# Land Use

# Appendix E

Trinity River Mainstem
Fishery Restoration

October 1999

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Appendix E

# 1.0 LAND USE

Land uses within the Trinity River Basin, Lower Klamath River Basin/Coastal Area, and Central Valley vary greatly given the difference in population, development, and general economy of each area. Land use within the Trinity River Basin and the lower Klamath Valley is greatly influenced by land held in public ownership or by Indian tribes. Private uses along the Trinity and Klamath Rivers are generally limited to scattered residential development. Land use within the Central Valley is more diverse, but is dominated by agriculture on privately held lands.

A summary of impacts (compared to No Action) is presented for each alternative in Tables E-1A, E-1B, and E-1C (all tables and figures located at the end of this appendix).

This section describes the primary land uses within each area with regard to, residential/ municipal and industrial (M&I),agriculture, and real estate. Only those areas that are expected to be impacted by the proposed action and alternatives are discussed.

# 1.1 RESIDENTIAL/MUNICIPAL AND INDUSTRIAL

This section provides an analysis of the municipal and residential environment in several regions focusing on key factors and characteristics that might be affected by Trinity River fisheries restoration alternatives. The major issues involve flood control and M&I water supply. Central Valley Project (CVP) M&I contract supplies may be affected by fisheries restoration actions on the Trinity River. An analysis of M&I water costs is conducted to show how costs of water are affected by the alternatives.

## 1.1.1 Affected Environment

The affected environment includes areas served or otherwise affected by CVP M&I contract water, areas protected by CVP flood control, and persons who live or work in these areas or closely related municipal economies.

### 1.1.1.1 Trinity River Basin

The Trinity River Basin study area consists of the majority of Trinity County, the easternmost portion of Humboldt County, and the majority of the Hoopa Reservation. The largest town in the Trinity River Basin is Weaverville, followed by Hoopa (which is located in Humboldt County), Hayfork, and Lewiston. Table E-2 shows the 1990 populations for the largest communities in the River Basin. The population of Trinity County was 13,400 in

1995 (compiled by the Watershed Research & Training Center from Census data). Humboldt County had a larger population (124,500 for 1995) and lower rates for unemployment (8.3 percent) because of Humboldt County's more diversified economy; however, the portion of the County included within the study area is very lightly populated.

Urban development within the Trinity River Basin is primarily limited to the communities of Weaverville, Lewiston, Junction City, and Willow Creek. Development potential of the overwhelming majority of acres in the watershed is restricted by topography, public ownership, Timber Production Zone zoning (which applies to most private land), and by county and tribal planning policies that guide development towards already developed areas and discourage development on resource lands. Several small communities exist along State Highway 299 on shallow terrain adjacent to the river. This development has been primarily residential in nature, typified by scattered single-family residences and mobile homes.

Much of this residential development has encroached on the floodplain of the Trinity River and some of its tributaries. Accordingly, flooding of some homes and bridges occurs during heavy storm events. The Trinity County Planning Department no longer allows development within the 100-year floodplain of the Trinity River.

In December 1996, the California Department of Water Resources (DWR) conducted an evaluation of flood risk from various flow releases from Lewiston Reservoir. The investigation determined the risk on bridges, houses, and other properties within the most developed portions along the river. These areas are generally limited to the area between Douglas City and Lewiston, although a limited number of other private properties are located adjacent to the river. Table E-3 shows the number of parcels located in flood areas along the Trinity River. The study site locations are shown on Figure E-1 (located at end of this appendix).

The Hoopa Valley Indian Reservation is located north of Willow Creek along the Trinity River and State Highway 96. The reservation is approximately 140 square miles, with the northern border lying near Weitchpec at the confluence of the Klamath River. Water diversions in the watershed serve a variety of uses including domestic, irrigation, agricultural, and mining. The majority of the diversions are located along the Trinity River around the population centers of Junction City and Willow Creek. Other diversions are located on tributaries such as South Fork, Hayfork Creek, Canyon Creek, New River, and Weaver Creek. The Trinity River Basin does not receive any CVP M&I contract supplies.

### 1.1.1.2 Lower Klamath River Basin/Coastal Area

The lower Klamath River flows entirely within the boundaries of the Yurok Indian Reservation, which comprises about a quarter of the watershed. The reservation extends from the northern border of the Hoopa Reservation along the Klamath River and State Highway 169 to the Pacific Ocean near Requa. Population in the overall watershed is 1,900, the majority of which are in the lower river area in or near the towns of Klamath Glen, Klamath, and Requa and along Highway 101. The primary commercial activities are tourism, forest management, and fishing. A gravel mine near the mouth of the Klamath River is the sole industrial operation. The predominant land use in the watershed is forest management; development of most of the land not situated near the river is constrained by Timber Production Zoning, county, and tribal land use restrictions, topography, and public ownership. The annual value of (non-timber) commercial agricultural production in the lower Klamath watershed is less than 1 percent of the totals for Humboldt and Del Norte Counties.

### 1.1.1.3 Central Valley

The Central Valley region extends between the coastal ranges and the Sierra from north to south central California. The bases for the region's economy have been cattle, gold, agriculture, and services. The continued population growth in California and corresponding changes in land use and the economy have profoundly affected the Central Valley land and water resource base. Increased population has led to greater urban water demand and more urbanization of agricultural and other lands. Until recently, most urbanization in California occurred near the coastal cities. In the last decade, there has been a relative shift in new development from the coast to the Central Valley and inland deserts, and the rate of urbanization of Central Valley land has increased.

Table E-4 shows some of the consequences of these trends in terms of population and water use. The increase in population in the San Francisco Region between 1967 and 1990 was 27 percent, but population doubled in the Sacramento Valley and tripled in the San Joaquin Valley and North Coast Regions during this same period.

Urban water conservation measures have tended to reduce urban per capita use, but total municipal water use has increased with population. Use per capita has declined in all regions since 1980 except in the San Francisco Region. Smaller lot sizes, new home construction with water-saving features, and a shift to less water-intensive manufacturing have worked to reduce per capita use; but higher real incomes and more urbanization farther from the ocean have increased per capita use. Recent urban development in the San Francisco Region has centered more to the east where a warmer climate and increased residential lot size has increased average use.

Table E-5 shows the population of some metropolitan areas within the scope of the municipal land and water use analysis. The Bay Area, which may be affected through CVP San Felipe deliveries, is the largest metropolitan area within the study area. Sacramento, Fresno, and Stockton also receive CVP supplies. These metropolitan areas are discussed below in the context of their regions.

The CVP supplies M&I project water to more than 40 entities in the CVP service area under contracts that total approximately 500,000 af. Table E-6 shows CVP M&I contract water deliveries between 1983 and 1991. CVP M&I contracts are subject to curtailments in dry years.

In addition to those deliveries, the CVP must be operated to provide M&I water under state water rights and exchange contracts. Water rights of approximately 410,000 af and exchange contracts typically must be given priority over any other deliveries if requested. M&I exchange contract deliveries recently ranged from 43,000-55,000 af on the basis of rights of approximately 75,000 af. As further described in Water Resources Technical Appendix A, the Trinity Reservoir represents approximately 23 percent of the reservoir storage capacity of the CVP.

Use of CVP contracts by M&I contractors varies considerably. Some M&I users have used their full contract amounts in recent years; most are not expected to do so until sometime after the year 2000. Total use of CVP M&I contracts, water rights contracts, and exchange contracts could exceed 800,000 af as early as 2010.

Table E-7 shows existing conditions for 1990 water use and costs for the provider groups within the scope of the analysis. These data are discussed under the subheading for each region.

**Sacramento Valley**. Residential and M&I land uses are concentrated primarily around the City of Sacramento along the major highway corridors leading out of the city; near Redding and near Yuba City/ Marysville, Davis, and Woodland in Yolo County; Chico and Paradise in Butte County; and Vacaville in the Solano County area. The largest metropolitan area in the Sacramento Valley is Sacramento, including the cities of Sacramento, Orangevale, Carmichael, and Roseville. The Sacramento area accounts for most of the region's CVP M&I contracts, and most of this water is provided by the American River system. The Redding area in Shasta County in the northern Sacramento Valley is the second largest metropolitan area.

