(Melanerpes lewis),* and California ground squirrel *(Spermophilus beecheyi)* feed on the nut crops. The fruit crops from orchards provide additional food for yellow-billed magpies *(Pica nuttalli),* American robin *(Turdus migratorious),* northern mockingbird *(Mimus polyglottos),* black-headed grosbeak *(Pheucticus melanocephalus),* gray squirrel *(Sciurus caroliniensis),* raccoon *(Procyon lotor),* and mule deer *(Odocoileus hemionus).*

Row Crops

Row crops in the project area include crops such as tomatoes, beans, and sugar beets. While intensive management and the use of chemicals to control pests limit the use of row crops by wildlife, rodent species such as California vole *(Microtus Californicus),* deer



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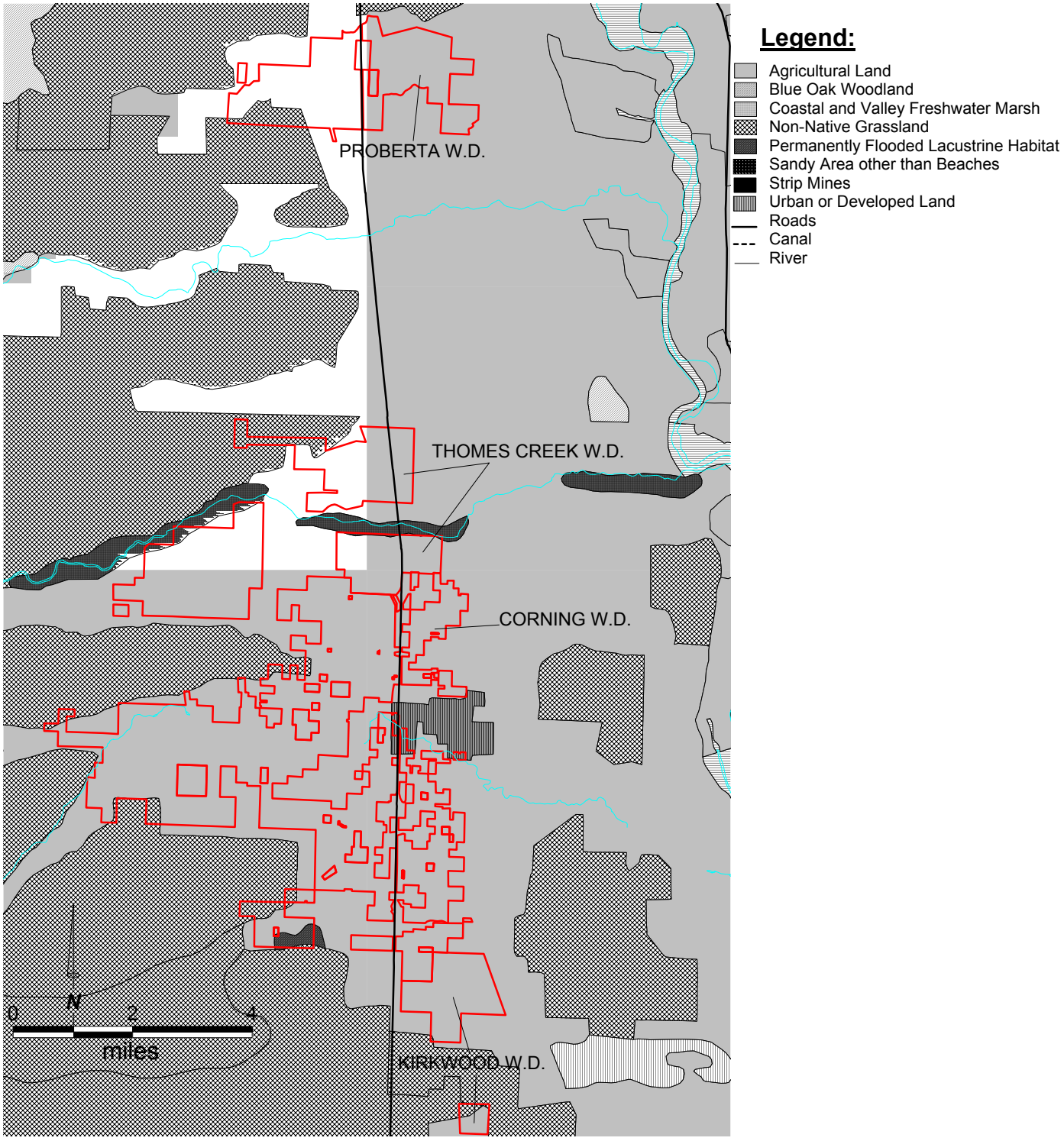
Included in this area are the Corning Canal water contractors (Proberta WD, Thomes Creek WD, and Corning WD).

Vegetative Habitat - Tehama County Area of Potential Effect

Tehama, Glenn, Colusa, and Yolo Counties, California

Figure 3.5-1



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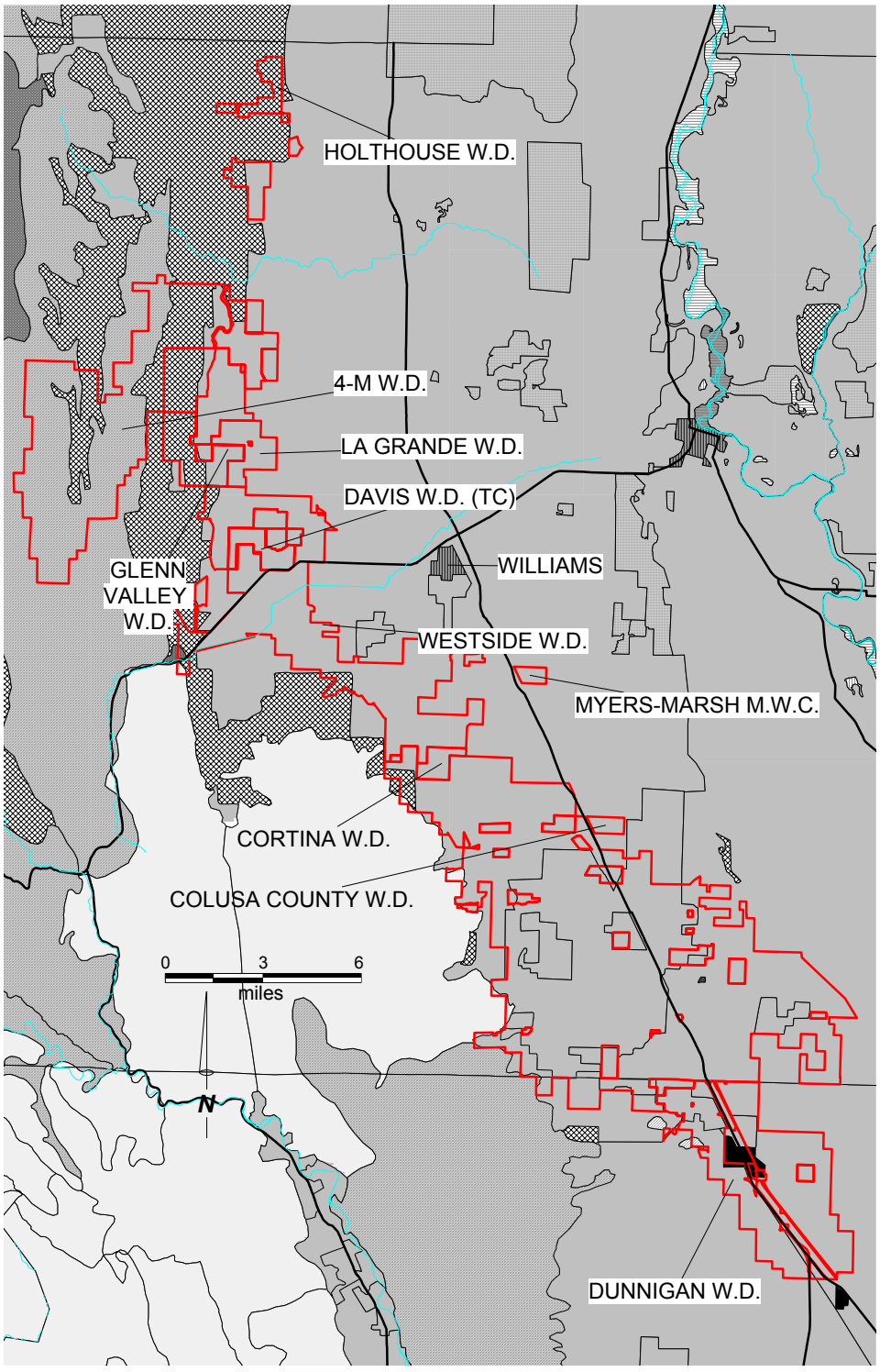
Included in this area are the northen Tehama-Colusa Canal water contractors (Orland-Artois WD, Glide WD, Kanawha WD). Although various contractors west of the canals (4-E WD, Stoney Creek WD, US Forest Service, Whitney Construction, and Stoneyford).

Vegetative Habitat - Glenn County Area of Potential Effect

Glenn County, California

Figure 3.5-2



Legend:

- Agricultural Land
- Blue Oak Woodland
- Chamise Chaparral
- Coastal and Valley Freshwater
- Eucalyptus
- Foothill Pine-Oak Woodland
- Great Valley Cottonwood Riparian Forest
- Non-Native Grassland
- Permanently Flooded Lacustrine Habitat
- Urban or Developed Land
- Roads
- Canals
- Rivers

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Included in this area are the southern Tehama-Colusa Canal water contractors (Holthouse WD, Glenn Balley WD, 4-M WD, La Grande WD, Davis WD, Westside WD, Meyers Marsh MWC, Cortina WD, Colusa County WD, Dunnigan WD).

Vegetative Habitat - Colusa and Yolo Counties Area of Potential Effect

Colusa and Yolo Counties, California

Figure 3.5-3

Table 3.5-1
Habitat Types in the Service Areas of the Sacramento River Division

	Agriculture	Blue Oak Woodland	Valley Oak Woodland	Foothill Pine/Oak Woodland	Coast Range Mixed Coniferous	Eucalyptus	Chamise Chaparral	Nonnative Grassland	Coastal/Valley Freshwater Marsh	Perm. Flooded Lacustrine	Sandy	Urban	Strip Mines
Tehama-Colusa Canal Unit													
Colusa County WD	45,042	68		386				362		19			
County Of Colusa													
subcontractor 4-M WD	1,800	11,489						4,306					
subcontractor Glenn Valley WD	718							1,261					
subcontractor Holthouse WD	816							1,179					
subcontractor Myers Marsh MWC	1,750												
subcontractor LaGrande WD	1468												
subcontractor Cortina WD	614												
Davis WD	1,017												
Dunnigan WD	7,525		52			206		2,974					
Glide WD	6,098							3,326					
Kanawha WD	15,384							1,150					
Kirkwood WD	1,110							46					
La Grande WD													
Orland-Artois WD	30,388							794	75	0.1			58
Westside WD (1 and 2)	16,344	137		48				1,098					
Corning Canal Unit													
Corning WD	12,318							322		104	100	88	
Proberta WD	2,717							220					
Thomes Creek WD	3,175							195					
Other													
Stony Creek WD		114					0.4						
Stonyford	NA												
Whitney Construction	NA												
USFS Conservation Camp	NA												
4-E WD		0.9		16	1,771								

Note: The habitat acres for each service area were calculated by overlaying service area boundaries on the habitat maps (Figures 3.5-1, 3.5-2, 3.5-3) generated from the California Gap Analysis Program data. NA means data not available.

mouse, and California ground squirrel forage in row crops. These rodent populations are preyed on by Swainson's hawks *(Buteo Swainsoni),* red-tailed hawks *(B. jamaicensis),* and black-shouldered kites *(Eulanus leucurus majuslus).*

Grain

Grains crops such as barley, wheat, corn, and oats are planted in the fall and harvested in the spring. Although intensive management and use of chemicals to control pests and diseases reduces the value of grain crops to wildlife, the young green shoots of these crops provide important foraging opportunities for such species as greater white fronted geese *(Anser albifrons),* tundra swans *(Cygnus columbianus),* and wild pigs *(Sus scrofa).* Other species, including red-winged blackbirds *(Agelaius phoeniceus),* Brewer's blackbirds *(Euphagus cyanocephalus),* ring-necked pheasants *(Phasianus colchicus),* various waterfowl, and

western harvest mice *(Reithrodontomys megalotis)* feed on the seeds produced by these plants.

Rice

Cultivated rice in the Central Valley has some of the attributes found in seasonal wetlands; however, the intensive management of this habitat reduces many of the benefits found in pristine wetlands. Flooded rice fields provide nesting and foraging habitat for waterfowl and shorebirds. The grain produced by this crop provides important forage for many wildlife species. After harvest, waste grain is fed upon by waterfowl (e.g., mallards *[Anas platyrhynchos]* and Canada geese *[Branta canadensis]*), sandhill cranes *(Grus canadensis),* California voles, and deer mice. Raptors, including northern harriers (*Circus cyaneus*), black-shouldered kites, and ferruginous hawks *(Buteo regalis)* feed upon rodents in this habitat. Irrigation ditches used to flood rice fields often contain dense cattail vegetation. These ditches provide habitat for wildlife species, such as the Virginia rail *(Ralius limicola),* American bittern *(Botaurus lentiginosus),* snowy egret *(Egretta thula),* marsh wren *(Cistothorus palustris),* common yellowthroat *(Geothlypis trichas),* and the song sparrow *(Melospiza melodia).*

Grassland

Grassland communities once occupied vast portions of the Central Valley region. Historically, the grasslands consisted of perennial bunch grass species such as needle grass, bunch or blue grass and three-awn *(Stipa pulchra, S. cernua, Poa scalbrella,* and *Aristida divaricata,* respectively). However, agricultural cultivation and livestock grazing introduced annual grasses, which have largely eliminated the native perennial grasslands. Annual grasses found in grassland vegetation include wild oat *(Avena fatua),* soft chess *(Bromus hordeaceous),* ripgut grass *(B. diandrus),* medusa head *(Taeniatherum caput-medusae),* wild barley *(Hordeum spontaneum),* red brome *(Bromus madritensis* ssp. *rubens),* and slender fescue *(Festuca rubra trichophylla).* Forbs commonly encountered in grassland vegetation include long-beaked filaree (*Erodium botrys*), redstem filaree *(Erodium cicutarium),* dove weed *(Eremocarpus setigerus),* clovers (*Trifolium* spp.), Mariposa lilies *(Calochortus nuttallii),* popcornflower *(Plagiobothrys kingii),* and California poppy *(Eschscholzia californica).*

Grassland habitats are important foraging areas for black-shouldered kite, red-tailed hawk *(Buteo jamaicensis),* Swainson's hawk, northern harrier, American kestrel *(Falco sparverius),* yellow-billed magpie, loggerhead shrike *(Lanius ludovicianus),* savannah sparrow *(Passerculus sandwichensis),* American pipit *(Anthus rubescens),* mourning dove, Brewer's blackbird, red-winged blackbird, and a variety of swallows (Family *Hirundinidae*). Birds such as killdeer *(Charadrius vociferus),* ring-necked pheasant, western kingbird *(Tyrannus verticalis),* western meadowlark *(Sturnella neglecta),* and horned lark *(Eremophilia alpestris)* nest in grassland habitats. Grasslands also provide important foraging habitat for the coyote *(Canis latrans)* and badger *(Taxidea taxus)* because this habitat supports large populations of small prey species, such as the deer mouse, California vole, pocket gopher *(Thomomys* ssp.*),* and California ground squirrel. Common reptiles and amphibians of grassland habitats include western fence lizard *(Sceloporus occidentalis),* common kingsnake *(Lampropeltis getula),* western rattlesnake *(Crotalus viridis),* gopher

snake *(Pituophis catenifer),* common garter snake *(Thamnophis sirtalis),* western toad *(Bufo boreas),* and western spadefoot toad *(Scaphiopus hammondii).*

Nonnative Grassland

Nonnative grasslands border the western-most boundaries of the districts (Figures 3.5-1, 3.5-2, 3.5-3) and occur in significant portions of Glide, 4-M, Glenn Valley, and Holthouse water districts. Smaller portions of Colusa County, Westside, Kanawha, Orland-Artois, Corning, Thomes Creek, and Proberta water districts include nonnative grasslands. Typically these areas of nonnative grasslands are grazed or are or have been cultivated for grain crops. In some cases, for example 4-M Water District, the nonnative grassland areas are too steep for cultivation and have predominantly served only as lands for grazing use.