The Shasta group includes a number of CVP contractors on the upper Sacramento River, including Clear Creek Community Services District (CSD), Bella Vista Water District, Shasta CSD, Keswick CSD, City of Redding, City of Shasta Lake, Mountain Gate CSD, Shasta County Water Agency, and some miscellaneous small users. The City of Redding, with a population of about 65,000, has grown rapidly in recent years. Redding is an agricultural, transportation, and service center for the northern Sacramento Valley. The Sacramento Valley service area for urban water supply potentially affected by Trinity River restoration includes most of the Sacramento area and another area near Redding.

The Sacramento group includes West Sacramento, the City of Sacramento, the entire CVP service area near Sacramento, and the Placer County Water Agency. Folsom Dam and Reservoir and the Folsom South Canal of the CVP currently serve the Sacramento area with American River water. Table E-6 shows that deliveries have averaged over 60,000 af over the 15-year period 1983 through 1997. Major Folsom Dam and Reservoir water users include Roseville, San Juan Suburban, and El Dorado Irrigation District (ID). The Sacramento Municipal Utility District (SMUD) is the major owner of Folsom South Canal water. Sacramento obtains its water from the Sacramento River.

As the state capital, Sacramento provides a base for many state and federal government offices. Its location in proximity to major transportation corridors, including the Sacramento River shipping channel and Interstate 80, and a large, diverse economy make it the largest urban area in the Central Valley.

Residential development has had a major impact on Sacramento County as well as surrounding areas including Placer, El Dorado, Butte, Yolo, Solano, and Sutter Counties. During the 1980s, the Auburn and Sacramento areas were among the fastest growing areas in California.

Table E-7 shows water balance estimates for the Shasta and Sacramento groups based primarily on PROSIM results, 1990 normalized demands, and local supplies from DWR's

Bulletin 160-93, as well as the hydrologic model runs. The total amount of demand served in the Shasta group is about 108,000 af annually. The region has contracts for about 54,000 af of CVP contracts and water rights, which yield about 46,000 af on average. Other supplies, primarily groundwater, can normally meet the remaining demand. In the dry condition, average demand is slightly larger, and CVP deliveries and other supplies are smaller; so the annual deficit during the dry condition is about 12,000 af. Much of this deficit is accommodated by drought conservation and by increased use of groundwater.

The Sacramento area has an average annual M&I demand of 458,000 af, most of which is met with water rights delivered by the CVP and CVP contract water (308 taf). Other supplies, primarily groundwater, meet the remaining demand. Demand during the dry condition is estimated to be about 50,000 more than average, and CVP contract supplies are reduced. Some of the increased need for water can be met with increased groundwater pumping and other local supplies, and some of the remaining deficit (40,000 af) can be met with drought conservation. Some CVP water users in this region rely on CVP water for a large share of their supplies.

Retail water costs for the Shasta and Sacramento areas reflect some of the lowest in the state. The average cost of water service in the City of Sacramento was recently estimated to be $165 per af (Department of Water Resources, 1994b). Some of the residential water use in the region is not metered because residential housing built prior to 1992 was not required to install residential water meters. Typical retail water costs range from $200-400 per month depending on source and other cost factors. Water costs in areas served by CVP contract water are often higher than average.

Raw water costs paid by providers vary substantially by location. CVP cost of service rates typically range from $15-45 per af, and full cost is typically $25-65 (U.S. Bureau of Reclamation, 1996). Folsom South, Clear Creek CSD, and Bella Vista Water District pay costs in the higher range. The CVPIA will add at least $12 to these costs in the form of restoration payments. DWR (1994) reports that the cost of groundwater in the region ranges from $50-80 per af.

**San Joaquin Valley**. The M&I analysis includes several San Joaquin Valley cities with some current or planned use of CVP supplies. Potentially affected CVP water contracts are held by the cities of Avenal, Coalinga, Huron, Tracy, and other small users in the Delta-Mendota Canal and the San Luis Unit. The largest single city that obtains CVP supplies in the region is Fresno. Fresno and other Friant Unit M&I deliveries are unaffected by Trinity River actions. Stockton East and Modesto are also included in the group but are not expected to be affected by Trinity River actions.

Major urban centers in the San Joaquin River Basin include the cities of Fresno, Stockton, Modesto, and Merced (1990 population 55,700). DWR (1994) places most of the Fresno metropolitan area in the Tulare Lake Hydrologic Region. These cities are regional hubs for food transportation and processing. The cities of Tracy (1990 population 32,400) and Stockton have grown recently as a direct result of growth increases in the Bay Area. The cost of living is one factor attracting many Bay Area workers to live in the San Joaquin Valley.

Residential and M&I land use occurs primarily near the cities of Fresno, Stockton, Modesto, Merced, and Tracy. These cities are large industrial and transportation centers for food and grain processing. The City of Fresno is the major urban center for the San Joaquin Valley. Agriculture and food processing are still its major industries. Other industries include services, chemicals, lumber and wood products, glass, textiles, paper, machinery, and fabricated metal products.

Table E-7 shows estimated water balance for the region. Supplies include 60,000 af of CVP supplies delivered through the Delta-Mendota Canal (DMC), the San Luis Unit, and the Friant Unit. Most of these supplies are delivered to agriculture to replace groundwater pumped by the City of Fresno. Remaining supplies needed to meet demand in the region are 127,000 af. These supplies are mostly groundwater, although Stockton East supplies water from the Calaveras River. In the dry condition, only 52,000 af of CVP supplies and 99,000 af of other supplies are available, leaving a shortage of 43,000 af. Much of this shortage can be met by increased groundwater pumping and drought conservation.

Retail water costs in this region are generally low relative to the coastal regions of the state, ranging from $131 in Modesto to $485 in Tracy (DWR, 1994b). Much residential water use in the region is not metered.

Raw water costs paid by providers vary substantially by location. CVP cost of service rates typically range from $30-70 per af, and full cost is typically $50-100 (U.S. Bureau of Reclamation, 1996). The CVPIA will add at least $12 to the cost of CVP contract supplies and more in the Friant Division. DWR (1994) reports that the cost of groundwater ranges from $70-270 per af.

### 1.1.1.4 Bay Area

For this documentation, the Bay Area includes most of the San Francisco Bay area except for the North Bay and parts of the East Bay. The region includes San Francisco, Contra Costa, Santa Clara, San Benito, and San Mateo Counties. The largest city in the Bay Area in population is San Francisco, followed by San Jose. Oakland is not within the scope of this environmental documentation because water supplies would not be affected by Trinity River fisheries restoration actions. Table E-5 shows populations of primary metropolitan statistical areas within the Bay Area.

The Bay Area is potentially affected through the San Felipe Unit of the CVP and the Contra Costa Water District (CCWD). The San Felipe Unit delivers water to Santa Clara Valley Water District (SCVWD) and San Benito County Water District (SBCWD). Table E-6 shows that over the 11-year period 1987 through 1997, deliveries averaged over 64,000 af. SCVWD wholesales water in a large part of the south San Francisco Bay. San Francisco and State Water Project (SWP) entitlement holders in the region are potentially affected through interactions with SCVWD. SCVWD also uses SWP supplies, and some providers within the SCVWD service area also receive supplies through the Hetch-Hetchy system.

The CCWD provides CVP M&I water in Contra Costa County for the cities of Antioch, Martinez, Pittsburg, Concord, Walnut Creek, and other areas. CCWD diverts its supply from the Delta and is the single largest CVP M&I contractor with 195,000 af of contract.

Table E-6 shows that deliveries averaged about 130,000 af over the 15-year period 1983 through 1997. CCWD provides water to the east San Francisco Bay Region north and east of Oakland.

The Bay Area is extensively urbanized. Undeveloped parts of the region are located in the west, north, and south, but much of the remaining undeveloped land is protected from or unsuitable for development. In 1990, urban land uses (residential and M&I) accounted for about 25 percent of the land area.