Native Valley Needlegrass Grassland

A pocket of native valley needlegrass grassland is located in Colusa County along Salt Creek 10 miles west of Williams bounded by Rt. 20, Tehama Colusa Canal, and Leesville Road/Walnut Drive (Colusa County 1989). Figure 3.5-3 indicates that a portion of this valley needlegrass grassland is located in the western-most portion of Westside Water District. However, the Westside Water District has recently completed the legal process for detaching that portion of the District as well as other small parcels (Personal Communication, Lisa Weber, Westside Water District, September 20, 2000). Hence, the native valley needlegrass grassland is now outside the Westside Water District.

This community is dominated by the tussock-forming purple needlegrass *(Nassella pulchra);* naturalized annual forbs and grasses are also common. Valley needlegrass grassland is found on fine-textured soils that receive ample water during winter. This community is much reduced in its historical range, which includes the Sacramento, San Joaquin, and Salinas Valleys and the Los Angeles Basin. Valley needlegrass grassland occurs in the Sacramento River and San Joaquin River, Tulare Lake, and Delta regions.

Permanently Flooded Lacustrine Habitat

Lacustrine habitats include wetlands and deepwater habitats that are situated in a topographic depression or a dammed river channel. They tend to lack trees and shrubs, with greater than 30 percent aerial coverage of persistent emergents, emergent mosses or lichens, and typically exceed 8 ha (20 acres). Lacustrine waters may be tidal or nontidal, but ocean derived salinity is always less than 0.5 percent. The Lacustrine System is bounded by upland or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Water in a permanently-flooded lacustrine habitat covers the land surface throughout the year in all years and vegetation is composed of obligate hydrophytes.

Figures 3.5-1, 3.5-2, and 3.5-3 show that both the Corning and Colusa County water districts contain permanently-flooded lacustrine habitat. The portion in Colusa County Water District is located east of Interstate 5 and north of Petroleum Creek and covers 19 acres. However, recent ground truthing by a representative of the Colusa County Water District indicates that permanently flooded habitat does not exist as indicated by

the GAP data shown in Figure 3.5-3 (Emrick 2000). The portion in Corning Water District encompasses 104 acres and is located in the southern most tip of the district to the west of Interstate 5.

Coastal and Valley Freshwater Marsh

This wetland community occurs on sites permanently flooded with slow-moving freshwater, where deep, peaty soils tend to accumulate. It is dominated by densely spaced perennial, emergent grass-like plants. Bulrushes *(Scirpus* ssp.*)* and cattails *(Typha latifolia)* dominate individually or together and may be supplemented with verbena *(Salvia verbenacea),* smartweed *(Polygonum* spp.*),* rose mallow (also known as California hibiscus, *Hibiscus lasiocarpus*) as well as some rush *(Juncus* ssp.*)* and sedge *(Scirpus* ssp.*)* species. Coastal and valley freshwater marsh is common in the Sacramento Valley in floodplain areas such as river oxbows. It also occurs along the fringes of perennially flooded drainage ditches, canals, ponds, and lakes and in coastal valleys near river mouths. This community is found in the Sacramento River, San Joaquin River, Tulare Lake, and Delta regions.

Freshwater marshes of the Central Valley provide important habitat for waterfowl and a variety of other bird species, including grebes (Family *Podicipedidae*), herons (family *Addenda*), egrets *(Egretta* ssp.*),* bitterns (family *Ardeidae*), coots *(Fulica* ssp.*),* rails (family *Rallidae*), as well as various shorebirds, and hawk and owl species. Other wildlife which may occur are the muskrat *(Ondatra zibethicus),* raccoon, opossum *(Didelphis virginiana),* and beaver *(Castor canadensis).* Many other upland species such as ring-necked pheasant, California quail *(Callipepla californica),* black-tailed hare, and desert cottontail *(Sylvilagus audubonii)* take cover and forage at the margins of wetland habitats. Many reptiles and amphibians such as common garter snake, aquatic garter snake *(Thamnophis couchi),* Pacific treefrog *(Hyla Regilla),* and bullfrog *(Rana cateshiana)* also breed and feed in freshwater habitats of the region.

The Orland-Artois Water District contains 75 acres of coastal and valley freshwater marsh.

Vernal Pools

Vernal pools found in small depressions with an underlying impermeable layer are isolated wetlands within grassland vegetation. Vernal pools develop in shallow basins that form in flat-to-hummocky terrain. Soil durapans underlying the basins prevent water infiltration and the nearly level terrain inhibits surface runoff. Saturated soil conditions cause the water table to become exposed because it is "perched" on the durapan. Hence, surface water accumulates in the basins, forming a seasonal wetland.

Vernal pools are important communities because of their current scarcity. Vernal pools support an ephemeral (part of the year) flora dominated by terrestrial annual species, with perennial (year-round) and aquatic species often contributing significant cover. Vernal pool species flower throughout the spring, resulting in conspicuous zonation patterns formed by consecutively blooming species around drying pool margins. Characteristic dominant plants include popcornflower, low barley *(Hordeum depressum),*

Genus *downingia* species, coyote-thistle *(Cirsium occidentale* var. *californicum),* goldfield *(Lasthenia chrysostoma),* meadowfoam *(Limnanthes floccosa* ssp. *floccosa),* owl's clover *(Castilleja* ssp.*),* mint plants *(Pogogyne* ssp.*),* woolly marbles *(Psilocarphus* ssp.*),* and various *Navarretia* species.

Although vernal pools are an ephemeral aquatic habitat, invertebrates and amphibians also have adapted to this resource. When standing water is available, California tiger salamanders *(Ambystoma californiense),* western spadefoot toads, and Pacific treefrogs may use the pools for egg-laying and for the development of young. Aquatic invertebrates, such as giant fairy shrimp *(Branchinecta gigas),* tadpole shrimp *(Lepidurus packardi),* clam shrimp *(Eocyzicus spp,),* water flea *(Cladoceran* spp.*),* copepods *(Copepoda* spp.*),* and crawling water beetles *(Brychius hungerfordi),* may also inhabit vernal pools. In winter and spring, water birds such as mallards, cinnamon teal *(Anas cyanoptera),* killdeer, California gulls *(Larus californicus),* green-backed herons *(Butorides striatus),* great blue herons *(Ardea herodias),* and great egrets *(Casmerodius albus)* may use vernal pools for resting and foraging grounds. Western kingbirds *(Tyrannus verticalis),* black phoebes *(Sayornis nigricans),* and Say's phoebes *(Sayornis saya)* feed on flying insects above vernal pools.

Since both nonnative and native grassland habitat occur within some of the water districts in the project area, vernal pools may exist. Those acres of nonnative grassland that have been cultivated in the past or are presently cultivated are less likely to support vernal pools. However, nonnative grassland areas that are not cultivated or are predominantly used for grazing, such as those in the 4-M Water District, may support vernal pools. In fact, many vernal pool-dependent species can coexist with grazing on these grasslands. Large acreages of nonnative grassland also are found in the Dunnigan and Glide Water Districts, as indicated in Table 3.5-1.

Valley Foothill Hardwood

The hardwood vegetation within and surrounding the project area consists of three types of oak woodland, which occur at increasing elevation respectively: valley oak woodland, blue oak woodland, and foothill pine and oak woodland.

Valley Oak Woodland

Valley oak woodland occurs at low elevations. The density of valley oaks ranges from open canopy to a more forest-like closed canopy. While valley oaks *(Quercus alba)* dominate, other trees such as western sycamore *(Platanus racemosa),* interior live oak *(Quercus fusiformis),* northern California black walnut *(Juglans hindsii),* box elder *(Acer negundo),* and blue oak *(Quercus douglasii)* may be present. The understory is predominantly comprised of grasses and forbs; however, shrubs, such as poison oak *(Rhus quercifolia),* California coffeeberry *(Rhamnus californica),* blue elderberry *(Sambucus caerulea),* and blackberries *(Rubus ursinus),* may be found.

The Stony Creek and 4-E water districts and the town of Stonyford contain valley oak woodland within their boundaries.

Blue Oak Woodland

Blue oak woodland typically occurs at higher elevations than valley oak woodland. The blue oaks provide an open canopy and are associated with other tree species such as interior live oak and foothill pine. The understory is predominantly annual grasses and forbs such as filarees *(Erodium* ssp.*),* brome grasses *(Bromus* ssp.*),* wild oat, and fiddlenecks *(Amsinckia* spp.*);* however, perennial grasses such as needlegrasses and melic grasses may also occur. Shrubs species such as California coffeeberry, buck brush *(Ceanothus cuneatus),* poison oak , California buckeye *(Aesculus californica),* western redbud *(Cercis occidentalis),* and manzanita *(Arctostaphylos* ssp.*)* may be found.

A significant portion of the 4-M Water District is comprised of blue oak woodland.

Foothill Pine and Oak Woodland

At higher elevations, foothill pine begins to intermix with oak species. When blue oak forms the majority of the overstory, the understory is comprised of grasses and forbs. At increasing elevations, live oak replaces blue oak and shrubs such as red root *(Ceanothus* spp.*),* manzanita, spiny redberry *(Rhamnus crocea),* and western redbud occur in the understory

The Colusa County, Westside, and 4-E water districts contain foothill pine and oak woodland.

Riparian

Riparian habitat in the project area exists along ephemeral streams that pass through the district boundaries. The most significant riparian forest in the region exists along the Sacramento River. Figure 3.5-3 does not show major riparian forest areas within the project area; however, the Dunnigan Area General Plan indicates that riparian habitat exists along Dunnigan and Buckeye Creeks (Yolo County 1981).

Wildlife

The Sacramento River Valley region supports a wide variety of wildlife species. The valley provides the most important wintering habitat for the millions of waterfowl that migrate along the Pacific Flyway. In fact, the 53,000 acres within the Sacramento National Wildlife Refuge Complex supports almost half of the valley's migratory birds. The grain crops and flooded rice fields in the project area provide supplementary foraging habitat for migratory waterfowl.

The Sacramento River and significant tributaries support anadromous fish as well as other fisheries. These fisheries resources have been addressed by the CVPIA PEIS and the supporting Draft Programmatic Biological Opinion for Operation of the CVP and Implementation of the CVPIA.

The East Park-Capay Deer *(Odocoileus hemionus columbianus)* herd stretches the length of Colusa County west of Interstate 5. Hence, the herd's range encompasses the contractors in Colusa County (Colusa County 1989).

Special Status Species

Special status species include those listed or proposed for listing by the US Fish and Wildlife Service (Service) or the California Department of Fish and Game (CDFG) as endangered, threatened, or rare, as candidate species for listing, or as species of concern. Wildlife resources listed by the Service and CDFG as potentially occurring in the vicinity of the Sacramento River Division include invertebrates, fish, reptiles, amphibians, birds, and mammals (including bats). Plants listed or proposed to be listed by the California Native Plant Society (CNPS) as rare or endangered are also included. Special status species are provided varying levels of legal protection under federal and state endangered species acts.

The Service identified the following species as potentially occurring in or near the region of influence (ROI), and Reclamation updated the list by service area and added critical habitat information in 2004. The updated lists by service area were provided to the Service in March 2004. Special status species potentially occurring in the project area are listed in the table in Appendix C. The list was created from a search of the California Natural Diversity Database for the USGS 7.5-minute quadrangles encompassing the project area and from a list prepared by the Service on September 20, 2000, for the same quadrangles. This comprehensive list was compiled using data collected from the California Natural Diversity Database (CNDDB), the Service, and the Point Reyes Bird Observatory.

Special status plant, invertebrate, amphibian, reptile, fish, bird, and mammal species are known to occur in these quadrangles, which encompass a broader area than the project boundaries. Given the wide geographic scope of the project area, many of the habitats suitable for these species occur in the project area. Consequently, 72 species have the potential to occur in the project area. The table in Appendix C indicates the habitat types found within the project area (as shown in Figures 3.5-1, 3.5-2, 3.5-3) that may potentially provide suitable habitat for these species.

This section provides a summary of the habitat requirements of those species that are either federally or state listed as threatened or endangered and that have the potential to occur in the project area.

3.5.2 Plants

All of the federally listed threatened and endangered plant species in Table C-1 can occur in the ROI, based on habitat requirements. They are described in detail below.

Hoover's Spurge (FT/CNPS 1B)

Hoover's spurge *(Chamaesyce hooveri),* a federally listed species with CNPS 1B status, is an annual herb. It is found most commonly in vernal pools on alluvial fans, ancient river terraces, volcanic mudflow, and clay substrate from 25 to 130 meters (USFWS 2003a; CDFG 2004a). The main threat to this species is habitat degradation resulting from grazing and habitat loss due to conversion of grassland for development (CDFG 2004a). Most of the extant populations are in or near Vina Plains of Tehama and Butte Counties (USFWS 2003a). There are three CNDDB occurrences of this species within the ROI,

all of which are in Logandale USGS 7.5-minute quadrangle, along the Sacramento National Wildlife Refuge.

Palmate-Bracted Bird's-Beak (FE/SE, CNPS 1B)

Palmate-bracted bird's-beak *(Cordylanthus palmatus)* is both federally and California-listed as endangered and has a CNPS 1B status. This California endemic occurs in valley and foothill grassland, chenopod or shadscale scrub, meadow and seep, and wetlands. Agricultural conversion is the primary factor in the decline of palmate-bracted bird's-beak. Urban expansion, changes in the hydrologic regime (seasonal water cycles and movements), road maintenance, and off-road vehicle use are among the numerous factors threatening the remaining populations. This species is known to occur in the Sacramento Valley, Livermore Valley (Alameda County), and San Joaquin Valley. The CNDDB indicates three occurrences within the ROI. One is in the Arbuckle USGS 7.5 quadrangle, at the Colusa National Wildlife Refuge and the other two are in Sacramento National Wildlife Refuge, in the Logandale USGS 7.5-minute quadrangle.