Table E-7 shows estimated water balance for the region. For purposes of this report, the Bay Area does not include East Bay Municipal Utility District (EBMUD) or regions north of the Bay/Delta. In the 1990 development condition in an average year, 772,000 af of demand is exceeded by available supplies of about 908,000 af made up of 257,000 af from the CVP; 448,000 from Hetch-Hetchy and the SWP; and 203,000 af from local supplies. Excess supply is about 153,000 af in the average condition. In the dry condition, however, supplies are not sufficient to meet demand of about 792,000 af. CVP supplies are reduced to 227,000 af; Hetch-Hetchy and SWP supplies are reduced to 371,000 af; and local supplies fall to 141,000 af. Shortage averages 149,000 af annually during the dry condition.

The retail costs of water in the Bay Area are some of the highest in the state for large providers, ranging from about $400-800 per af (Table E-7). Raw water costs paid by providers vary substantially by location. 1994 revenues paid to Reclamation per af delivered in the SFD ranged from $133-169 per af (U.S. Bureau of Reclamation, 1996), and Contra Costa paid about $10 per af delivered. The CVPIA will add at least $12 to the cost of CVP contract supplies. DWR (1994) reported that the cost of groundwater for urban uses ranges from $85-330 per af.

## 1.1.2 Environmental Consequences

### 1.1.2.1 Methodology

The potential for flood damage was taken from an investigation conducted by the DWR. The Trinity River Damage Assessment - Lewiston to Douglas City was conducted to analyze potential damage associated with a number of potential peak flow releases from Lewiston Dam (Department of Water Resources, 1997). DWR utilized BOSS HEC-2 software, a version of the United States Corps of Engineer's HEC-2 model, to perform the hydraulic modeling. In May 1996, a constant flow of 5,000 cubic feet per second (cfs) was released from Lewiston Reservoir for several days to allow for model calibration through surveying a number of cross sections. This level was staked and surveyed at 59 cross sections within six separate sites, and the model was determined to be within 0.3 foot of the surveyed water elevation for 90 percent of the surveyed sites. The results of model runs are presented for the peak flows associated with each alternative.

The economic analysis of M&I water supply involves the costs of alternative supplies and end-user costs. PROSIM provides M&I contract deliveries for each alternative, and these deliveries are input to the M&I water supply economics model.

The economic analysis for each alternative includes both a long-run and a short-run analysis. The differences between these analyses are as follows:

- The short-run condition analysis estimates economic impacts during drought; the long-run analysis estimates impacts based on average supplies. The drought condition is the hydrology that occurred during the period of 1928 through 1934. The average condition is the period of 1922 through 1990.
- Most water supply facilities are fixed going into a drought because they have a long planning and construction horizon. The long-run analysis determines supplies to meet average conditions, and these supplies are also available during drought. This assumption is allowed because the alternative supply options considered can provide the same supply during drought as in average years.
- Retail customers are less willing and able to make adjustments in the short run than in the long run. This means the quantity of water demanded is less responsive to price during a drought than in the long run; demand is less elastic (more inelastic).
- In the long run, economic revenues must equal costs. Prices must respond to water sales and costs in the long run. The model calculates costs of additional supplies needed to meet demand where demand depends on water price and price depends on supply costs. In the short run during drought, the financial resources of providers can be drawn down. Most providers maintain contingency funds for use during drought. The model assumes that price is not affected by incremental costs of drought conditions.
- For purposes of economic analysis, shortage is defined as a situation in which water customers cannot take the quantity of water they want at the existing price. Shortage is not allowed in the long-run analysis. Shortage is allowed in the short-run analysis in the form of drought conservation. Drought water conservation is required before drought make-up supplies can be bought. Total dry condition costs are estimated as the costs of customer shortage, plus costs of new supplies, plus net revenue losses from reduced water sales.

Economic demand functions show the relationship between the price of a good and how much customers want to buy. Water demand functions have several purposes in the analysis. They define a maximum willingness to pay for alternative supplies, they calculate response to long-run price changes, and they determine costs of shortage in the drought condition. Retail water demand functions are obtained by using a baseline retail price and quantity of water to define a point, and an elasticity of demand defines the slope. The standard elasticity assumption for residential, government, and other unclassified demands (RGO) is -0.2 in the long run and -0.1 in the drought condition. For example, a permanent price increase of 10 percent results in a 2 percent decline in RGO quantity demanded, on average, but the reduction would be only 1 percent if the price increase occurred in the dry condition.

Industrial and commercial demands are assumed to be insensitive to price. The reason for this assumption is, primarily, a lack of data concerning price responsiveness. The result of the assumption is that overall demand elasticity is decreased by the percent of demand that is industrial and commercial. For example, if 30 percent of total M&I demand is industrial and commercial, the overall demand elasticity is reduced to -0.14 ( .7*0.20).

Use of alternative supplies and demand reduction are the only means of coping with permanent shortage in the long-run analysis. The additional costs of make-up supplies are passed on to customers in the form of higher water prices. Higher water prices reduce customer use according to the long-run water demand function. Economic loss is calculated as the cost of new water supplies.

In the Central Valley groups, cost of groundwater is used as the basis for water supply costs. Alternative supply costs, based on data from DWR (1994a), range from $200-300 and $240-400 per af in the Sacramento and San Joaquin Valleys, respectively.

In the Bay Area, alternative costs are calculated based on data developed for CALFED's Economic Evaluation of Water Management Alternatives process (CALFED, 1999). Data on costs of alternative supplies were used to estimate a cost function. The data used for these functions are provided in Table E-8. The economic costs of recycling include a benefit, or negative cost, of $300 per acre-foot for reduced waste loading in the San Francisco Bay. To reflect uncertainty in the cost estimates, impacts involving water supply costs are expressed as a range within plus or minus 25 percent.

Voluntary water transfers are not allowed as an alternative supply in the analysis. Relative to a with-transfer case, the lack of transfers increases the costs of CVP water supply reductions because potentially lower-cost supplies are not included.

Costs of customer shortage during the dry condition include lost consumer surplus, which is the value of water to customers above what is actually paid for it. These costs are estimated using the retail water demand functions. Drought water conservation also creates costs in the form of reduced net revenues to water providers. Net revenue losses are reduced water sales less variable water cost savings. If drought conservation cannot accommodate the shortfall, then more supplies are bought and their cost is included in the total.

### 1.1.2.2 Significance Criteria

Significance criteria have not been developed for municipal land use economics because economic impacts are not physical effects. However, economic effects can be used to assist in judging if a physical effect is significant. The term "substantial" is reserved for economic effects that may indicate a significant physical effect. Impacts to residential and M&I land uses would be significant if they would result in any of the following:

- Flooding and resultant damage to structures or improvements such as homes and bridges, or increasing the likelihood of flooding such structures or improvements, or periodic flooding of entire vacant parcels that currently have buildable areas outside of the 100-year floodplain
- Substantially degrading existing roads or resultant levels of service
- Precluding the continued residential or M&I use of an existing parcel
- Conflicting with adopted plans and goals of a community (e.g., general, community, or specific plan)

Water supply reductions might conflict with continued residential or M&I use of land, and supply reductions could conflict with adopted plans. An increase in regional average water price of more than 1 percent is assumed to have potential to substantially impact existing M&I use of land. In these cases, a potentially significant adverse effect on M&I water supply is suggested.

Population and urbanization are two concerns associated with M&I water supply costs, but no quantitative techniques are available to relate water supply or costs to growth. This analysis assumes that a change in average water supply of less than 5 percent has little potential to affect growth, and a change of 5-15 percent has some potential to affect growth. There is no need to consider larger changes for this analysis because no average water supply changes exceed 15 percent.

A 1 percent retail water price increase for a region in the average condition is considered substantial and suggests a potentially significant impact on adopted plans or continued residential use. A 1 percent increase in regional average price is usually caused by a much larger price increase in a small part of the larger region. Price impacts would be significant only for those CVP M&I water service contractors within each region who have limited supply alternatives.