Colusa Grass (FT/SE, CNPS 1B)

Colusa grass *(Neostapfia colusana)* is a federally listed threatened and a California-listed endangered plant, with a CNPS status of 1B. This California endemic is predominantly found on the clay bottom of large or deep vernal pools when the pools are flooded. It also inhabits the alkali banks of intermittent streams common to the Central Valley grassland communities. The remaining 40-plus populations are threatened by the loss or degradation of vernal pool habitat due to overgrazing, agricultural conversion, and flood-control projects. Historically, Colusa grass was abundant in the lowest foothill "gooseland" vernal pools of Colusa and Stanislaus Counties. The present-day distribution of Colusa grass is restricted to scattered vernal pools in Stanislaus and Merced Counties, plus an occurrence in Solano County and another in Yolo County. The CNDDB indicates that one population was observed within the USGS 7.5-minute Logandale quadrangle, but that population has been extirpated. No extant populations are known within the ROI.

Hairy Orcutt Grass (FE/SE, CNPS 1B)

Hairy Orcutt grass *(Orcuttia pilosa)* is both federally and California-listed as endangered, with a CNPS status of 1B. This California endemic occurs in vernal pools with adobe soils of 25 to 125 meters under vernally flooded conditions, and it almost always occurs under natural conditions in wetlands. Hairy Orcutt grass is slowly declining throughout its range. Populations have been regularly affected by free-ranging cattle and horses that are allowed to wallow in vernal pools and by urban expansion. This species' historic distribution includes the eastern margins of Sacramento and San Joaquin Valleys, from Tehama County south to Stanislaus County and through Merced and Madera Counties (USFWS 1997a). Ten of the 34 historic populations have been extirpated. The CNDDB indicates four populations of hairy Orcutt grass within the project area, within the Sacramento National Wildlife Refuge in the Logandale USGS 7.5-minute quadrangle (CDFG 2004a).

Slender Orcutt Grass (FT/SE,CNPS 1B)

Slender Orcutt grass *(Orcuttia tenius),* an annual in the grass family *(Poeceae),* is a federally and California-listed species and CNPS 1B species. It inhabits vernal pools in valley grassland and blue oak woodland (USFWS 2004) and is endemic to the Sacramento Valley. This species is threatened by degradation of vernal pool habitat or loss as a result of agricultural conversion and development (CDFG 2004a). The species is restricted to northern California, in areas of the Sacramento Valley, from Siskiyou County to Sacramento County (USFWS 2004). Of the existing 59 native populations, most are found in Shasta County and Tehama County (USFWS 2004). There are no CNDDB records of this species within the ROI.

Solano Grass (FE/SE, CNPS 1B)

Solano grass *(Tuctoria mucronata),* also known as Crampton's tuctoria, is a federally and California-listed endangered species and CNPS 1B species. It inhabits vernal pools in valley and foothill grasslands (CDFG 2004a). Agricultural conversion and development are thought to have reduced available habitat for this species. Changes to hydrology and grazing may be causing further decline in the remaining populations (CDFG 2004a). This species is endemic to Solano and Yolo Counties. Solano grass may have been more widely distributed in the flooded areas of the Sacramento Valley (USFWS 2004). There are no CNDDB records of this species within the ROI.

Greene's Tuctoria (FE/R, CNPS 1B)

Greene's tuctoria *(Tuctoria greenei),* also known as Greene's Orcutt grass, is a federally listed endangered and CNPS 1B species, and is considered by the state as rare. It occurs in vernal pools in valley and foothill grassland from 30 to 1,065 meters. Grazing has been identified as a past and present threat to the survival of this species (CDFG 2004a), whose historical range included portions of the Sacramento and San Joaquin Valleys (USFWS 2004). Current populations are limited to Shasta, southern Tehama, Butte, Glenn, and eastern Merced Counties (USFWS 2004). There are no CNDDB records of this species within the ROI.

Indian Valley Brodiaea (FSC/SE, CNPS 1B)

The Indian valley brodiaea *(Brodiaea coronaria* ssp. *rosea)* is a federal species of concern and a state endangered plant, which occurs in chaparral, valley grassland, or closed-cone pine forest plant communities and often is found in serpentine substrate. It is a monocot in the family *Liliaceae* and is a perennial herb that is native to and endemic to California. It is equally likely to occur in wetlands or non-wetlands. There are CNDDB records of this species within the ROI.

Boggs Lake Hedge-Hyssop (-/SSC, CNPS 1B)

Boggs Lake hedge-hyssop (*Gratiola heterosepala*) is a federal species of concern and state endangered plant. It occurs under vernally flooded conditions in lake-margin, vernal pool, and edge habitats and is found almost always under natural conditions in wetlands. It is a dicot in the family *Scrophulariaceae* and an annual herb that is native to California, occurring from California to Oregon. The CNDDB indicates two occurrences of this species within the ROI.

Milo Baker's Lupine (FSC/ST, CNPS 1B)

Lupinus milo-bakeri is a federal species of concern and a state-listed threatened plant, which occurs in foothill woodland or valley grassland plant communities and often is found in disturbed habitats. It is a dicot in the family *Fabaceae* and is an annual herb native to and endemic to California. It can be found along road sides or ditches. The CNDDB indicates one occurrence of this species within the ROI.

Red Mountain Catchfly (FSC/SE, CNPS 1B)

Red mountain catchfly *(Silene campanulata* ssp. *campanulata)* is a federal species of concern and a state-listed endangered plant that occurs in chaparral or yellow pine forest plant communities and often is found in serpentine substrate. It is a dicot in the family *Caryophyllaceae* and is a perennial herb native to and endemic to California. There are no CNDDB records of this species within the ROI.

3.5.3 Invertebrates

All four of the federally listed threatened and endangered invertebrate species in Table 3 can occur in the ROI, based on their habitat requirements. However, they are generally confined to undeveloped areas along the rivers and creeks or are associated with vernal pools.

Conservancy Fairy Shrimp (FE/-)

Conservancy fairy shrimp *(Branchinecta conservatio)* is a federally endangered species that inhabits the highly turbid water in vernal pools that form in cool wet months. Fairy shrimp are not known to occur in permanent bodies of water and depend on seasonal fluctuations in their habitat, such as absence or presence of water during specific times of the year. The remaining populations are imperiled by a variety of human activities, primarily urban development, water supply/flood control projects, and conversion of land to agricultural use. The conservancy fairy shrimp is known from several disjunct populations: Vina Plains, north of Chico in Tehama County, south of Chico in Butte County, Jepson Prairie in Solano County, Sacramento National Wildlife Refuge in Glenn County, near Lake Yosemite and Haystack Mountain in Merced County, and the Lockewood Valley of northern Ventura County. The CNDDB indicates one occurrence of this species within the ROI, in the Sacramento National Wildlife Refuge, in the Logandale USGS 7.5-minute quadrangle.

Vernal Pool Fairy Shrimp (FT/-)

The vernal pool fairy shrimp *(Branchinecta lynchi)* is a federally threatened species that inhabits vernal pools. The remaining populations are imperiled by a variety of human activities, primarily urban development, water supply/flood control projects, and conversion of land to agricultural use. There are 32 known populations of the vernal pool fairy shrimp along the length of the Central Valley to Tulare County and along the central portion of the Coast Range, as well as four additional disjunct populations. The CNDDB indicates four locations where this species is found within the ROI. One population spans Black Butte Dam and Henleyville USGS 7.5-minute quadrangles, following a Pacific Gas and Electric pipeline and access road (CDFG 2004a). A second population is known from Corning and Gerber USGS 7.5-minute quadrangles at the

Thomes Creek Restoration site five miles northwest of Corning. Additional populations have been recorded at a restoration site nine miles west of Orland (Fruto NE USGS 7.5-minute quadrangle), and another recorded approximately four miles south of Red Bluff (Gerber USGS 7.5-minute quadrangle) (CDFG 2004a).

Vernal Pool Tadpole Shrimp (FE/-)

The vernal pool tadpole shrimp *(Lepidurus packardi)* is a federal endangered species that is found in grass-bottomed swales of unplowed grasslands in mud-bottomed and highly turbid pools. The remaining populations are imperiled by a variety of human activities, primarily urban development, water supply/flood control projects, and conversion of land to agricultural use. The vernal pool tadpole shrimp is known from 18 populations in the Central Valley, ranging from east of Redding in Shasta County south to the San Luis National Wildlife Refuge in Merced County, and from a single vernal pool complex on the San Francisco Bay National Wildlife Refuge in the city of Fremont, Alameda County. The CNDDB indicates one recorded observation of vernal pool tadpole shrimp within the ROI. This population was found in roadside ditches within the Williams USGS 7.5-minute quadrangle between the towns of Williams and Delphos.

Valley Elderberry Longhorn Beetle (FT/-)

Valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)* is federally listed as a threatened species and is found in grasslands, woodlands, and upland areas near rivers in California's Central Valley. The beetle relies on elderberry shrubs *(Sambucus* ssp.*)* to reproduce. The primary threats to survival of the beetle include loss and alteration of habitat by agricultural conversion, inappropriate grazing, levee construction, stream and river channelization, removal of riparian vegetation and rip-rapping of shoreline, recreational, industrial and urban development, and nonnative animals, such as the Argentine ant, which may eat the early phases of the beetle. The valley elderberry longhorn beetle's current distribution is patchy throughout the remaining riparian forests of the Central Valley from Redding to Bakersfield. The CNDDB indicates there are records of 14 populations within the ROI; one population was observed in the Rumsey USGS 7.5-minute quadrangle near Cache Creek. Five populations were observed within the Red Bluff East USGS 7.5-minute quadrangle, three by the Sacramento River, one by Millrace Creek, and one by Salt Creek. Four occurrences are recorded in the Foster Island USGS 7.5-minute quadrangle, including one population 1.68 miles northeast and 2.7 miles northwest of the Glenn-Colusa Canal pumping station (CDFG 2004a). One population each was observed at the USGS 7.5-minute quadrangles of Grimes, Glenn, Gerber, and Black Butte Dam.

3.5.4 Fish

There are six species of federally listed endangered or threatened fish that have been identified by the Service as occurring or potentially occurring in the ROI (USFWS 2004, Table 3). They are two runs of Chinook salmon, Central Valley steelhead, Sacramento splittail, Coho salmon, and Delta smelt, and all occurred historically in the ROI. These species are described in detail below.

Chinook Salmon, Winter-Run (FE/SE), Spring-Run (FT/ST), Fall/Late Fall-Run (FC/SSC)

There are three Central Valley Chinook salmon *(Oncorhynchus tshawytscha*) evolutionary significant units *(*ESU), fall/late-fall, winter, and spring, that are grouped based on the timing of their spawning migrations (Goals Project 2000). The fall/late fall-run Chinook is a federally designated species of concern and state-listed species of concern. The spring-run Chinook is a federally and California-listed threatened species, and winter-run Chinook is a federally and California-listed endangered species. The primary threats to the Sacramento Valley population are the drastic changes to the Sacramento River basin, including blockage of migration due to dams and other water diversions, increasing water temperatures, agricultural and industrial pollution, and drought conditions. Historically, Chinook salmon ranged as far south as the Ventura River, California, and as far north as the Russian Far East. These three salmon runs are now found most commonly in the Sacramento headwater, such as snow-dominated streams of the Sierra and the rain-dominated watersheds above Shasta Dam. Human influences on stream habitat and fishing pressures caused populations to decline such that the only remaining winter-run Chinook (king) salmon breed in the Sacramento River and its tributaries. The CNDDB indicates only one of the Central Valley Chinook salmon ESUs has been recorded within the ROI. The winter-run ESU was recorded within the Red Bluff East and Gerber USGS 7.5-minute quadrangles. The migration and spawning of these Chinook salmon ESUs have been negatively affected by RBDD operations and water diversion in the Sacramento River Division (NOAA Fisheries 1993, Reclamation 2004a).

Coho Salmon (So OR/No CA)(FT/SE)

There are no CNDDB records of this species within the ROI. This species is unlikely to occur within the project-affected waterways, based on local distribution and drainage patterns.

Central Valley Steelhead (FT/-)

The Central Valley steelhead *(Oncorhynchus mykiss),* a federally listed threatened species, historically spawned in perennial and seasonal tributaries throughout the Central Valley. The introduction of other races of steelhead has resulted in a population that can be found in the Central Valley in any month. Degradation of streams is due to obstruction of spawning habitat by dams, insufficient quality of water due to water diversion, and degradation of water quality due to logging, development, and industrial effluent and urban runoff. Steelhead are likely to have migrated through, to have spawned, or to have been reared in most coastal streams in Washington, Oregon, and California, as well as many inland streams in these states and in Idaho (NOAA Fisheries 1998). Presently, the species distribution extends from the Kamchatka Peninsula, east and south along the Pacific coast of North America, to approximately Malibu Creek in southern California, though many populations are believed to have been extirpated or to be in decline at historic coastal streams (NOAA Fisheries 1998). There are no CNDDB records of this species within the ROI, but an individual was identified in the Colusa drainage near the point where the CC and GCID canals come close together (Holt 2002). The migration and spawning of the Central Valley steelhead have been negatively affected by RBDD operations and water diversion in the Sacramento River Division (Reclamation 2004a).

Delta Smelt (FT/ST)

Delta smelt *(Hypomesus transpacificus)* is a federally listed threatened species. The delta smelt is adapted to living in fresh and brackish water and occupies estuarine areas with salinities below two grams per liter. It rarely occurs in estuarine waters with more than 10 to 12 parts per thousand salinity, which is about one-third the salinity of seawater (Ganssle 1966, in Moyle 1976). Because of substantial human-caused changes in the relative ratios of seasonal freshwater outflows, the center of delta smelt abundance has shifted to the Sacramento River channel in the delta since 1981 (Moyle 1992). This species historically occurred from Suisun Bay upstream to Sacramento on the Sacramento River and Mossdale on the San Joaquin River (Moyle 1992). It is the only smelt endemic to California and the only true native estuarine species found in the delta (Moyle 1989; Stevens et al. 1990; Wang 1986). Delta smelt historically congregated in upper Suisun Bay and Montezuma Slough (mainly from March to mid-June), when the Sacramento and San Joaquin river flows were high. There are no CNDDB records of this species within the ROI.

3.5.5 Amphibians and Reptiles

The California tiger salamander is a federally proposed species for listing and a California species of special concern which may occur in the ROI. Both the California red-legged frog and the giant garter snake, both of which are federally listed threatened species, could occur in the ROI, based on habitat requirements. These species are described below in more detail.