Some M&I providers obtain water supplies from many sources, but others are completely dependent on CVP contract supplies. The main analysis does not differentiate these CVP-dependent users, but results can be used to infer the size of local water supply impacts. CVP-dependent users are characterized by a relatively high average cost per capita because there are no other water supplies to reduce the average cost. To reveal impacts on CVP service areas, water supply reductions for individual providers are interpolated from PROSIM results. Per capita costs are estimated and provided for some CVP service areas.

### 1.1.2.3 No Action Alternative

**Trinity River Basin**. Peak scheduled releases with the No Action Alternative are assumed to remain approximately 2,000 cfs in May, excluding uncontrolled spill events. Since the construction of the Trinity River Division (TRD), flows have greatly exceeded this amount, including approximately 14,500 cfs in 1974. Consequently, such events could occur again with or without the proposed action and, as such, represent the true No Action condition. Storm events within the past few years have resulted in flooding of some residences and would continue to flood some residences absent the proposed action. However, for this analysis, it was determined that the anticipated controlled peak flow of 2,000 cfs should be used as the basis for comparison because it represents a "normal" condition. At this flow level, no residences or structures are impacted. It was determined that impacts should be identified with regard to an alternative increasing the frequency of flooding given its relative flow schedule.

M&I water use within the basin is not served by the CVP and is not anticipated to be served in the future.

**Lower Klamath River Basin/Coastal Area**. As described in the Water Resources section, tributary flow is the primary influence on Trinity River flows at the confluence with the

Klamath. It is assumed that the area will continue to contain a very limited number of structures or improvements.

M&I water use within the Lower Klamath River Basin/Coastal Area is not served by the CVP and is not anticipated to be served in the future.

**Central Valley**. Results for the No Action Alternative are shown in Table E-9. The Central Valley is broken into two subregions: the Sacramento Valley and the San Joaquin Valley. The affected region in the San Joaquin Valley includes the Tulare subregion defined as Kings, Tulare, and Kern Counties.

Sacramento Valley. The Sacramento Valley subregion includes two separate groups of potentially affected M&I providers. The Shasta Area, primarily M&I use around Redding, would have 36,900 af of CVP M&I contracts in 2020. The Sacramento Area would have 75,900 af of CVP M&I contracts from the Sacramento and American Rivers. Total 2020 M&I demand is estimated to be 933,000 af. The incremental cost of supplies needed to serve demand in average years is about $200-350 per af measured at the treatment plant. Under the No Action Alternative, the project simulation model (PROSIM) estimates that average delivery of water under CVP contracts would be about 94 percent (105.5/112.8) of the contract level. In the dry condition, demand is increased to about 1.011 million af, but CVP contract deliveries would be reduced to 73 percent of the contract amount, resulting in a shortfall of 24,000 af. This shortfall would be managed with drought conservation, and no additional water supplies are needed. Dry condition costs, which include net revenue and consumer surplus losses, are about $5.6 million annually.

Table E-10 shows M&I providers included in the analysis, their 2020 contract amounts, No Action deliveries, and change in deliveries by alternative. CVP contract deliveries would be a small share (11 percent = 105.5/933) of all supplies in the region, but some CVP contractors in the group would be entirely dependent on CVP M&I supplies for their water.

The Shasta subregion of the Sacramento Valley includes a large number of small M&I contractors. Clear Creek CSD would have about one-third of the subregion's contract amount, and this amount would be about 9 percent of the Sacramento Valley total. The City of Redding obtains much of its water through a water rights contract not shown in Table E-10. Almost half of all CVP M&I contract water in the Sacramento Valley is delivered to three providers: Roseville, SMUD, and San Juan Suburban.

San Joaquin Valley. Table E-11 shows that the San Joaquin Valley subregion would have 29,100 af of CVP M&I contract that could be affected by Trinity River fisheries restoration actions. Most of the contract water is provided for Tracy (10,000 af) and Coalinga (10,000 af). Friant-Kern M&I contracts are not included in the analysis.

Under the No Action Alternative, the San Joaquin Valley cities would receive about 93 percent of their contract amounts on average. CVP contract deliveries would be a small share (7 percent = 27/414) of all supplies in the region, but some CVP contractors in the group would be entirely dependent on CVP M&I supplies for their water.

Table E-9 shows that total supplies and demand would be equal at 414,000 af in the average condition. The incremental cost of supplies needed to serve demand in average years is about

$200-350 per af measured at the treatment plant. Retail water prices in the No Action condition are little changed from their 2020 baseline level. In the dry condition, CVP contract deliveries would be reduced to 73 percent of the contract amount, resulting in a shortfall of 11,900 af. This entire shortfall could be met with drought conservation. The dry condition costs are estimated to be $1.7 million annually.

Bay Area. The Bay Area includes two separate provider groups. The South Bay group includes providers potentially affected by San Felipe Unit contracts of 119,400 af for SCVWD and 8,250 af for SBCWD. CCWD would have the single largest CVP M&I contract of 167,000 af. Table E-12 shows M&I providers included in the analysis, their 2020 contract amounts, No Action deliveries, and change in deliveries by alternative.

Table E-9 shows that CVP contract deliveries would be an important share (30 percent = 279.4/937) of all supplies in the region, and one CVP contractor in the group (CCWD) would be almost entirely dependent on CVP contract supplies for its water supply.

Under the No Action Alternative, PROSIM results suggest that SCVWD would receive about 93 percent of its contract amounts on average (Table E-12). CCWD would receive about 96 percent of its contract amount. Table E-9 shows that total supplies would be slightly larger than demand in the average condition, but CCWD would have a small shortfall on average. CCWD acquires a small amount of new supplies in the average condition, and retail water prices in the No Action condition would be increased 0.2 percent, region-wide, from their 2020 baseline level.

In the dry condition, San Felipe CVP contract deliveries would be reduced to 73 percent of the contract amount. CCWD obtains 83 percent of its demand. The shortfall would be met with drought conservation and the acquisition of new supplies. The costs of this shortfall are estimated to be between $137-225 million annually during the dry period.

### 1.1.2.4 Maximum Flow Alternative

This alternative would have the largest adverse impact on municipal flooding and M&I water supplies and economics. Flooding effects would occur primarily in the Trinity River Basin. CVP contract water supplies for M&I use would be decreased by anywhere from about 8-13 percent in the average condition. Supplies would be decreased by 6-22 percent in the dry condition. These impacts, taken alone, are not believed to suggest a substantial region-wide adverse impact on M&I water supplies. However, individual providers who are entirely dependent on CVP contract supplies and have no alternative supplies available at a comparable cost might experience a substantial increase in water costs and customer shortage costs. Significance criteria suggest a potentially significant adverse effect on water supply and some potential to reduce economic growth in localized areas.

**Trinity River Basin.** Peak flows associated with this alternative would increase 15-fold from 2,000 cfs to 30,000 cfs in the month of May in extremely wet years (assumed to occur 12 percent of the time over a 100-year period). These flows would result in approximately 120 properties being flooded. Salt Flat Bridge, Bucktail Bridge, and Treadwell Bridge would need to be replaced in order to accommodate such peak events. The Poker Bar Bridge would not need to be replaced because the 77 parcels served by it are assumed to be purchased because of substantial flooding of the associated road system (6 feet or more) serving the parcels (Table E-13). The total monetary value associated with this damage would be approximately $14.3 million (August 1999 estimate) (Department of Water Resources, 1997). Additional damage to some structures or improvements could also occur in areas that were not modeled but are within the areas that would be inundated by this peak flow. This would be a significant, long-term impact.

M&I land use is not anticipated to occur within the area that would be impacted by a 30,000 cfs peak flow, and as such would not be impacted. CVP water is not provided for M&I use in the region.

**Lower Klamath River Basin/Coastal Area**. As described in the Water Resources section, tributary flow is the primary influence on Trinity River flows at the confluence with the Klamath River. Additionally, there is little development within the lower Klamath River area. As such, this alternative is not anticipated to significantly impact structures or improvements.

M&I use is not anticipated to occur within the area that would be impacted by a 30,000 cfs peak flow, and as such would not be impacted.

**Central Valley**. The Central Valley would be affected by reduced water supply. Table E-14 provides results for the Maximum Flow Alternative.

Sacramento Valley. In the average condition, CVP contract deliveries would be reduced by 13,300 af, or about 13 percent of No Action deliveries. This small supply decrease would have a small potential to reduce urbanization and population. The delivery reduction requires 11,600 af of more expensive non-CVP supplies costing $2.3-3.9 million annually. Retail price would be increased about 1.6 percent, and demand would be reduced by 1,700 af.

In the dry condition, PROSIM estimates that CVP contract deliveries would be reduced by 17,800 af annually. This supply reduction would have a cost, but the 11,600 af of additional non-CVP supplies plus 1,700 af of demand reduction from the long-run condition reduce the need for additional drought make-up supplies. The remaining drought shortfall of 4,500 af (17,800-11,600-1,700) can be managed with drought conservation. Costs would be increased by $1.8 million annually during the dry condition relative to No Action. This cost increase is in addition to the average cost increase. Most of the cost is lost net revenue and economic surplus from residential, government, and other water sales.

Table E-15 shows average costs per capita in Redding, San Juan Suburban, and Roseville. Costs per capita are $2-10 in the average condition, and the incremental cost in the dry condition is $1-6 per capita. Costs could be more if replacement supplies are more expensive in CVP service areas.

San Joaquin Valley. In the average condition, CVP contract deliveries would be reduced by 2,200 af, or about 8 percent of No Action deliveries. This small supply decrease would have a small potential to reduce urbanization and population. The delivery reduction requires 1,800 af of more expensive non-CVP supplies costing $0.4-0.8 million annually. Retail price would be increased about 0.8 percent reducing demand by 400 af annually.

In the dry condition, PROSIM estimates that CVP contract deliveries would be reduced by 1,200 af annually relative to No Action. This supply reduction would have a cost, but the 1,800 af of new non-CVP supplies plus the 400 af of demand reduction from the long-run condition eliminate the need for new drought make-up supplies in comparison to No Action. Additional dry condition costs would be negative during the dry condition relative to No Action.

Table E-11 shows results in terms of water delivery for affected providers, and Table E-15 shows average costs per capita in Coalinga, Huron, and Tracy. Costs per capita in the average condition range from $2-10, and incremental per-capita benefits in the dry condition range from $1-4. Costs could be more if replacement supplies are more expensive.

Bay Area. In the average condition, CVP contract deliveries would be reduced by 24,800 af, or about 9 percent of No Action deliveries. This supply decrease would have a small potential to reduce urbanization. The delivery reduction would require 13,300 af of more expensive non-CVP supplies costing $6.5-10.7 million annually. Retail price would be increased about 1.4 percent, and demand would be reduced by 1,600 af.

In the dry condition, PROSIM estimates that CVP contract deliveries would be reduced by 35,600 af annually. This supply reduction would have a cost, but the 13,300 af of non-CVP supplies bought in the long-run condition plus the 1,600 af of demand reduction reduce the need for drought make-up supplies. The increase in shortfall compared to No Action would be 20,700 taf, and dry condition costs would be increased $38-65 million, relative to No Action, during the dry condition. This dry condition cost is 28 percent of the No Action cost. These costs might be reduced if water transfers were available.

Table E-12 shows results in terms of water delivery for affected providers, and Table E-15 shows average costs per capita in CCWD. Costs per capita are about $20 more in the average condition and $120 more during the 6-year dry condition period. This relatively large cost reflects higher water prices in CCWD and a lack of inexpensive supply alternatives. The values do not account for the share of costs that must be paid by non-residential customers, so the actual cost per residential customer may be less. Still, this level-of-cost increase suggests a potentially significant adverse effect on water supply.

### 1.1.2.5 Flow Evaluation

This alternative would have adverse effects on municipal land use through flooding and M&I water costs, but the effects are much smaller than for the Maximum Flow Alternative. Average M&I contract deliveries would be reduced by 1-3 percent relative to No Action, and deliveries in dry periods would be reduced 2-15 percent. These effects are not substantial at the regional level, but some areas are completely dependent on CVP supplies. Impacts during the dry condition in one region (the Sacramento Valley) just meet the criteria for a substantial effect in support of a significant effect on water supply.

**Trinity River Basin**. Peak flows associated with this alternative would increase from 2,000 cfs to 11,000 cfs in the month of May in extremely wet years (assumed to occur 12 percent of the time over a 100-year period). These flows would result in seven properties being flooded (one developed, six undeveloped) as well as necessitate the replacement of four bridges (Bucktail Bridge, Poker Bar Bridge, Salt Flat Bridge, and Treadwell Bridge). The total monetary value associated with this damage is approximately $5 million (1996 dollars) (Department of Water Resources, 1997). Additional damage to some structures or improvements could also occur in areas that were not modeled but are within the areas that would be inundated by this peak flow. This would be a significant, long-term impact.

M&I use is not anticipated to occur within the area that would be impacted by an 11,000 cfs peak flow, and as such would not be impacted.

**Lower Klamath River Basin/Coastal Area.** As described in the Water Resources section, tributary flow is the primary influence on Trinity River flows at the confluence with the Klamath River. Additionally, there is little development within the lower Klamath River area. As such, this alternative is not anticipated to significantly impact structures or improvements.

M&I land use is not anticipated to occur within the area that would be impacted by an 11,000 cfs peak flow, and as such would not be impacted.

**Central Valley.** Results of the municipal water cost analysis are provided in Table E-16. In general, this alternative would have a small effect on M&I water supplies. Average supplies would be reduced slightly in comparison to No Action.

Sacramento Valley. In the average condition, CVP contract deliveries would be reduced by 3,500 af, or about 3 percent of No Action deliveries. This delivery reduction would require about 3,000 af of more expensive non-CVP supplies costing $0.6-1.0 million annually. Retail price would be increased by about 0.4 percent. CVP contract supplies in the dry condition are reduced by 12,200 af, and dry condition costs are $3.5 million more than in No Action. Costs per capita are increased by $2-12 during the dry condition.

San Joaquin Valley. PROSIM estimates that San Joaquin Valley average and dry condition M&I water supplies would be reduced by only 400 af or about 1 percent in this alternative. Economic impacts are negligible.

Bay Area. In the average condition, CVP contract deliveries would be reduced by 5,100 af, or about 2 percent of No Action deliveries. This delivery reduction requires 3,300 af of more expensive make-up supplies costing about $1.1-1.9 million annually. Retail price would be increased by about 0.2 percent.

CVP contract supplies would be reduced by about 22,400 af annually in the dry condition. With 3,300 af of new non-CVP supplies and 100 af of demand reduction from the average condition, dry condition shortfall would be reduced to 19,000 af in comparison to No Action. The cost of managing this shortfall is $25-43 million annually above the cost in the No Action condition. This cost is 19 percent of the No Action cost. Table E-16 shows that costs in CCWD during the dry condition would amount to about $80 per person annually.

### 1.1.2.6 Percent Inflow Alternative

This alternative would affect flood control and M&I water supply economics. Adverse impacts on flood control costs would be more than the Flow Evaluation Alternative, but still much less than under the Maximum Flow Alternative. This alternative has a negligible effect on M&I water supply and economics. Effects range from slightly positive to negative.

**Trinity River Basin**. Peak flows associated with this alternative would increase from 2,000 cfs to 11,000 cfs in peak years. This alternative would result in the same peak release at Lewiston as the Flow Evaluation Alternative, but it would be anticipated to occur during winter and early spring when tributary inflow from creeks such as Rush Creek, Grass Valley Creek, and Indian Creek would be much higher than during late May. These flows would result in approximately 24 properties being flooded, as well as necessitate the replacement of four bridges (Bucktail Bridge, Poker Bar Bridge, Salt Flat Bridge, and Treadwell Bridge). The total monetary value associated with this damage is approximately $6 million (1996 dollars) (Department of Water Resources, 1997). Additional damage to some structures or improvements could also occur in areas that were not modeled but are within the areas that would be inundated by this peak flow. This would be a significant, long-term impact.