California Tiger Salamander (PT/SSC)

The California tiger salamander *(Ambystoma californiense)* needs underground refuges and may use ground squirrel burrows. It breeds in vernal pools or other seasonal water sources. The California tiger salamander is found in the Central Valley and adjacent foothills and coastal grasslands. Urbanization has had drastic effects on populations of California tiger salamander, which has been eliminated from an estimated 55 to 58 percent of its historic breeding sites and has lost an estimated 75 percent of its habitat (USFWS 2004a). There are three distinct population segments, in Sonoma County, Central California (which includes the Bay Area, Central Valley, southern San Joaquin Valley, Central Coast Range regions), and Santa Barbara (USFWS 2003b). The CNDDB indicates no extant population recorded within the ROI. Four extirpated populations were noted at Bird Valley, Dunnigan, Willows, and Zamora USGS 7.5-minute quadrangles.

California Red-Legged Frog (FT/SSC)

The California red-legged frog *(Rana aurora draytonii)* is a federally listed threatened species and a California-listed species of concern. The California red-legged frog needs a distinct habitat, with both aquatic and riparian components. It tends to inhabit moist areas, streams and ponds with slow or still water, such as marshes and swamps, wetlands, aquatic areas, flowing or standing waters, riparian scrubs, riparian woodlands, and riparian forest. California red-legged frogs have been virtually extirpated from the floor of the Central Valley despite their historic presence in numbers large enough for commercial harvest. Factors that have caused the degradation of the frog's habitat

include disturbance to riparian zones by cattle and feral pigs, erosion, and introduction of nonnative predators. Historically this species extended along the coast from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico (CDFG 2004b). Current distribution is limited to 248 streams or drainages in 31 counties (USFWS 2004e). There are no CNDDB records of this species within the ROI.

Giant Garter Snake (FT/ST)

The giant garter snake *(Thamnophis gigas)* is a federally listed and California-listed threatened species. To protect itself from predators, the giant garter snake often remains concealed in vegetation surrounding freshwater marshes, sloughs, and canals. The distribution and abundance of the giant garter snake is decreasing due to wetlands management practices in the Central Valley, including diking, channeling, and draining. The giant garter snake occurs in the Central Valley, from Gridley south to the Mendota Wildlife Area in Fresno County. The current range has shrunken considerably since 1940, when giant garter snakes ranged 100 miles north of the current northern boundary and as far south as Buena Vista Lake (approximately 200 miles south of the current southern boundary). Suitable habitat for the giant garter snake exists in the ROI, particularly in rice fields and irrigation ditches, and CNDDB indicates 10 populations are known to this area.

3.5.6 Birds

The two federally listed as threatened bird species designated by the Service as having the potential to occur in the area, as well as the three state listed bird species, also could occur in the ROI, based on habitat requirements. These species are described in more detail below.

Bald Eagle (FPD/SE, FP)

The bald eagle *(Haliaeetus luecocephalus)* is currently federally proposed for delisting but is still considered a federally threatened and California-listed endangered species. Bald eagles typically build large nests of sticks in tall old-growth conifers. Threats to population arise from recreation and development activities in preferred habitat, shooting, electrocution, poisoning, and pesticide contamination. Although it was previously more widespread in California, and breeding pairs are found further south, most bald eagles breed at altitudes up to 2,100 meters (7,000 feet) in the northern portion of the state. The wintering habitat for the bald eagle is much larger and includes most areas of California, except for extremely hot desert areas and at very high altitudes (Thelander et al. 1994). The CNDDB indicates a nesting pair at Stony Gorge Reservoir territory, on the west edge of Stony Gorge Reservoir, 20 miles west of Willows (CDFG 2004), which falls within the ROI.

Northern Spotted Owl (FT/-)

Northern spotted owl *(Strix occidentalis caurina),* a federally listed threatened species, is usually found in old-growth coniferous forests that are structurally diverse and that are at least 150 years old. The owls have large home ranges and require forested areas of at least 4,000 acres. This species is in decline as a result of extensive loss and degradation

of suitable habitat. In California, the northern spotted owl range is bounded on the south by Marin and Napa Counties, on the east by Modoc and Lassen Counties, and on the north by Del Norte and Siskiyou Counties (Thelander et al. 1994). The 4-E Water District, in the foothills west of Stony Gorge Dam, has some coniferous forest but only about half of the amount necessary for the home range of one owl pair; however, adjacent lands might support owls. The blue oak woodland habitat in the 4-M Water District may provide a fairly large area of habitat that is suitable, but not ideal, to support the owl. The presence of suitable or marginal habitat in a portion of the ROI and its vicinity make it possible that the spotted owl may occur there. There are no CNDDB records of this species within the ROI.

Swainson's Hawk (FSC/ST)

Swainson's hawk *(Buteo Swainsoni)* is a state-listed threatened species. Swainson's hawks may forage in virtually all the habitats at the west Sacramento Valley area. They occur in Great Basin grassland, riparian forest, riparian woodlands, valley, and foothill grassland communities with adjacent suitable foraging areas (such as grasslands or alfalfa or grain fields that support rodent populations). They are also sometimes associated with freshwater wetlands.

Greater Sandhill Crane (-/ST,FP)

The greater sandhill crane *(Grus Canadensis tabida)* is state listed as threatened and is a fully protected species. It breeds in wetlands and feeds in different habitat types, such as meadows, irrigated pastures, grainfields, bogs, fens, marshes, and nearby fields. Cranes like to roost together at night for safety in an open expanse of shallow water. The sandhill crane uses the Sacramento Valley, mainly just south of Sacramento, but they can be found throughout the valley. They can be found in agricultural areas depending on the amount of standing water available in the fields. There are no CNDDB records of greater sandhill cranes within the ROI.

Bank Swallow (FSC/ST)

The bank swallow *(Riparia riparia)* is state listed as threatened. It is listed as a nesting bird in the area by the Service. The bank swallow is a neotropical migrant and requires vertical banks or cliffs with fine-textured or sandy soils near streams, rivers, lakes, or the ocean to dig nesting holes. There are CNDDB records of this species within the ROI.

3.5.7 Mammals

There are no federally listed threatened or endangered mammal species designated by the Service as possibly occurring in the ROI.

Pacific Fisher (FSC/SSC)

Pacific fisher *(Martes pennanti pacifica)* is a federal and state-listed species of concern. It inhabits north coast coniferous forests, old growth, and riparian forests. It uses cavities, snags, logs, and rocky areas for cover and denning. No CNDDB records exist for this species within the ROI, but suitable habitat may occur within the area.

Small-Footed Myotis Bat (FSC/-)

Small-footed myotis bat (*Myotis ciliolabrum)* is a federal species of concern. It prefers open stands in forests, woodlands, and brushy habitats and roosts in caves, buildings, crevices, and sometimes under bark and bridges. Habitat suitable for this species is present within the ROI, although there are no CNDDB records of it within this area.

Long-Eared Myotis Bat (FSC/-)

Long-eared myotis bat *(Myotis evotis)* is a federal species of concern. It inhabits coniferous forests in mountain areas and roosts in small colonies in caves and buildings and under tree bark. Habitat suitable for this species is present within the ROI, although there are no CNDDB records of it within this area.

Fringed Myotis Bat (FSC/-)

Fringed myotis bat (*Myotis thysanodes)* is a federal species of concern. This species can be found in a wide variety of habitats, including pinyon-juniper, valley foothill hardwood, and hardwood-conifer forests. It uses caves, mines, buildings, and crevices for maternity colonies and roosts. Habitat suitable for this species is present within the ROI, although there are no CNDDB records of it within this area.

Yuma Myotis Bat (FSC/SSC)

Yuma myotis bat *(Myotis yumanensis)* is a federal and state species of concern. This species lives near lakes, creeks, or ponds and roosts by day under building sidings or shingles. Habitat suitable for this species is present within the ROI, although there are no CNDDB records of it within this area.

San Joaquin Pocket Mouse(FSC/-)

San Joaquin pocket mouse *(Perognathus inornatus inornatus)* is a federal species of concern. It inhabits coastal scrub and valley and foothill grasslands with friable soils. Habitat suitable for this species is present within the ROI. The CNDDB indicates multiple occurrences within the project ROI.

Pale Townsend's Big-Eared Bat (FSC/SSC)

Pale Townsend's big-eared bat *(Plecotus townsendii pallescens)* is a federal and state species of concern. It is found in mesic habitats in all but subalpine and alpine areas and roosts in caves, mines, tunnels, buildings, or other human-made structures. It gleans from brush or trees or feeds along habitat edges (CDFG 2004). Habitat suitable for this species is present within the ROI, although there are no CNDDB records of it within this area.

3.5.8 Environmental Consequences

This section discusses potential impacts to biological resources that would occur under each alternative due to changes in water use related to implementation of the alternatives. The main habitat types within the service area boundaries are agricultural cover and nonnative grassland. These habitat types, as well as the small areas of freshwater marsh and lacustrine habitat, would be most sensitive to changes in water use. Potential impacts would occur if water use changed due to contract terms, which

indirectly led to a shift in crop patterns or a change in land use. For example, a reduction in water use might result in a shift from water intensive crops to dry crops such as grains or result in land being left fallow. On the other hand, an increase in water use might result in nonnative grassland being cultivated. Similarly, impacts might occur if changes in water use altered the inflows to the freshwater marsh, lacustrine, and riparian areas in the project area.

No Action Alternative

The migration and spawning of the winter-run, spring-run and fall/late fall-run Chinook salmon and Central Valley steelhead are being negatively affected by RBDD operations and water diversion in the Sacramento River Division (NOAA Fisheries 1993). Gate closures limit upstream and downstream migration of anadromous fish and reduce water quantity in certain portions of the ROI which lowers water suitability for these species. The water diverted from the Sacramento River at the RBDD into the Corning and Tehama-Colusa Canals is screened, however entrainment of anadromous fish in unscreened diversions from lower Stony Creek via the Constant Head Orifice (CHO) into the Tehama-Colusa Canal can be an additional source of mortality. Since 2000 Reclamation has operated fyke nets at the head of the CHO during diversions into the TCC to capture and release downstream any salmonids that could be entrained, via a BO from NOAA Fishereis, although fall-run have been the predominant species caught. The effects of limiting migration at the RBDD together with some minimal entrainment into the TCC at the CHO can combine to lower the reproductive success of the runs that utilize the ROI and contribute to their population level decline. Consultation for these impacts, which would continue to occur under the No Action Alternative, was conducted between Reclamation and NOAA Fisheries and is addressed for the RBDD in the Operation of the Federal Central Valley Project and the California State Water Project Biological Opinion, the OCAP BA, and the OCAP BO (NOAA Fisheries 1993, Reclamation 2004a). Impacts on lower Stony Creek are being addressed between Reclamation and NOAA Fisheries in the Biological Opinion for Water Management on Lower Stony Creek where consultations are ongoing, and a final BO is expected in March of 2006 (Reclamation 2004b).

The economics analysis for the No Action Alternative shows that in 2030 land in production would range from 95,000 acres under average hydrologic conditions to 82,000 acres under dry hydrologic conditions. The crops with value to wildlife for forage, such as rice and small grains, would decrease on the order of a few thousand acres between the average and dry hydrologic conditions. A change in return flows of irrigation water between the average and dry hydrologic conditions would have minimal impact on riparian, freshwater marsh and lacustrine habitats within the service areas. Such special status species as sandhill crane that forage in the rice and grain fields would not be affected by these minor variations in the number of acres in rice and grain production.

Alternative 1

Impacts under Alternative 1 are expected to be similar to those described for the No Action Alternative because the water pricing system will be similar.

Alternative 2

Alternative 2 would impact biological resources, although the Service has issued a BO stating that the proposed action would have no adverse effect on listed species (USFWS 2005). The economic analysis (Section 3.2) indicates that Alternative 2 would not change the irrigated acreage compared to the No Action Alternative, except for the case when 2030 is an average hydrologic year following five dry hydrologic years. In this case, approximately 65,000 acres in the service area would be fallowed because CVP water by that point would be too expensive for irrigated crops. This represents 68 percent of the 95,000 acres estimated to be irrigated in 2030 for average hydrologic conditions under the No Action Alternative. Almost a third of these fallowed acres would result from a reduction in rice and small grain production, as shown in Table 3.2-19.

This loss of rice and small grain production would impact special status species that forage on these crops within the Sacramento River Division. The greater sandhill crane, for example, forages on the crops while other species such as the Swainson's hawk and the giant garter snake forage on rodents supported by the grain crops. However, the loss of approximately 20,000 acres of crops within the Sacramento River Division accounts for about five percent of the 469,000 acres of rice fields in the Central Valley that provide waste grain for some of the migratory species. In addition, because the 53,000 acres of national wildlife refuges near the project area now have secure water supplies, the reductions would account for little more than 4 percent of the wetlands available as resting habitat.

The reduction of return flows to streams and water districts that would result from 65,000 acres going fallow, which would occur when an average hydrologic year follows five dry years, may have a local impact on the level of flows in streams and irrigation ditches and the wetland and riparian habitat along these waterways. Species dependent upon these flows and habitats would be affected. The reduction of return flows may reduce flows and water levels in local streams and irrigation ditches. The reduced flows may dewater wetland, marsh and riparian areas, which may stress the vegetation and result in fewer species foraging or residing in these habitats. If these conditions are sustained for multiple years, then the local impacts may become more pronounced. However, any CVP water not purchased by the Sacramento River Division contractors either would remain in the CVP system or would be purchased by other contractors. To the extent that other contractors used this water for agricultural irrigation, return flows would benefit habitat and species found in riparian and wetland areas along streams and irrigation ditches elsewhere in California. To the extent that the water remained in rivers, streams, and bypasses operated or controlled by the CVP, habitat and species also would benefit outside of the project area.

Since 65,000 acres would be fallowed in a year of average hydrologic conditions following five years of dry hydrologic conditions, nonnative grasslands, which have the potential to support vernal pools, would not be at risk for cultivation. Because vernal pools are fed by winter and spring rains, they are not dependent upon irrigation water or return flows to form. Potential negative impacts on vernal pools are unlikely and would be limited to minor hydrological regime changes. Consequently, vernal pool species,

such as Hoover's spurge, palmate-bracted bird's-beak, Colusa grass, conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp, are not likely to be affected. There are no direct or indirect impacts on either the valley elderberry longhorn beetle or on riparian habitat in which the blue elderberry, its host plant, is found. Project-related actions are unlikely to negatively affect habitat and prey availability for sensitive amphibians or reptiles occurring in the project area, such as the California red-legged frog, California tiger salamander and giant garter snake. Runoff from agricultural use of the conveyed water could run into and contribute to wetlands, pools, and streams, which support these species. However the project may result in lower habitat quality by contaminating water with agricultural wastewater, which would likely include pesticide and organic matter. Pesticides have been identified as a potential factor in the decline of amphibians, such as the California red-legged frog (Sparling et al. 2001). Birds are likewise unlikely to suffer a decline in foraging and roosting habitat as a result of the proposed action but may be affected by the dissemination of pesticides. Bioaccumulation of toxins in species, such as the bald eagle, foraging in the action area could occur as the result of pesticides in the return flow of irrigation water and the uptake. Prey, such as fish, would ingest contamination through diet and respiration, which would then be further concentrated in the bald eagle.

Anadromous fish would be affected by the proposed action. Effects could include lower water quality, change in water quantity, and entrainment. The limited distribution of Coho salmon in southern Oregon and northern California within the action area means little to no chance for entrainment impacts due to lowered instream levels from the proposed action. Contract renewal could affect the Central Valley steelhead in terms of water conveyance. Lower water level affects were analyzed as part of the Long-Term Central Valley Project and State Water Project OCAP BA (Reclamation 2004a), and it was determined that water levels in the Upper Sacramento River would still be sufficient to support all Central Valley steelhead life stages. Other than at the RBDD any adverse impacts on fish in the Sacramento River Division system are expected only as a result of water use or conveyance, not water supply. Water conveyance is not controlled by Reclamation, other than in its oversight to ensure reasonable and beneficial uses, nor is the use of private diversion facilities under Reclamation's control. Any impacts on fish as a result of water conveyance need to be addressed by the water users.

The proposed action of contract renewal could affect the Chinook salmon spring-run and winter-run ESUs only in terms of water conveyance. The effects of water conveyance are not believed to prevent the Upper Sacramento River from providing suitable flows for most life stages of Chinook salmon year-round (Reclamation 2004a). Chinook salmon tend to spawn in the mainstem of rivers or larger tributaries with suitable substrate. All current runs of Chinook salmon have been known to spawn in the Sacramento River and tributaries from Colusa north to Keswick Dam, with the best spawning habitat being upstream of the RBDD.

However, during dry years the temperature may reach levels that are detrimental to survivorship. Even with increased temperatures due to lowered water levels in the Sacramento River, incubation conditions for winter-run Chinook are estimated to cover

98 percent of winter-run spawning (Reclamation 2004a). Winter-run salmon spawn directly in the Sacramento River and depend on cold water releases from Shasta Dam to allow them to hold for several months until they spawn in early summer (Behnke 2002). The winter-run is currently limited to the 70 miles below Keswick Dam (Moyle 2002), from Redding to Tehama.

Spring-run salmon spawn in higher streams with adequate spring fed run-off to keep summer water temperatures low. They hold in the stream for several months before spawning in the summer. The majority of spring-run salmon spawn in tributaries of the Sacramento River such as Butte, Deer and Mill Creeks. Only a small percentage of the Spring-run ESU spawns in the Sacramento River (Reclamation 2004a) so no population level impact is expected.

The proposed action would affect the amount and timing of freshwater flow in the Sacramento River and Delta, which in turn affects Delta smelt survivorship. By allowing for a maximum amount of water to be conveyed to CVP contractors, this long-term contract renewal may cause indirect take of Delta smelt. Modifying the flow may lead to increased predation of the Delta smelt or cause them to locate in such a way that causes increased smelt mortality (Reclamation 2004a). However, there would be little to no net loss of water flow in the Delta due to diversions from the Trinity River (Holt 2004).

Water use may affect anadromous fish by the return flow of irrigation water, which may be contaminated by pesticides and fertilizers. Agricultural contamination would combine with other contamination sources to lower water quality of Glenn County water bodies which this ESU may inhabit. The effect of such contamination on salmonid survivorship is not well known, but it may lower reproductive success by making the species more susceptible to disease or predation. Although more study is needed, continued agricultural runoff as a result of project actions is unlikely to have population level effects on this coho salmon ESU. Water diversion could also be responsible for entraining listed fish species. Entrainment in the Sacramento River is possible, but unlikely due to the efficiency of the screens at Red Bluff. Entrainment is possible at the diversion structures located in lower Stony Creek; however Reclamation biologists monitor potential entrainment during the irrigation season. Reclamation is also conducting an anadromous fish monitoring program on lower Stony Creek, and after three years (2001-2004) no steelhead adults or juveniles have been collected. Separate consultations for entrainment at both the Red Bluff Diversion Dam and lower Stony Creek, which are approximately 52 river miles away from each other, are in place or are ongoing. Red Bluff Diversion Dam's effects on the migration, spawning, and production of anadromous fish is fully analyzed in the OCAP BA (Reclamation 2004a).

3.5.9 Cumulative Impacts

Implementing the proposed action would not contribute significantly to cumulative impacts on sensitive species or critical habitat. The proposed action would result in no changes to the infrastructure, physical disturbances, or water delivery because no changes are expected in water purchased by the contractors or in acreage cultivated.

Special-status species with the potential to occur in the Sacramento River Division could be affected by actions unrelated to the implementation of the long-term contract renewals. These actions could include the following:

- Decrease in lands used for agriculture and a conversion of agricultural lands to M&I use;
- Continued agricultural or urban activities using groundwater or other surface water supplies only; and
- Any potential urban development and associated impacts in the M&I only contract areas.

Identification of the location, nature, and extent of such non-federal actions is speculative.

Some landowners may choose to dryland farm their land or to rely on groundwater wells to supply their irrigation needs. If there were no continuing deliveries under renewed CVP contracts or increases in water pricing, groundwater pumping might increase. Land fallowing could also increase, which could improve habitat conditions for listed species.

It is unlikely that planted acreage could increase from baseline conditions. The decrease in CVP water reliability and falling commodity prices have had a tendency to discourage new farming operations.

Conversion of agricultural land to M&I uses by the landowner could result in adverse cumulative effects on listed species, although the likelihood of this action to occur to any great extent is minimal. Any listed species displaced from agricultural lands could still make use of the remaining available agricultural habitat. In addition, the Central Valley Project Conservation Program has contributed funding to projects that have converted agricultural land to native riparian habitat. These projects have occurred along the Sacramento River, predominantly in the Sacramento River Conservation Area between Red Bluff and Colusa, benefiting a great diversity of native wildlife species.

Listed fish species could be entrained at the Red Bluff Diversion Dam in Tehama County and on Stony Creek in Glenn County, when water is being diverted. This impact has been addressed in a past consultation (NOAA Fisheries 1993) and as an ongoing Section 7 consultation with the Service and NOAA Fisheries (Reclamation 2004a and 2004b).

Cumulative CVP impacts were addressed in the CVPIA PEIS and are incorporated here by reference. Beyond those cumulative impacts discussed in the CVPIA PEIS and BO, there are no additional cumulative impacts that would result from long-term water service contract renewals in the Sacramento River Division.

3.6 SOCIAL CONDITIONS AND ENVIRONMENTAL JUSTICE

3.6.1 Affected Environment

This section describes general economic and sociological characteristics of the project area. Most observations will be made at the county level because impacts are unlikely to be felt solely within the limited boundaries of the Sacramento River Division.

Population and Income

Four counties are in the project area. Yolo County is not included since only the Dunnigan Water District is within Yolo County and socioeconomic effects would not substantially affect the rest of the County. Tehama County is the most populous and the least dependent upon agriculture, with only 8.2 percent of its workforce in agriculture. Colusa County has the highest per capita income, as shown in Table 3.6-1. Tehama, Glenn, and Colusa counties all expect population growth over the next twenty-five years of greater than 50 percent (California Employment Development Department 2000, 2000a, 2000b).

Poverty levels are relatively high in the project area: 17 percent of Colusa, 26 percent of Glenn, and 24 percent of Tehama County children under 18 live in poverty (Umbach 1997). Glenn and Tehama Counties also have lower per capita incomes than Colusa County (United States Department of Commerce 2000).

Table 3.6-1
Population Estimates and per capita income

	Population January 2000	Expected Population by 2030	Per Capita Income 1998
Colusa County	18,750	54,995	$20,287
Glenn County	27,100	59,242	$16,882
Tehama County	56,200	96,511	$17,600
Total	102,050	210,748	

Source: California Department of Finance 2000; US Department of Commerce 2002.

Employment

Figures for 1999 indicate total (farm and nonfarm) civilian employment in Tehama, Colusa, and Glenn Counties is 43,820 out of a total of 102,050 residents (California Employment Development Department 2000a, 2000b, 2000c).

Unemployment levels in the project area are significantly higher than they are in the rest of the state or the rest of the country. As shown in Table 3.6-2, recent figures indicate that the unemployment rate in the three counties ranges from 6.7 percent (in Tehama County) to 15.8 percent (in Colusa County), as compared to 5.2 percent for the state of California and 4.2 percent for the country as a whole (California Employment Development Department 2000, 2000a, 2000b).

Table 3.6-2
June 2000 Unemployment Rates for Colusa, Glenn, and Tehama Counties in 1999

County	Unemployment Rate (percent)
Colusa	15.8
Glenn	11
Tehama	6.7

Source: California Employment Development Department 2000a, 2000b, 2000c.

All three counties expect both population and employment in the area to grow, however it is expected that most of the jobs growth will be in services and retail trade, rather than agriculture (California Employment Development Department 2000, 2000a, 2000b). Therefore future agricultural employment figures are not expected to differ greatly from current levels.

Agricultural employment figures vary seasonally. Colusa County agricultural employment varied from a high of 4,100 in July of 1999 to a low of 1,650 in January of 2000. Glenn County agricultural employment figures varied from a high of 2,250 in October 1999 to a low of 1,280 in January of 2000. Tehama County's agricultural employment varied from 2,210 in October of 1999 to 950 in March of 2000 (California Employment Development Department 2000e, 2000f, 2000g). These changing figures are probable indicators of the presence of a seasonal/migrant worker population in the project area. While strict reliance on demographic reporting is not advisable because of under reporting and possible illegal status of migrant workers, one can make conservative estimates based on the information available.

As detailed in Section 3.2, there are 1189 farms in Glenn County, 1362 farms in Tehama County, and 810 farms in Colusa County. Total agricultural employment in the three county project area is estimated at approximately 7,100 (California Employment Development Department 2000, 2000a, 2000b).

Table 3.6-3
Farms and Farmworkers in the Project Area

County	Agricultural Workers	Farms	Estimated Number of Temporary Workers	Total Est. Workers per Farm
Colusa	1650 - 4100	810	2,450	2 – 5
Glenn	1280 – 2250	1189	970	1 – 2
Tehama	950 – 2210	1362	1,260	1 – 2
Total	3880 – 8560	3361	4680	

Source: California Employee Development Department 2000e, 2000f, 2000g; United States Department of Agriculture 2000.

Based on the above estimates, it can be calculated that as many as 4,680 people work as temporary labor on the farms in Colusa, Glenn, and Tehama counties. As of August 2000, total farm employment in the three counties was estimated by the State of California at roughly 7,000 workers, but this figure does not separate temporary work

from permanent full-time employment (California Employee Development Department 2000e, 2000f, 2000g).

Demographics and Environmental Justice

Executive Order 12898 requires federal agencies to identify and avoid disproportionate impacts on minority or low-income communities; therefore it is important to identify any minority or low-income communities in the project area. From 1990 to 1998, the project area population increased in almost every demographic category (Tables 3.6-4 – 3.6-6). Each county has a significant Hispanic and minority population, all of which are expected to grow significantly during the next twenty-five years.

Table 3.6-4
Colusa County Population Totals and Projections with Race/Ethnic Detail

Year	Total	White	Hispanic	Asian/ Pacific Islander	Black	Native American
1990	16,275	10,147	5,424	321	81	302
1998	18,638	10,258	7,562	408	90	320
	Projection					
2000	20973	11092	9074	382	88	337
2005	26092	12188	12930	502	105	367
2010	31110	13159	16807	583	123	438
2015	35945	13970	20686	627	161	501
2020	41398	14687	25283	686	201	541
2025	47410	15407	30455	751	232	565
2030	42220	15983	34593	803	257	584

Source: California Department of Finance 2002e; California Department of Finance 2002a.

Table 3.6-5
Glenn County Population Totals and Projections with Race/Ethnic Detail

Year	Total	White	Hispanic	Asian/ Pacific Islander	Black	Native American
1990	24,798	18,489	4,958	773	131	447
1998	26,848	18,347	6,617	1,242	140	502
	Projection					
2000	29298	19553	7654	1448	141	502
2005	34208	21127	10404	1961	152	564
2010	39055	22426	13263	2530	178	658
2015	43792	23543	16199	3105	234	711
2020	49113	24580	19742	3777	268	746
2025	54809	25565	23617	4518	299	810
2030	59365	26353	26717	5111	324	861

Source: California Department of Finance 2002f; California Department of Finance 2002a.

Table 3.6-6
Tehama County Population Totals and Projections with Race/Ethnic Detail

Year	Total	White	Hispanic	Asian/ Pacific Islander	Black	Native American
1990	49,625	43,081	5124	325	246	849
1998	55,184	46,628	6990	382	327	857
Projection						
2000	56666	47215	7827	387	317	920
2005	62920	51253	9720	474	425	1048
2010	70567	56494	11809	581	550	1133
2015	77239	60605	14067	647	708	1212
2020	83996	64210	16845	754	847	1340
2025	90951	67742	19956	837	988	1428
2030	96,515	70568	22444	903	1101	1498

Source: California Department of Finance 2000g; California Department of Finance 2000a.

As noted above, poverty levels are higher in the three counties than they are in the rest of the state of California. In addition, farmworkers (especially migrant workers) in California tend to be both minority and low-income; however no data are available concerning the ethnic status of particular occupations for the project area.

3.6.2 Environmental Impacts

No Action Alternative

As discussed in Section 3.2, Agricultural Economics, implementation of the No Action Alternative would result in no major impact on population, income, or employment rates in the project area. Most of the growth in these counties is expected to be confined to the non-farm industries. As shown in Table 3.2-15, agricultural jobs in Colusa, Glenn, and Tehama Counties are expected to total 8,218 by 2030, an increase of about 1,200 people, which is not a major change given the overall growth expected in the three-county area. There should be no major impact on population, income, or employment levels or predicted growth in Colusa, Glenn, and Tehama Counties as a result of implementation of the No Action Alternative.

Minority or low-income populations, although expected to increase numerically over the project period, would not be disproportionately affected by the implementation of the No Action Alternative because there is, by definition, no change. Therefore, there would be no environmental justice concerns raised by the No Action Alternative.

Alternative 1

Alternative 1 is assumed to have similar effects on agricultural water costs, land use, economics, and employment within the affected region as the No Action Alternative. Therefore, no major impacts are expected on social conditions or environmental justice in Colusa, Glenn, and Tehama Counties.

Alternative 2

As discussed in Section 3.2, Agricultural Economics, there would be an incremental increase in CVP water rates under Alternative 2 as compared to the No Action Alternative. The implementation of this alternative might have impacts on employment in Colusa, Glenn, and Tehama Counties and within the service areas specifically. The severity of these impacts will depend upon whether the preceding five years were wet, dry, or average, and on whether the particular year being considered is wet, dry, or average.

As identified in Table 3.2-19, under the worst-case scenario of five dry years followed by an average year, approximately 65,100 acres would be taken out of agricultural production in the project area. The precise outcome of the increase in water prices would probably vary from farm to farm; however it is probable that agricultural employment levels in each district would drop under those circumstances.

Direct and indirect impacts to employment are possible. As discussed above, and as addressed in more detail in the agricultural economics section (see Table 3.2-24), as many as 1,000 jobs could be lost in the project area under the worst-case scenario, of which approximately 500 would be in agriculture. However, overall impacts to the Sacramento Valley region are not likely to be large, because employment levels are increasing and most of the increase is expected outside the agricultural industry.