M&I use is not anticipated to occur within the area that would be impacted by an 11,000 cfs peak flow during a period with relatively high tributary flow, and as such would not be impacted. CVP water is not provided for M&I use in the region.

**Lower Klamath River Basin/Coastal Area**. As described in the Water Resources section, tributary flow is the primary influence on Trinity River flows at the confluence with the Klamath River. Additionally, there is little development within the lower Klamath River area. As such, this alternative is not anticipated to significantly impact structures or improvements.

M&I land use is not anticipated to occur within the area that would be impacted by an 11,000 cfs peak flow during a period with relatively high tributary flow, and as such would not be impacted.

**Central Valley**. Table E-17 provides results of the M&I water supply economic analysis. In general, this alternative would have a very small effect on M&I water supplies. There would be a very small reduction in M&I water delivery in the average condition, and slightly more water would be obtained in every region in the dry condition. These impacts do not suggest a substantial adverse impact on M&I water supplies.

Sacramento Valley. In the average condition, CVP contract deliveries would be reduced by 600 af, or about 0.6 percent (less than 1 percent) of No Action deliveries. The delivery reduction would require 500 af of more expensive make-up supplies costing $100,000 annually, and retail price would be increased by about 0.1 percent. In the dry condition, PROSIM estimates that CVP contract deliveries would be increased by about 1,500 af. This supply increase would reduce the need for drought conservation by a similar amount. Dry-condition costs would be reduced by about $700,000 annually relative to No Action.

San Joaquin Valley. PROSIM estimates that San Joaquin Valley M&I water supplies would be reduced by about 100 af on average. Dry-year supplies would be increased by about 400 af, and dry-condition costs would be reduced by about $100,000 annually.

Bay Area. In the average condition, CVP contract deliveries would be reduced by 300 af, or less than 1 percent of No Action deliveries. The delivery increase would reduce the acquisition of more expensive non-CVP supplies, and retail price would be increased by less than 0.1 percent. In the dry condition, PROSIM estimates that CVP contract deliveries would be increased by 4,700 af. Drought shortfall would be reduced, and dry condition costs would be reduced by $4-8 million annually relative to No Action. These savings would be worth about $14.10 per capita in CCWD (Table E-15).

### 1.1.2.7 Mechanical Restoration Alternative

No impacts to residential or M&I land use would occur within any of the study areas as the flows (including peak flows) for this alternative are the same as No Action.

### 1.1.2.8 State Permit Alternative

This alternative is not expected to affect municipal land use through change in flooding damages or costs. Municipal water supplies in the Central Valley and Bay Area would be increased. The amount and value of new supplies in the average condition is limited, but CVP contract supplies are increased about 10 percent in the dry condition relative to No Action. Therefore, there would be no adverse impact on M&I water supply economics.

**Trinity River Basin**. No impacts would occur to residential land uses with regard to flooding because peak flows would be reduced from 2,000 cfs in May to 250 cfs in November. Uncontrolled spill events would be anticipated to occur at a slightly increased frequency compared to the No Action Alternative.

**Lower Klamath River Basin/Coastal Area**. Trinity River flow contributions to the Klamath River downstream of the confluence of the two rivers associated with this alternative would be reduced from the No Action Alternative. As such, this alternative is not anticipated to significantly impact structures or improvements. CVP water is not provided for M&I use in the region.

**Central Valley**. In comparison to No Action, more water would be available from the Trinity River for M&I use. CVP contract water deliveries would be increased slightly (about 2 percent) in the average condition. Cost savings amount to only $0.6-0.8 total for the Sacramento and San Joaquin Regions. The increase in supply and value would be more substantial in the dry condition. Supplies increase by about 10 percent, and additional cost savings during the dry condition amount to about $2 million annually.

Table E-10 shows results in terms of water delivery for affected providers, and Table E-15 shows average costs per capita in Redding, San Juan Suburban, and Roseville. Cost savings per capita are small ($0-2) in the average condition, but they increase up to $6 per capita in the dry condition. In Coalinga, Huron, and Tracy, the additional water is worth $0-2 per capita in the average condition, and up to $6 per capita in the dry condition.

**Bay Area**. CVP contract water deliveries would be increased slightly (about 2 percent) in the average condition. Cost savings amount to $0.7-1.1 million annually. The increase in supply and value would be more substantial in the dry condition. CVP contract supplies would increase by about 10 percent, purchases of drought supplies could be reduced by 18,000 af, and additional cost savings during the dry condition amount to $17-30 million





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annually. Table E-15 shows that benefits per capita in CCWD would be small in the average condition, but they increase up to $55 per capita annually during the 6-year dry-condition period.

### 1.1.2.9 Existing Conditions versus Preferred Alternative

California Environmental Quality Act (CEQA) requires that the Preferred Alternative be compared to existing conditions. Table E-7 showed existing condition results in terms of water balance. In comparison to existing conditions, the Preferred Alternative would provide more water for more people. Water supply costs and shortfall costs would be substantially increased. Both of these effects would be caused primarily by increased population. Differences in CVP contract supplies between existing conditions and the Preferred Alternative are negligible by comparison.

Sacramento Valley. In the average condition, 2020 demand in the Preferred Alternative (933,000 af) is much larger than in existing conditions (566,000 af). Most of the increase in demand is met with increased use of existing supplies and development of more local supplies. Use of CVP municipal contracts and water rights contracts nearly double. Results in the dry condition are similar. Supplies increase at a rate similar to demand.

San Joaquin Valley. In the average condition, 2020 demand in the Preferred Alternative (414,000 af) is much larger than in existing conditions (192,000 af). Most of the increase in demand is met with increased use of existing supplies and development of more local supplies. Use of CVP supplies increases two to three times. Results in the dry condition are similar. Supplies increase at a rate similar to demand.

Bay Area. In the average condition, 2020 demand in the Preferred Alternative (928,000 af) is much larger than in existing conditions (772,000 af). Some of the increase in demand is met with increased use of existing supplies and development of more local supplies. Use of CVP M&I contracts increases some, and supplies are close to sufficient for demand in either case. In the dry condition, the shortfall is increased in comparison to existing conditions. The total amount of water needed to eliminate the shortfall would be about 286,000 af as opposed to 149,000 af in existing conditions.

## 1.1.3 Mitigation

The following mitigation measures would reduce the significant flooding impacts identified under the Maximum Flow, Flow Evaluation, and Percent Inflow Alternatives within the Trinity River Basin to a less than significant level:

- Property owners would be compensated at fair market value for all flood-related structure/ improvement losses incurred, or funding would be provided to retrofit structures/improvements to withstand peak flows associated with the selected alternative.
- Property owners who have parcels with buildable sites outside of the current 100-year floodplain that would be regularly inundated by an alternative would be compensated at fair market value for the loss of development rights to that parcel.

Potentially significant land use (M&I) related impacts could occur as a result of decreased surface-water supplies associated with the Maximum Flow Alternative. Although water supply changes per se were not considered an impact, the development of additional water supplies to meet demands would lessen the associated impacts. A number of demand- and supply-related programs are currently being studied across California, many of which are being addressed through the on-going CALFED and CVPIA programs and planning processes. Although none of these actions would be directly implemented as part of the alternatives discussed in this Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS), each could assist in offsetting impacts resulting from decreased Trinity River exports. Examples of actions being assessed in the CALFED and CVPIA planning processes include:

- Develop and implement additional groundwater and/or surface-water storage. Such programs could include the construction of new surface reservoirs and groundwater storage facilities, as well as expansion of existing facilities. Potential locations include sites throughout the Sacramento and San Joaquin Valley watersheds, the Trinity River Basin, and the Delta.
- Purchase long- and/or short-term water supplies from willing sellers (both in-basin and out-of-basin) through actions including, but not limited to, temporary or permanent land fallowing.
- Facilitate willing buyer/willing seller inter- and intra-basin water transfers that derive water supplies from activities such as conservation, crop modification, land fallowing, land retirement, groundwater substitution, and reservoir re-operation.
- Promote and/or provide incentive for additional water conservation to reduce demand.
- Decrease demand through purchasing and/or promoting the temporary fallowing of agricultural lands.
- Increase water supplies by promoting additional water recycling.