The migrant farmworker community is almost by definition low-income, and is primarily made up of minorities. Therefore, any negative impact on agricultural employment would be reflected in the minority and low-income communities. It is likely that a measurable impact would be felt in these communities as a result of the predicted loss of agricultural jobs under the worst-case scenario. The precise scale and nature of the impact is difficult to determine at this stage, however, given the imprecise data available and the difficulty of adequately predicting choices on the part of farm operators in response to changes in water rates and water availability. Additionally, the worst-case scenario of one average year following five dry years is only one of nine possible scenarios under Alternative 2.

3.6.3 Cumulative Impacts

No cumulative impacts on social conditions or environmental justice are expected from implementation of any of the alternatives identified in this EA.

3.7 RECREATIONAL RESOURCES

3.7.1 Affected Environment

Recreation can be an active or passive use of unimproved open space land or improved recreational facilities. Wildlife areas, areas of scenic, historic and cultural value, lake shores, beaches, and rivers and streams are all examples of open space as a passive use which may have few or no improvements. Parks, golf courses, and sports clubs are all examples of recreation areas that provide for more active uses and have more facility improvements.

Sacramento River

The upper reach of the Sacramento River, above the Red Bluff Diversion Dam (RBDD), is the key water source to the various service areas that comprise the Sacramento River Division. However, the middle reach from the RBDD to the Feather River confluence is the major aquatic recreation resource for the study area. This is a 160-mile segment of the river characterized by slower moving water and a meandering river channel lined with riparian thickets and orchards (California Department of Water Resources 1982, as cited in Reclamation 1997). Although most land along this reach is privately owned, the California Department of Parks and Recreation and Tehama, Glenn, and Colusa counties provide public access points along the middle reach. Water-dependent activities in this reach include boat and shore fishing, swimming, and beach use. Water-contact activities, such as swimming and tubing, are popular because the water is relatively warm compared to the upper reach. Water-enhanced activities include camping and relaxing. Black Butte and Stony Gorge Reservoirs also provide some recreational potential.

Wildlife Refuges

More ducks and geese winter in the Sacramento Valley than in any other areas of the Pacific Flyway. Several wildlife refuges were established in this area to sustain birds through the fall and winter by providing an abundance of food and a place to rest. Recreation activities at national wildlife refuges (NWRs) located in the vicinity of the Sacramento River Division include the Sacramento, Delevan, and Colusa refuges managed as the Sacramento NWR Complex. The proximity of these refuges to several of the service areas in the southern portion of the TCC and Corning Canals, such as the Westside Water District, results in movement of waterfowl into the district grasslands and fields during fall and winter. Within the Westside Water District, in-season hunting of waterfowl, upland game birds, and small mammals is important (Westside Water District 1994).

Most recreation activities on the refuges are associated with the presence of waterfowl. These activities include non-consumptive uses (e.g., wildlife observation and hiking) and consumptive uses (e.g., hunting). Hunting of ducks, geese, coots, snipes, and pheasants is permitted between October and January on portions of all refuges in the Sacramento NWR Complex (USFWS 2000). Fishing does not occur on any refuge in the complex. Certain activities, such as hiking and driving tours, can be restricted when birds are present on the refuges.

Use records indicate that non-consumptive recreation uses, primarily activities associated with wildlife observation, account for most of the use at the refuges. Hunting is the most popular consumptive use. Most visitation to the wildlife refuges occurs in the winter, when waterfowl are present. Use estimates from the Sacramento NWR Complex show that approximately 75 percent of total use occurs between October and January. Summer use (June through August) accounts for only four percent of total use. All hunting occurs between October and January, with approximately 80 percent between November and January.

The primary goal of the NWRs is to provide habitat for waterfowl and other wildlife; therefore, recreation activities that would disturb wildlife are not promoted. Management regulations to control wildlife disturbance may affect recreation at the refuges by preventing access during certain periods or by not providing facilities that would enhance visitation (Reclamation 1997).

3.7.2 Environmental Consequences

Two types of changes related to recreation are considered in the following impact analysis—recreation opportunities and recreation use.

No Action Alternative

Under this alternative it is assumed that there would be no change in water flow conditions to the Sacramento River Division contractors as compared to the Affected Environment. River-related and other recreation opportunities in the project area and vicinity are expected to be similar to conditions described in Section 3.7.1, Affected Environment. No impacts to the use or enjoyment of the Sacramento River or other recreation opportunities in the project vicinity are expected under the No Action Alternative.

Alternative 1

Alternative 1 is assumed to have similar effects to recreation resources as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Alternative 2

Under Alternative 2, recreation opportunities in the project area and vicinity are expected to remain unchanged. Changes in Sacramento River water flows would not result from this alternative, and the NWRs, which provide the best duck habitat in the study area, have secure water supplies. Therefore, these resources would not be affected. In addition, no changes to Stony Gorge or Black Butte reservoirs would occur. Therefore, no impacts to the use or enjoyment of the Sacramento River and other recreation opportunities in the project vicinity are anticipated.

3.7.3 Cumulative Impacts

Implementation of Alternatives 1 and 2 would not contribute significantly to cumulative impacts to recreation resources.

3.8 INDIAN TRUST ASSETS

3.8.1 Affected Environment

This section describes Indian Trust Assets in and adjacent to the service areas in the western part of the Sacramento Valley that could be affected by renewal of water service contracts. Indian Trust Assets are legal interests in property that the United States holds in trust for Indian tribes or individuals. The Secretary of the Interior is the trustee for the United States on behalf of recognized tribes. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights.

Reclamation, in carrying out its activities, shares the responsibility to protect and maintain Indian trust assets reserved by or granted to Indian tribes or individuals by treaty, statute, or Executive Order. Reclamation carries out its activities in a manner that, where possible, protects Indian trust assets and avoids impacts. When it is not possible to avoid impacts to trust assets, compensation or mitigation is provided in consultation with the affected tribes or individuals.

No federally recognized Indian Tribes or assets are within or adjacent to any of the districts in this ROI. Indian Trust Assets do exist within the counties of the west Sacramento Valley and in the general proximity of the project area. Federally recognized Indian rancherias which may be held in trust include the following:

- Grindstone Rancheria in Glenn County, approximately 15 miles west of the Orland-Artois Water District;
- Cortina Rancheria in Colusa County, approximately 10 miles west of the Colusa County Water District;
- Colusa Rancheria in Colusa County, approximately 15 miles east of the La Grande District; and
- Rumsey Rancheria in Yolo County, approximately 20 miles west of the Dunnigan Water District.

Additional Indian Trust Assets in the region include the Gertie Patterson property in Tehama County, approximately 10 miles southeast of the Proberta Water District, and the Santiago McDaniel property in Colusa County, approximately 20 miles west of the Holthouse Water District.

3.8.2 Environmental Consequences

No federally recognized Indian Tribes or trust assets are within or adjacent to the ROI evaluated in this EA or would be affected by continued CVP water delivery. No impacts to Indian trust assets would occur as a result of the long-term contract renewal under any of the alternatives.

3.8.3 Cumulative Impacts

Implementation of Alternatives 1 and 2 would not contribute to cumulative impacts to Indian Trust Assets.

3.9 CULTURAL RESOURCES

3.9.1 Affected Environment

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. Cultural resources include expressions of human culture and history in the physical environment such as prehistoric or historic archaeological sites, buildings, structures, objects, districts, or other places including natural features and biota which are considered to be important to a culture, subculture, or community. Cultural resources also include traditional lifeways and practices, and community values and institutions.

The affected environment for cultural resources or Area of Potential Effects (APE) consists of the water service areas in the west Sacramento Valley, primarily those served by the TCC and Corning Canal. The APE is the geographic area within which an undertaking may cause changes in the character or use of historic properties. The renewal of water service contracts between Reclamation and the Sacramento River Division contractors is a Federal undertaking that has the potential to affect cultural resources in the service area.

Cultural Resource Types

Cultural resources have been organized into the categories of prehistoric resources, historic resources, and traditional cultural properties (TCPs) and practices. These types are not exclusive and a single cultural resource may have multiple components. Prehistoric cultural resources refer to any material remains, structures and items used or modified by people before the establishment of a Euroamerican presence in the region. Historic cultural resources include architectural resources and other material remains and landscape alterations that have occurred since the arrival of Euroamericans in the region. TCPs and practices refer to places or activities associated with the cultural heritage or beliefs of a living community and that are important in maintaining cultural identity.

Regulatory Setting

The identification of cultural resources and Reclamation responsibilities with regard to cultural resources are addressed by a number of laws, regulations, executive orders, programmatic agreements and other requirements. The principal Federal law addressing cultural resources is the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 USC Section 470), and implementing regulations (36 CFR 800), that describe the process for identification and evaluation of historic properties; assessment of the effects of Federal actions on historic properties; and consultation to avoid, reduce, or minimize adverse effects. The term "historic properties" refers to cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP). This process does not require preservation of historic properties, but does ensure that the decisions of Federal agencies concerning the treatment of these places result from meaningful considerations of cultural and historic values and of the options available to protect the properties.

Under the NHPA, cultural resources undergo an evaluation process to determine whether a resource is eligible for listing on the NRHP. Resources that are already listed, determined eligible for listing, or are undetermined are afforded a level of consideration under the NHPA Section 106 process. Undetermined resources are those for which eligibility cannot be determined based on current knowledge of the resource and where further work is needed to make an evaluation.

In order to be determined eligible for listing on the NRHP, a resource must meet one or more of the following criteria (36 CFR Part 60):

Criterion A – associated with events that have made a significant contribution to the broad patterns of our history.

Criterion B – associated with the lives of persons significant in our past.

Criterion C – embodies the distinctive characteristics of a type, period, or method of construction.

Criterion D – yielded or may be likely to yield information important in prehistory or history.

The resource must also retain most, if not all, of seven aspects of integrity: location, design, setting, workmanship, material, feeling, and association.

The identification and evaluation of cultural resources for NRHP-eligibility is the responsibility of the lead Federal agency with the concurrence of the State Historic Preservation Officer (SHPO), in this case the California Office of Historic Preservation (OHP). The Advisory Council on Historic Preservation (ACHP), an independent Federal agency, administers the provisions of Section 106 of the NHPA regarding cultural resources and has review and oversight responsibilities defined in 36 CFR 800.

Additional cultural resource management responsibilities of Reclamation are addressed in other sections of the NHPA. It should be noted that the provisions of the NHPA refer only to cultural resources that are tangible properties and that Federal agencies are required by other statutes to consider impacts on traditional cultural and religious practices.

Other major Federal laws, regulations, and executive orders which outline Reclamation's cultural resource responsibilities include: the Archeological Resources Protection Act (ARPA) (16 USC 470aa-47011), the American Indian Religious Freedom Act (AIRFA), as amended (42 USC 1996-1996a), NEPA (42 USC 4321-4370c), Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001-3013), Executive Order 11593 - *Protection and Enhancement of the Cultural Environment*, Executive Order 13006 - *Locating Federal Facilities in Historic Properties in Our Nation's Central Cities,* Executive Order 13007 - *Indian Sacred Sites*, Executive Order 13084 - *Consultation and Coordination With Indian Tribal Governments*, and Presidential Memorandum: *Government-to-*

Government Relations with Native American Tribal Governments. The role of Reclamation is to ensure that the process of water contract renewals is conducted in compliance with these standards and to ensure that provisions are in place for subsequent compliance by the water contract agencies. With little exception, virtually all of the potential effects to cultural resources related to water contract renewal arise from subsequent decisions under non-federal jurisdiction.

City and county governments have been granted some regulatory power to list and provide limited protection of cultural resources. This authority is usually exercised in the local permitting process for specific projects and guided by General Plans or similar documents. These water districts are within counties that all have General Plans with provisions for the recognition and protection of cultural resources in future development. The responsibilities of local jurisdictions to address effects to cultural resources through permitting are generally triggered by compliance with the California Environmental Quality Act (CEQA). CEQA guidelines addressing the significance of impacts to cultural resources are outlined in Title 14, Chapter 3, Section 15064.5. The criteria for consideration of resources under CEQA are similar, but somewhat broader than the Federal standard. California maintains a "Register of Historical Resources" which includes all NRHP-listed properties, all California Registered Landmarks, as well as other formally nominated properties. Consideration is also afforded to resources included in local historic registers and to those resources that the CEQA lead agency determines meets the requirement for listing on the California Register (Public Resources Code SS5024.1, Title 14 California Code of Regulations, Section 4852). California also designates Points of Historical Interest, which are markers placed at historic locations to interpret past events to the public. Listing on a state or local register does not imply that a resource would not meet Federal NRHP criteria; only that formal action has only been taken on a local level.

During the preparation of the PEIS, Reclamation investigated the possibility of conducting Section 106 consultation on a programmatic basis. It was determined in consultation with the OHP that Reclamation should address its Section 106 responsibilities on a project-specific basis (Reclamation 1999).

Cultural Setting

Prehistoric Overview

The Sacramento River Division is west of the Sacramento River and includes portions of Tehama, Glenn, Colusa and Yolo Counties. The Sacramento River Division is part of the Sacramento River Valley, an area rich in the evidence of prehistoric and historic use. Before extensive reclamation projects, the valley bottomlands experienced seasonal flooding which produced lush vegetation and attracted abundant wildlife. The waterways provided habitat for fish and mussels. Outside of the river corridors there were grasslands, oak groves and other plants. These resources were extremely attractive to prehistoric inhabitants and there is evidence of regional human use that dates back to around 6,000 B.C. (Reclamation 1999).

Recognition of the archaeological potential of the western Sacramento Valley occurred early. Regional archaeological research began in 1907 with surveys of mounds near Tehama and Red Bluff by Nels Nelson. Other researchers from UC Berkeley excavated sites in Colusa County in the 1930s. In 1951 a burial of probable great antiquity was excavated at a depth of almost 2 meters near Capay in Yolo County. Because of alluvial action, Sacramento Valley archaeological remains are often buried under natural sediments of considerable depth. Reconnaissance and salvage archaeology conducted during the 1950s and 60s for construction of water delivery and storage facilities provided much of the archaeological data used in attempts to synthesize the prehistory of the region. Excavations were conducted of cemeteries, and midden (trash heap) sites at the Red Bluff and Black Butte reservoir sites (Moratto 1985). Many of these sites date to the late prehistoric period; consequently older manifestations remain poorly known. Archaeological work in recent years has been most extensive on public lands. It would be anticipated that numerous undiscovered and deeply buried prehistoric sites are located on agricultural lands in the subject water service areas.

Several cultural chronologies have been proposed to describe the prehistory of the western Sacramento Valley. In recent years, there has been an emphasis on describing local developments and dividing the area into a number of geographic districts and defining a succession of cultural or temporal phases. While this represents a refinement of archaeological study, it often obscures larger trends. Dave Fredrickson has formulated a model for tracing the overall pattern common to the prehistory of Central California. He defined several patterns that indicate a general way of life shared by people without imposing strict temporal implications. Smaller descriptive units called aspects and phases are defined in terms of distinctive features, which are local manifestations. As described below, the patterns relevant to Sacramento Valley prehistory are the Windmiller, Berkeley, and Augustinian Patterns (Moratto 1985).

The Windmiller Pattern is primarily a hunting and fishing economy. The artifact assemblage includes highly developed flaked and groundstone industries, polished charmstones, baked clay artifacts, twined basketry, *Haliotis* and *Olivella* shell ornaments and beads. There was some utilization of seeds and acorns, but it was not as extensive as later. Groups occupying the Sierra foothills (Moratto 1985) may have used the Sacramento Valley in the winter months.

The Berkeley Pattern focuses on acorns as a dietary staple. Relatively more mortars are found indicating a shift to this dependable, but labor intensive food source. Changes in the form of points and shell ornaments are noted and more bone tools and ornaments are found. There are fewer grave goods associated with the Berkeley Pattern internment than with Windmiller burials (Moratto 1985).

The Augustinian Pattern is distinguished by sites with evidence of intensive fishing, hunting, and acorn gathering. There is a shift toward densely populated villages, highly developed exchange systems, ceremonialism, social stratification, cremation, and preinternment burning of grave goods. Artifacts include shaped mortars and pestles, bone awls and the use of the bow and arrows. Augustinian Pattern in the Sacramento

Valley is associated with the migration southward of Wintun peoples, bringing with them new cultural traditions and technologies (Moratto 1985).

An extensive discussion of regional prehistory was prepared in support of the PEIS from which this EA is tiered. The reader is directed to the Cultural Resource Appendix of the Draft PEIS for further information (Reclamation 1997).

Historic Overview

EuroAmericans came later to interior California than they did to the Pacific coast or the Southwest. By 1776 Jose Canizares had explored areas south of present day Sacramento (Wilson and Towne 1978). In the early years of the 19th century, the missions established by the Spanish on the coast were losing populations due to disease and flight. Expeditions were organized to the interior to recapture fugitives and punish groups harboring mission escapees. Though not conclusive, the evidence strongly suggests that these military expeditions did capture native inhabitants of the Sacramento Valley for resettlement at the missions (Jackson 1994). Active native resistance led to a major battle in 1813 between the Spanish under Luis Arguello and Miwok tribelets near the mouth of the Consumnes River to the south (Wilson and Towne 1978). In 1833, a great epidemic swept through the Sacramento Valley wiping out entire villages (Wilson and Towne 1978).

In 1848, the discovery of gold on Sutter's holdings in Coloma caused rapid change to all of California. Literally hundreds of thousands of people immigrated to the gold fields causing widespread destruction of what was left of native culture and resource base. In 1850 the California Indian Indenture Act, permitted, in effect, the enslavement of Native Americans. Kidnapping and selling of Indian women and children was common, as were massacres (Heizer 1974).

The agricultural potential of the west Sacramento Valley was recognized in the second half of the 19th century. Unreliable precipitation and the need for protection from periodic flooding limited further growth of agriculture in the region. A huge private irrigation enterprise was proposed in 1871 to address water shortages and agricultural irrigation in the Central Valley. Enthusiasm and investment for this project evaporated quickly, but in the 1930s the State of California proposed the State Water Project (Pisani 1992). The basic concept and facilities outlined by the State Water Project were approved and built by the Federal government beginning in 1935. The storage, delivery, power generation and flood control facilities of the Central Valley Project were constructed over the next 40 years. Farmers in the irrigation districts are assessed for system construction and water use. Reliable irrigation allowed the development of new crops including rice in the Sacramento Valley.

In contrast to other parts of California, regional growth has been steady throughout the 20th century with no large metropolitan areas developing. Agriculture remains the most important industry.

Ethnographic Overview

At the time of European contact, the area now included in the Sacramento River Division was primarily within the territory of the Wintun-speaking peoples. Linguistic analysis divided the Wintun speakers into the Wintu, Nomlaki and Patwin groups. The Wintu were primarily north of Cottonwood Creek in the northern part of Tehama County. The Nomlaki lived primarily in the Sacramento Valley and the foothills of Tehama and Glenn Counties. The Patwin occupied areas adjacent to the river in Southern Colusa and northern Yolo Counties. The Northwestern Maidu or Konkow, a linguistically unrelated group, also occupied a portion of the river in northern Colusa and southern Glenn County.

These groups shared similar subsistence and settlement patterns in late prehistory and early historic times. The river and valley were rich in resources and allowed the growth of large concentrated populations. Deer, fish and acorns were the main dietary staples, which were supplemented by mussels, small mammals, birds and seasonally available plants. Each village or tribelet of villages controlled its territory, including hunting, fishing and plant gathering locations.

Each of these groups was terribly affected by a devastating epidemic in the Sacramento Valley in 1833, when whole villages were depopulated. The arrival of miners and other settlers brought further reductions in population, followed by the collapse of their economic and social base. Many survivors were removed to reservations or became part of the wage economy.

In recent years there has been a revival of interest in traditional religious practices and arts. Resources likely to be of concern to contemporary groups include village locations and burials, and gathering locations for traditional foods or resources needed for basketry and regalia.

An extensive discussion of regional ethnography was prepared in support of the PEIS from which this EA is tiered. The reader is directed to the Cultural Resource Appendix of the Draft PEIS for further information (Reclamation 1997).

Inventory of Cultural Resources

Inventory information specific to the individual water contractors has not been developed. Limited data are available for each of the counties. Formal surveys for prehistoric and historic archaeological resources in each of the counties are limited to a small percentage of the land area. Typically, an archaeological survey is conducted prior to development projects so it unlikely that much of the potentially affected agricultural land in the service area has been surveyed. The region is rich in prehistoric resources. Because of the low percentage of surveyed land and the relative lack of development, the potential for undiscovered and unrecorded archaeological sites is high (Reclamation 1997). Subsurface archaeological deposits may also occur below shallow disturbances, even in areas that have been inventoried.

Information on historic buildings and structures is generally more available, due to the visibility of these resources and public advocacy. Percentages of buildings and structures of historic age that have been surveyed in each of the counties are not available. Complete recordation of these resources would require archival research to determine historic associations or architectural significance, and field documentation to assess current historical integrity.

As part of their completion of the Section 106 process, Reclamation is required to consult with Indian tribes and other groups to identify any TCPs or traditional use areas (TUAs) that could be affected by the alternatives. Some archival ethnographic research was conducted in support of the PEIS to identify general areas that may be of importance to the Indian tribal groups in the area (Reclamation 1997). In compliance with 36 CFR 800.4(a) (4), Reclamation has sent letters to Indian tribes requesting their input regarding the identification of any properties to which they might attach religious and cultural significance to within the area of potential effect. To date no comments or formal responses have been received from the tribes.

Colusa County

Between two and three percent of Colusa County has been surveyed for archaeological resources. A total of 199 sites have been recorded. Of these, 84 are historic sites or have historic components. Prehistoric site types include habitation sites, temporary camps, artifact scatters, bedrock milling stations, quarries, cemeteries and trails. Prehistoric site densities are highest near the Sacramento River and tributary streams and in the vicinity of Grimes (Colusa County 1989). Historic archaeological resources include the sites of early settlements and agricultural activities, and refuse scatters (Reclamation 1997). The site of the Nowi Rancheria is the only archaeological resource that is formally listed on the NRHP. Many additional sites have been determined eligible for listing or are likely to meet the criteria for NRHP and/or California Register listing (National Park Service [NPS] 2000).

Four buildings are formally listed on the NRHP (NPS 2000). One of these, the Colusa County Courthouse, is also listed as a California State Landmark along with two other properties (OHP 1996). The California Inventory of Historical Resources lists six resources and includes three California Points of Historical Interest. Historic themes illustrated by these resources include aboriginal use, architecture, economic and industrial history, exploration and settlement, government, and religion (Reclamation 1997).

Glenn County

Between one and two percent of Glenn County has been surveyed for archaeological resources. Over 475 sites have been recorded. Of these, 101 are historic sites or have historic components. Prehistoric site types include habitation sites, temporary camps, artifact scatters, bedrock milling stations, quarries, ceremonial sites, cemeteries, and trails. Prehistoric site densities are highest near the Sacramento River and tributary streams. High site densities have also been recorded in higher elevation zones in the western part of the county, outside of the boundaries of the water service areas. Historic archaeological resources include the sites of early settlements, homesteads, ranches and agricultural

activities, and refuse scatters (Glenn County 1993b; Reclamation 1997). No prehistoric or historic archaeological resources are formally listed on the NRHP, but many additional sites have been determined eligible for listing or are likely to meet the criteria for NRHP and/or California Register listing (NPS 2000).

The Gianella Bridge and the Willows Post Office are the only historic buildings or structures formally listed on the NRHP (NPS 2000). Two additional properties, the Swift Adobe and site of the first posted water notice, are listed as California State Landmarks. The first water posting site marks the Sacramento River location where water was diverted for irrigation on the west side of the Sacramento Valley (OHP 1996). The California Inventory of Historical Resources lists 17 resources. The county also includes 17 California Points of Historical Interest. Historic themes in the county include economic and industrial history, exploration and settlement, and government (Reclamation 1997). TCPs and TUAs have been identified in studies conducted in the Mendocino National Forest, which includes part of the county (Glenn County 1993b).

Tehama County

Approximately two percent of Tehama County has been surveyed for archaeological resources. Recorded site density is very high with over 1,615 recorded sites. Historic era sites or sites with historic components number over 200. Prehistoric site types include habitation sites, temporary camps, artifact scatters, milling stations, quarries, ceremonial sites and features, possible celestial alignments, petroglyphs, cemeteries, fishing sites, and trails. Many habitation sites are located on ridges near the numerous streams and creeks which cross the county. Prehistoric site densities are highest near the Sacramento River and other watercourses. Historic archaeological resources include the sites of early settlements and agricultural activities, and refuse scatters (Tehama County 1983; Reclamation 1997). Only one archaeological resource is formally listed on the NRHP, the Sulfur Creek Archaeological District, located near Mill Creek, east of the subject water service areas. Many additional sites have been determined eligible for listing or are likely to meet the criteria for NRHP and/or California Register listing (NPS 2000).

Eight buildings are formally listed on the NRHP (NPS 2000). Four additional properties are listed as a California State Landmark along with two other properties (OHP 1996). The California Inventory of Historical Resources lists 13 resources and the county also has 1 designated California Point of Historical Interest. Historic themes illustrated by these resources include architecture, economic and industrial history, exploration and settlement, government, military, religion, social and education (Reclamation 1997).

3.9.2 Environmental Consequences

Impact Assessment Methodology

Potential impacts to cultural resources, in general, are assessed by applying the criteria of adverse effect as defined in 36 CFR 800.5a. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion on the NRHP in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Some examples of adverse effect to cultural

resources include: physical destruction or damage; alterations not consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*; relocation of a property; isolation and restriction of access; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect resulting in deterioration; or transfer, lease or sale of historic properties without adequate protections. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative. Activities conducted under the alternatives are measured against the criteria of adverse effect to determine the potential for and intensity of impacts to cultural resources. Likewise under CEQA, a significant effect on the environment may result from actions that cause a substantial adverse change in the significance of an historical resource. The assessment of impacts to TCPs, TUAs, and cultural practices also requires a focused consultation effort with the affected community.

In the Section 106 process, Reclamation, as the lead Federal agency, is responsible for applying the criteria of adverse effect and in developing mitigation efforts to avoid or reduce any impacts. This is done in consultation with the SHPO and other consulting parties identified in 36 CFR 800. Prior to implementing individual actions, Reclamation will complete the Section 106 process for the water contract renewal undertakings.

No Action Alternative

The No Action Alternative would continue delivery of project water under terms consistent with the existing contracts. No direct impacts to cultural resources would be expected under the No Action Alternative. Renewal of long-term water service contracts between Reclamation and the Sacramento River Division contractors would not require any new construction or other activities that could directly disturb the integrity of known or unrecorded cultural resources in the service area. Actions by Reclamation under this alternative are within the range of existing conditions.

Indirect impacts to cultural resources could result from the renewal of long-term water service contracts under the terms of the No Action Alternative if it leads to changes in agricultural practices or land use. Certain crops require more ground disturbing activities than others do and changes in land use can cause effects to cultural resources. These effects may be either positive or negative depending on the presence of resources, location, and other factors associated with the changes. Renewal of long-term water contracts is one of many factors that could influence decisions in agricultural practices or land use. The potential for cultural resource impacts related to this alternative is speculative and dependent on future decisions by other parties. Since the No Action Alternative represents a continuation of current quantities of water delivery and pricing terms, it would be expected to have the smallest potential of the alternatives for influencing decisions on future agricultural practices and land use.

Alternative 1

Alternative 1 is assumed to have similar effects to cultural resources as the No Action Alternative. Therefore, no adverse environmental impacts are expected.

Alternative 2

No direct impacts are anticipated to cultural resources as a result of Alternative 2. Alternative 2 does not include any provisions for any new construction or other activities that could directly disturb the integrity of known or unrecorded cultural resources in the districts. Actions by Reclamation under this alternative are within the range of existing conditions.

Indirect impacts to cultural resources could result from the renewal of long-term water service contracts under the terms of Alternative 2. Implementation of Alternative 2 may decrease the quantity of water delivered to the contractors due to the increased cost of water. These changes may contribute to changes in crops grown or patterns of land use in the service areas. Changes in agricultural practices and land use may affect cultural resources either positively or negatively depending on the presence of resources, location, extent of ground disturbance and other factors associated with the changes. Renewal of long-term water contracts is one of many factors that could influence decisions in agricultural practices or land use.

The potential for cultural resource impacts related to this alternative is speculative and dependent on future decisions by other parties. It can be inferred, however, that this alternative would be associated with more potential for change than the others would, because it could affect the economic viability of some current agricultural practices. Anticipated changes could include removing land from agricultural production of water intensive crops such as rice; it is anticipated that in 2030 about 10,683 acres of rice are projected to be fallowed in an average hydrologic year following five dry hydrologic years (see Section 3.2, Agricultural Economics). If land currently planted in rice is left fallow, there may be a beneficial effect to the preservation of archaeological resources present. However, if this land is not managed to prevent erosion, there could be impacts to archaeological resources present. If land taken out of agricultural use is developed for commercial, industrial or housing uses; there could be impacts related to ground disturbing activities.

Specific actions that lead to changes in land use or new construction would require the identification of resources, evaluation of eligibility, and determination of effects to historic properties. Mitigation plans, if required, would be developed in consultation with the SHPO and the Advisory Council.

3.9.3 Cumulative Impacts

Renewal of long-term water contracts under any of the alternatives is one of many factors that could influence decisions in agricultural practices or land use in the water service areas. Demographic, economic, political, and a variety of other issues, independent of the contract renewal, are causing changes with direct and indirect effects to cultural resources. The contribution of the water renewal contracts under the terms of the alternatives would be a minor factor in decisions that could cause impacts to cultural resources in the service areas.