# 1.2 AGRICULTURE

## 1.2.1 Affected Environment

This section provides an analysis of the agricultural environment in each geographical area and will focus on key factors and characteristics that might be significantly affected by Trinity River restoration alternatives.

### 1.2.1.1 Trinity River Basin

Agriculture is not a major activity in the Trinity River Basin because of the rugged terrain and lack of suitable agricultural lands. In Trinity County, only 5.7 percent of the land is farmland, due mostly to the lack of suitable land and/or zoning. In contrast, 26.9 percent of neighboring Humboldt County is farmland, mostly along the coast.

The largest sector of the agricultural economy in the Trinity River Basin is cattle ranching and grazing. The area that Trinity Reservoir now occupies was once prime ranch land. Currently, small tracts of land classified as prime agricultural land are located in the Hayfork, Hyampon Valley, Willow Creek, and Hoopa areas.

Roughly 75 percent of the Trinity River Basin is under federal or state ownership and is used for timber production, grazing, mineral extraction, water reservoirs, and recreational activities. These public lands are managed by the U.S. Forest Service (USFS) (including Shasta National Forest, Trinity National Forest, and Six Rivers National Forest), U.S. Bureau of Reclamation (Reclamation), the Bureau of Land Management (BLM), and the Bureau of Indian Affairs (BIA) Trust Lands (including the Hoopa Valley Indian Reservation and various state and county entities). Of the 25 percent of the Trinity River Basin that is privately owned, the majority is used for timber production, with the remainder being residential, rangeland, and the limited agricultural uses described above. About 14 percent of the basin lies in Humboldt County, one-quarter of which consists of the Hoopa Reservation; the remainder of the basin is located in Trinity County. Figure E-2 depicts land ownership in the basin.

**Timber Production.** Until 1990, federally managed lands accounted for the largest portion of the timberland base in the watershed. Since then, private lands have produced the majority of timber as a result of habitat management for the northern spotted owl on federal lands.

The decline of timber harvest on federal lands has made the role of private timberlands more important in maintaining a viable timber-based economy. As of 1986, Trinity County had 672,000 acres of USFS-owned commercial forest land, plus an additional 39,000 acres of other public commercial forest land, while private commercial timberland made up 370,000 acres. Humboldt County had 273,000 acres of USFS-owned commercial forest land, 124,000 acres owned by other public concerns, and 1,157 acres of private commercial forest land (Department of Finance, 1994). Table F-19 depicts the area and commercial forest land managed by the Service (U.S. Department of Agriculture) included in the Trinity River Basin as of 1993.

During 1994, Trinity County produced 94.9 million board feet (mbf) of timber, which had a market value of $44.5 million according to state timber tax records. Recently released harvest levels for 1995 indicate an increase to 114.2 mbf with a market value of $53.5 million. The county's timber production peaked in 1959 at 430 mbf. Currently, only one lumber mill in the County still operates, which is down from 28 in 1961. This trend is due in part to the shift toward fewer, larger, and more efficient mills, but is also due to reduced local supplies and higher transportation costs.

A small portion of Humboldt County is in the Trinity River Basin. Data on timber production within this small portion are not available. During 1994, Humboldt County timber production was 488.4 mbf with a market value of $283,784. Humboldt County is the highest volume timber producer in the state of California, followed by Mendocino County with 227.4 mbf. Trinity County was the eighth largest producer of timber in the state during 1994. With the decline in the harvest of timber on National Forest lands, a shift is occurring in the types of products being extracted from the forest as alternative sources of income. These products include firewood, mosses, mushrooms, cones, ferns, manzanita, herbs, and wildflowers. Special-use permits are being granted by the Service for collecting rights. The Service is attempting to work with rural communities to develop diversified and sustainable economies that are consistent with sustainable ecosystem management principles (Shasta-Trinity National Forest, 1996).

### 1.2.1.2 Lower Klamath River Basin/Coastal Area

Agricultural land in the area is limited. Roughly 200 acres are cultivated for livestock forage, fruit trees, and row crops on relatively small tracts near the river; and some cattle grazing occurs higher in the watershed. The annual value of non-timber commercial agricultural production in the lower Klamath watershed is less than 1 percent of the totals for Humboldt and Del Norte Counties.

### 1.2.1.3 Central Valley

The Central Valley is an important agricultural region for both California and the United States. The valley contains almost 80 percent of the irrigated land in California. In 1993, the 19 Central Valley counties contributed more than 60 percent, by value, of California's agricultural production and included 6 of the top 10 agricultural counties in the state (Table F-20). For purposes of this analysis, the Central Valley is divided into three regions: Sacramento Valley, San Joaquin Valley, and Tulare Basin. The Sacramento Valley includes the entire Central Valley north of Contra Costa, San Joaquin, and Calaveras Counties. The San Joaquin Valley includes these counties extending south through Fresno County. The Tulare Basin includes Kings, Tulare, and Kern Counties.

The Central Valley produces almost 10 percent of the total U.S. market value of crop production, including 40 percent of the nation's fruits and nuts, 20 percent of cotton, and 15 percent of vegetables (U.S. Bureau of Reclamation, 1997). Major crops grown in the Central Valley and their value are shown on Figure E-3.

In addition to its importance to domestic markets, California agriculture plays an important role in international markets. California producers account for about 10 percent of total U.S. agricultural exports. These exports represent almost 25 percent of the gross farm income of the state (Carter and Goldman, 1992). Many of California's leading export commodities are largely or exclusively grown in the Central Valley, including cotton, rice, almonds, grapes, oranges, walnuts, prunes, tomatoes, wheat, and hay (Carter and Goldman). More than 80 percent of the cotton grown in California in 1990 was exported. Crops produced for export are produced on more than 2 million acres and are worth more than $2.5 billion (Department of Water Resources [DWR], 1994).

The Census of Agriculture (U.S. Dept. of Commerce, 1994) estimated that 42,000 farms existed in the Central Valley in 1992. Total farm expenses were estimated to total $8.2 billion, total sales were $10 billion, and net cash return including government payments and other income was $2.4 billion. About 23,500 farm operators listed farming as their primary occupation. Of the $8.2 billion in expenses, $1.4 billion was spent for farm labor, $5.9 billion for contract labor, $270 million for cash rent, and $168 million for property taxes.





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Most of the irrigated land served by the CVP receives supplemental CVP supplies. The CVP recently served 13,000 full-time farms and 6,300 part-time farms, or just less than 50 percent of all Central Valley farms. In 1988, CVP-served lands produced about $3.3 billion worth of agricultural commodities valued at the farm, which is equivalent to approximately one-third of the total value of Central Valley production. Field crops, including cotton, cereals, forage, and seed accounted for 61 percent of acreage served, but only 29 percent of value of production. Fruits and nuts accounted for 48 percent of the value of production. Crop mix and value for 1988 is provided in Table E-21.

Central Valley agriculture also receives irrigation water from the State Water Project (SWP), local water districts, individual water rights holdings, and groundwater. Most of this water is delivered to farmers through irrigation districts and other water agencies. Figure E-4 shows irrigated acreage and irrigation water deliveries by source for the years 1985-1992. Deliveries average about 22.5 million acre-feet (af) per year, with the SWP providing about 10 percent, local surface-water rights about 30 percent, and groundwater about 35 percent.

The CVP normally supplies irrigation water to approximately 200 water districts, individuals, and companies through water service, water rights, and exchange contracts. The type of contract a particular district holds determines the potential CVP water supply curtailments in dry years. Those districts with water service contracts are subject to the greatest curtailments (as much as 100 percent), while districts with water rights settlement contracts, such as those along the Sacramento River, are cut no more than 25 percent. Districts/entities with pre-1914 water rights that do not have settlement contracts with Reclamation are entitled to their full right regardless of CVP operations (see the Water Resources/Water Quality Technical Appendix A).