3.10 GEOLOGY AND SOILS

3.10.1 Affected Environment

Geologic Setting

The Sacramento River Division study area is located within the Sacramento Valley physiographic province, with portions of the study area bordering on the Coast Range physiographic province. In terms of landscape features, the northern valley portion (generally north of Stony Creek) is dominated by highly eroded (dissected) uplands, while the southern portion (known as the Colusa Basin) is predominantly low alluvial plains and alluvial fans, with dissected uplands on its western margin (Poland and Evenson 1966). Thus, the Corning Canal water districts, which lie north of Stony Creek, and the TCC water district service areas furthest to the west of the study area lie in areas affected by rapid runoff and soil erosion problems.

The most important economic mineral deposit in the study area is natural gas. Relatively large deposits of natural gas have been identified in the Willows area (Orland-Artois, Glide, and Kanawha water districts), and in the vicinity of Arbuckle (Hart 1966).

Two potentially active faults are present in the study area. The Corning Fault runs adjacent to and parallel to the Corning Canal from Red Bluff to a point south of Artois. Further to the south is the Dunnigan Hills Fault, which runs the length of the Dunnigan Water District, along the west side of Interstate highway 5. Neither fault has been active within the past 200 years (Jennings 1994).

Soils

Soils throughout the study area tend to be clayey (clay and silt loams), with slow infiltration rates and rapid run off (NRCS 2000). This means that precipitation tends to run off rather than infiltrate into the soil, and this can result in erosion problems. Soils on the basin margins tend to have slower infiltration rates than soils on flatter lands toward the center of the basin.

Service areas in which the predominant soils are more permeable and have higher infiltration rates than the average throughout the region, include the Colusa, Dunnigan, and Cortina water districts. Service areas in which the soils have predominantly lower permeability and slower infiltration rates than average include the 4-M, Glenn Valley, La Grande and Holthouse water districts, and the western parts of the Westside, Kanawha, Glide, and Orland-Artois water districts.

3.10.2 Environmental Consequences

No Action Alternative

Soils

Soil characteristics, including slope, permeability, water holding capacity, and other variables, influence and limit irrigation practices and types of crops that can be grown

on the land. Soil and slope are therefore important factors in the economics of farming a given parcel of land. Soil characteristics are taken into account in the water needs assessment used by Reclamation to estimate crop water use (see Section 3.2). Soil characteristics are also taken into account by the CVPM used to estimate future cropping and water use decisions of farmers in response to changes in water rates.

The agricultural economic analysis (Section 3.2) indicates that under the No Action Alternative, in average hydrologic conditions, approximately 95,300 acres would be irrigated in the year 2030. This represents a small reduction in acreage compared to the 106,110 acres irrigated in 1996. By contrast, the CVPM indicates that under dry hydrologic conditions, a total of about 81,700 acres would be irrigated by the year 2030.

Reductions in irrigated acres are likely to be temporary, and would primarily affect deciduous orchards, rice, and row crops, which require frequent and relatively heavy irrigation. Reductions would be greatest in the TCC districts. Within the TCC area, the largest percentage decreases during dry hydrologic conditions would occur in service areas with lands furthest west of the canal and with the poorest soils. These include the 4-M, Glenn Valley, Holthouse, Davis, and La Grande water districts, and also the Kanahwa and Westside water districts.

Under prolonged dry conditions, some of the marginally productive lands might be permanently withdrawn from irrigation. Fallowing and permanent withdrawal of land that has been cultivated could result in increased potential for soil erosion, if the land were not managed to prevent it. Cultivated soils tend to lose stratification and structure, reducing their resistance to natural erosion processes. However, watershed management programs designed to reduce soil erosion have already been initiated within the study area, and it is likely that management practices would be implemented that would reduce the potential for impacts.

Alternative 1

Soils

Water use and cropping patterns under Alternative 1 are not expected to differ substantially from the No Action Alternative. Therefore, additional impacts on soils are expected compared to the No Action Alternative.

Alternative 2

Soils

Results of CVPM modeling presented in Section 3.2 indicate that Alternative 2 would result in a reduction of approximately 65,000 irrigated acres in a scenario in which five dry years are followed by an average year. The reduction is relative to the number of acres expected to be irrigated under the No Action Alternative in dry hydrologic conditions at the end of year 2030. It must be kept in mind that such a comparison is most valid for the case in which average conditions have prevailed until the year 2021, and the dry conditions occurred from 2021 through 2030, with an average water year in

2030. However, if the 5-year dry period occurred early in the study period, then the amount of land irrigated in subsequent years would probably continued to decline, making the impacts of Alternative 2 more severe in the year 2030 than the model suggests.

In any event, the model results show that the amount of land receiving irrigation under Alternative 2 is highly sensitive to antecedent dry conditions. If approximately 65,000 acres were taken out of irrigation, it would likely have a severe effect on soils. As discussed under the No Action Alternative, cultivation tends to remove soil structure, making the soil more vulnerable to both wind and water erosion. If large tracts of land were taken out of irrigation relatively rapidly, it would be difficult to manage the land to prevent erosion. Under dry conditions, vegetation cover would be reduced and natural cover might be slow to re-establish itself. Areas that have been filled and leveled for farming would be particularly susceptible to water erosion during winter rains.

3.10.3 Cumulative Impacts

Reductions in irrigated land might also occur in adjacent, downslope farm areas, most notably in the Glenn-Colusa Irrigation District. Reduced return flows and reduced groundwater recharge could result from the reductions in irrigation of the Sacramento River Division lands, reducing the amount of water available to farmers on downslope lands. Farmers of adjacent lands could be affected by increased water costs similarly to the farmers within the study area. Thus, if soil loss affected the region as a whole, any resources available for addressing soil erosion problems might have to be spread thinly, reducing the chances of successful implementation.

Depending on the timing of dry hydrologic conditions and the sensitivity of declines in water purchases to the price of water, the rate structure of Alternative 2 could result in a cumulative impact on water prices, accelerating reduction in water use as the cost of the water is allocated among fewer and fewer water users over time. As farmland is withdrawn from production, there would be a potential for soil erosion. Therefore, any cumulative impact on water prices would result in a similar cumulative increase in potential for soil erosion.

3.11 AIR QUALITY

3.11.1 Affected Environment

Ambient Air Quality

The EPA has established ambient air quality standards for several different pollutants, which are often referred to as criteria pollutants (ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, inhalable particulate matter [PM_{10}], and lead). Federal ambient air quality standards are based primarily on evidence of acute and chronic health effects. California also has adopted ambient air quality standards, some of which are more stringent than the comparable federal standards.

The federal Clean Air Act requires each state to identify areas that have ambient air quality in violation of federal standards. States are required to develop, adopt, and implement a State Implementation Plan (SIP) to achieve, maintain, and enforce federal ambient air quality standards in these nonattainment areas. Deadlines for achieving the federal air quality standards vary according to air pollutant and the severity of existing air quality problems. The SIP must be submitted to and approved by EPA. SIP elements are developed on a pollutant-by-pollutant basis whenever one or more air quality standards are being violated.

The air pollutants of greatest concern in the Sacramento Valley are ozone and PM_{10}. Ozone concentrations in the middle and northern part of the Sacramento Valley periodically exceed state standards, but seldom exceed the federal ozone standard in the west Sacramento Valley. PM_{10} concentrations throughout the Sacramento Valley periodically exceed state standards but do not exceed federal standards outside of Sacramento County. The Yolo County portion of the study area is considered a nonattainment area for the federal ozone standard, but other portions of the study area are considered attainment areas for both the ozone and PM_{10} standards.

Ozone is not emitted directly into the air but forms through chemical reactions that involve nitrogen oxide emissions and reactive organic compound emissions. Ozone is a strong oxidizing agent that reacts with a wide range of materials and biological tissues. Ozone is a respiratory irritant that can cause acute and chronic effects on the respiratory system. In addition, ozone causes major damage to leaf tissues of crops and natural vegetation and also damages many materials by acting as a chemical oxidizing agent.

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for measurable periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns. PM_{10} can be generated as a primary pollutant by abrasion or erosion processes. PM_{10} also can form as a secondary pollutant through chemical reactions or by gaseous pollutants condensing into fine aerosols.

Many components of suspended particulate matter are respiratory irritants. Some components are primarily physical irritants; others are chemical irritants (such as

sulfates, nitrates, and various organic chemicals). Suspended particulate matter also can contain toxic or carcinogenic compounds (such as heavy metals and various organic compounds).

Regulatory Considerations

Section 176(c) of the Clean Air Act requires federal agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the Clean Air Act and with federally enforceable air quality management plans. EPA has promulgated separate rules that establish conformity analysis procedures for highway/mass-transit projects and for other (general) federal agency actions. General conformity requirements are potentially applicable to most other federal agency actions but apply only to those aspects of an action that involve ongoing federal agency responsibility and control over direct or indirect sources of air pollutant emissions.

The EPA conformity rule establishes a process that is intended to demonstrate that the proposed federal action:

- Would not cause or contribute to new violations of federal air quality standards;
- Would not increase the frequency or severity of existing violations of federal air quality standards; and
- Would not delay the timely attainment of federal air quality standards.

The EPA general conformity rule applies to federal actions occurring in nonattainment or maintenance areas when the net increase in total direct and indirect emissions of nonattainment pollutants (or their precursors) exceeds specified thresholds. The emission thresholds that trigger requirements of the conformity rule are called "de minimis" levels. Only the Yolo County portion of the study area is subject to the EPA general conformity rule. The conformity de minimis thresholds for the Yolo County portion of the study area are 50 tons per year of reactive organic compounds and 50 tons per year of nitrogen oxides.

3.11.2 Environmental Consequences

No Action Alternative

The No Action Alternative would continue CVP water deliveries to the contractors under the terms of current contracts. Water delivery systems are not in themselves major sources of air pollution emissions. The only identifiable sources of emissions would be vehicles used for periodically inspecting or maintaining system facilities. Emission quantities from such sources are small, and would continue essentially at past levels. Thus, there would be no net increase in these emissions under the No Action Alternative.

There is no reason to expect that continuing CVP water deliveries to the contractors would result in any major changes in cropping patterns or agricultural management

practices in the service areas. Thus, the No Action Alternative is not expected to have any indirect effects on air pollutant emissions associated with agricultural land use practices (emissions from agricultural equipment or burning or pesticide use or from fugitive dust).

The No Action Alternative would not be subject to the EPA Clean Air Act conformity rule because there would be no net increase in direct or indirect emissions from sources that are under federal agency control.

Alternative 1

Alternative 1 is assumed to have similar air quality effects as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Alternative 1 would not be subject to the EPA Clean Air Act conformity rule because there would be no net increase in direct or indirect emissions from sources that are under federal agency control.

Alternative 2

Air quality impacts associated with Alternative 2 would be similar to those under the No Action Alternative. Water delivery systems are not in themselves large sources of air pollution emissions. The only identifiable sources of emissions would be vehicles used for periodically inspecting or maintaining system facilities. Emission quantities from such sources are small and would continue essentially at past levels. Fugitive dust emissions, however, would be expected during cultivation or harvesting.

Under Alternative 2, it is anticipated that about 65,000 acres or approximately 68 percent of the service area is projected to be fallowed in an average hydrologic year following five dry hydrologic years. This change in cropping patterns is anticipated to result in increases in ozone precursor emissions (from fugitive dust). However, the indirect effects of altered crop patterns on air pollutant emissions associated with agricultural land use practices are not expected to have a noticeable impact on overall air quality conditions in the Sacramento Valley.

Alternative 2 would not be subject to the EPA Clean Air Act conformity rule because there would be no net increase in direct or indirect emissions from sources that are under federal agency control.

3.11.3 Cumulative Impacts

Implementation of Alternatives 1 and 2 would not contribute to cumulative air quality impacts.

3.12 VISUAL RESOURCES

3.12.1 Affected Environment

Physical form and visual character are the result of the interaction of natural and engineered elements. Natural elements, including topography, hydrology, vegetation, and climate, create the basic physical context. Engineered elements, including buildings, roads, infrastructure, and settlement patterns, are secondary elements that act on the natural context to establish a particular physical or visual environment.

Landscape Character Types

Landscape character types are described based on State of California Natural Landscape Provinces (USFS 1976) and are represented by seven immense provinces with similar physiographies; that is, combinations of landform, vegetation cover, and surface water bodies. A province's landscape character types are based on its total visual character; no single physical characteristic dictates character type, although landform has a stronger influence than other characteristics (Reclamation 1997).

The west Sacramento Valley is encompassed by the Central Valley Province, which is characterized as predominately lowlands and plains with few hills. This province is mostly agricultural, with areas of wetlands and oaklands, riparian areas along the major watercourses, and numerous small communities throughout the valley.

Wild and Scenic Rivers

Congress created the National Wild and Scenic Rivers System in 1968 (Public Law 90-542; USC 1271 *et seq*.) to preserve rivers and outstanding natural, cultural, or recreational features in a free-flowing condition. High priority is placed on visual resource management of these rivers to preserve or restore their scenic characteristics.

California has its own system of protected rivers. The California Wild and Scenic Rivers System consists of rivers and river segments established by legislative action because of the extraordinary scenic, recreational, fishery, or wildlife values that the rivers or segments possess in their free-flowing condition.

From the viewpoint of visual resources assessment, all rivers designated as wild, scenic, or recreational by the federal government or state of California are regarded as having high scenic quality. None of the streams in the Sacramento River Division are identified under either the national or state wild and scenic river systems.

Scenic Highways

Scenic highways are roads designated as scenic by California or local agencies. Scenic highways are recognized as having exceptional scenic qualities or as affording panoramic vistas. There are no officially designated state or local scenic highways in the Sacramento River Division (Caltrans 2000). However, one roadway—State Route 16 in Yolo County, approximately 10 miles west of the Dunnigan Water District—is eligible for designation in the project area (Caltrans 1992, as cited in Reclamation 1999). The portion of State Route 16 from the Yolo-Colusa county line south to Capay is

considered a Yolo County scenic highway because it affords views of chaparral, woodland, and grassland areas and unusual rock formations (Yolo County 1983).

3.12.2 Environmental Consequences

Impacts to visual resources depend primarily on changes in cropping patterns, which may result in increased fallowed lands and associated modified agricultural viewsheds.

No Action Alternative

Under the No Action Alternative, total irrigated acreage within the service area is projected to be approximately 95,300 acres in 2030 under average hydrologic conditions. Viewsheds in the project area would remain predominately agricultural in nature.

Alternative 1

Alternative 1 is assumed to have similar effects to visual resources as the No Action Alternative. Therefore, there are no environmental impacts of this alternative.

Alternative 2

Under Alternative 2, of the approximately 95,300 acres of irrigated land within the service area directly affected by long-term CVP contract renewal, about 65,000 acres or approximately 68 percent is projected to be fallowed in an average hydrologic year following five dry hydrologic years (see Section 3.2, Agricultural Economics). The largest reduction in acreage for a single crop type (13,838 acres) would be field crops. The magnitude of this type of change in agricultural cropping patterns is expected to change the current viewshed in the service area from one characterized by the varying pattern and texture of various agricultural crops and orchards to one characterized by flat fallow plains.

3.12.3 Cumulative Impacts

Implementation of Alternatives 1 and 2 would not contribute significantly to cumulative impacts to visual resources.