**Federal Farm Programs**. The federal role in Central Valley agriculture is not limited to the CVP. The federal government has taken an active role in agricultural production and marketing since the 1930s. Although national economic conditions and political philosophies have changed, there have been two essential goals of agricultural policies: to provide for prosperity in the agricultural sectors, and to ensure a safe, reliable food supply for the population. Farm programs were developed from a national perspective without particular emphasis on regional or state production. Conservation provisions also have been part of farm programs since the 1930s.

Farm programs have been especially important in the Central Valley for rice and cotton production. A substantial share of the revenue from these crops was derived directly or indirectly from farm programs. From 1985-1995, as many as 400,000 acres of California rice and cotton land have been idled by acreage reduction requirements (set-asides). Additional fallowing was allowed during the worst drought years, without loss of most government payments. The 1996 Farm Bill represents a major revision to the farm programs for most crops, including rice and cotton. Acreage reduction programs have been eliminated and government payments per unit of crop produced have been replaced with declining, lump-sum payments. 1997 was the first full year under the new law. Because of the limited experience and the expiration of many provisions in the year 2002, great uncertainty exists about the long-term impacts on water demand and land use.

**Central Valley Subregions**. For analytical purposes, the Central Valley was divided into three subregions: the Sacramento Valley, San Joaquin Valley, and Tulare Basin. These are shown on Figure E-3 and described below. Table F-22 summarizes agricultural land use, water use, value of production, and net revenue for these regions.

Sacramento Valley. Agriculture is the largest industry in the Sacramento Valley. The region produces a wide variety of crops, including rice, grain, tomatoes, field crops, fruits, and nuts. Figure E-2 shows that grains and field crops, rice; hay, pasture, and alfalfa, are the major crops in the Sacramento Valley (72 percent of irrigated acres). The value of Sacramento Valley crop production reached $1.7 billion in 1992, with rice, tomatoes, and orchard crops providing the highest revenues. The CVP's Tehama-Colusa Service Area is representative of areas within the region that are heavily dependent on CVP supplies. Approximately 10 percent of the applied water within the region is provided through CVP service contracts. Table F-22 shows the agricultural land use, water use, value of production, and net revenue for the Sacramento Valley.

San Joaquin Valley. The San Joaquin Valley includes portions of Stanislaus, Merced, Madera, Mariposa, Tuolumne, and Fresno Counties. Almost half of the 1990 acreage was planted with grains, hay, and pasture (Figure E-4). Orchards were planted on about 30 percent of the irrigated acres, cotton on 18 percent, and vegetables on 14 percent. The San Joaquin Valley is the leading California area for production of grapes, almonds, walnuts, tomatoes, melons, and many other crops. Table F-22 shows the agricultural land use, water use, value of production, and net revenue for the San Joaquin Valley.

Value of crop production in 1992 was $5.3 billion. Most of the region west of the San Joaquin River depends on CVP water exported from the Sacramento-San Joaquin River Delta (Delta). Westlands Water District (WWD) has a CVP water service contract for over 1 maf and is representative of areas within the San Joaquin Valley that are dependent on CVP water supplies. More than 20 percent of the applied water within the region is provided through CVP supplies (with WWD being the single largest contractor). CVP water service contractors are subject to curtailments up to 100 percent in dry years. There are 29 water service contractors within the region, 25 of which receive water through Delta export facilities. During the drought years of 1990 through 1992, shortages in CVP water resulted in greater overdraft of groundwater and some land fallowing.

Tulare Basin. Irrigated agriculture accounts for more than 2 million acres of private land in the Tulare Basin. Other agricultural lands and areas with native vegetation cover an additional 1.4 million acres. The principal crops grown in the region are cotton, grapes, and deciduous fruits. Substantial acreage of almonds and pistachios is also grown, as well as increasing acreage of truck crops, such as tomatoes. As shown on Figure E-3, fruits and nuts account for 34 percent of the total irrigated land in the Tulare Basin. Other important crops are cotton (32 percent), hay and pasture (15 percent), and vegetables (10 percent). On the east side of the region, hay and pasture are grown to support dairy production-Tulare County is the leading milk-producing county in the U.S. The Tulare Basin counties produced $3.4 billion in crop revenue in 1992. Grapes had the highest value of production, followed by cotton and citrus. More than 10 percent of the applied water within the region is provided through CVP service contracts. There are 28 districts in the region that hold water service contracts with Reclamation, nine of which hold Cross Valley Canal exchange contracts that rely on water delivered through Delta export facilities. Table F-22 shows the agricultural land use, water use, value of production, and net revenue for the Tulare Basin.

San Francisco Bay/San Felipe Unit. The San Felipe Unit of the CVP delivers irrigation water to parts of San Benito and Santa Clara Counties, and is the only CVP irrigation water delivery unit outside the Central Valley. The San Felipe Unit's main agricultural crops are vegetables, orchards, and vineyards. As shown on Figure E-3, vegetables are the primary crop in the Unit, accounting for 50 percent of the total irrigated land in the Unit. Other important crops are fruits and nuts at 30 percent. Total value of production in 1990 was $65 million.

Irrigated land in the two counties is supplied by CVP water, SWP water, local surface water, and groundwater. In 1992, total irrigated acreage in the two counties was about 100,000 acres. Of that, CVP water supplies the equivalent of about 25,000 acres (25 percent).

# 1.2.2 Environmental Consequences

This section describes the methodology and results of agricultural economics and land use analysis. First, the model and assumptions used in the analysis are discussed. Then, the results of each alternative are presented and discussed. Summaries of impacts to agriculture are also presented in Tables F-23 and F-24, for average and dry years, respectively.

## 1.2.2.1 Methodology

The Central Valley Production Model (CVPM) was used to assess potential changes in irrigated land use, gross revenue for irrigated lands, net revenue, and water use to estimate likely responses to changes in CVP water deliveries. The model considers groundwater pumping, land fallowing, crop changes, and irrigation efficiency changes; it estimates the least costly combination of these to adjust to changes in CVP water delivery. Data for the model were gathered from County Agricultural Commissioner reports, the California DWR, Reclamation, USDA, and individual water districts. (See Attachment E1 for data tables.) Twenty-two agricultural production regions within the Central Valley were defined. Within each region, water deliveries were identified from federal and state projects, local water rights or district delivery, and groundwater. Up to 26 crop categories can be used in the model, however, for consistency with data and water operations analysis used in this study, 12 aggregated crop categories were used. All prices and costs are measured in 1997 dollars.

The model was calibrated using data for the most recent years for which complete data were available and which did not include the worst drought years of 1991 and 1992. The performance of the calibrated model was then tested against conditions in the two drought years. For the impact analysis in this report, changes in CVP water supply resulting from Trinity River operations were used to estimate changes in groundwater use, crop acreage, and irrigation water use. Changes in pumping costs caused by changes in groundwater elevations were incorporated in the analysis. Runs were conducted for a simulated dry period (1928-1934) and for the average 1922-1990 water supply. Additional impacts not specifically estimated by CVPM, including land values, farm financing, and risk are also noted. The CVPM model is described in detail in the CVPM Technical Appendix to the CVPIA Draft Programmatic EIS (Reclamation, 1997b). References to all data sources are provided in that document.

The CVPM does not include San Felipe Unit lands. A separate spreadsheet analysis was used to estimate agricultural impacts in that region.

Results for areas receiving CVP irrigation water are summarized for the four aggregated regions: Sacramento Valley, San Joaquin Valley, Tulare Basin, and the San Felipe Unit. In addition, two subregions dominated by water service contractors are assessed to better describe potential impacts in areas most likely affected by changes in water supply (due to the nature of the contracts). The subregions are the Tehama-Colusa subregion (an example of a subregion north of the Delta) and the Westlands subregion (an example of a subregion south of the Delta).

### 1.2.2.2 Significance Criteria

Impacts on agriculture land uses would be significant if they would result in any of the following:

- Convert prime agricultural land to non-agricultural use or permanently impair the agricultural productivity of prime agricultural land. For purposes of this assessment, land is considered converted or impaired if it has lost some or all of its agronomic capability to produce a crop. Agricultural land that is idled or fallowed due to lack of water is not considered permanently converted or impaired.
- Result in an aggregate increase in idling of more than 5 percent of the irrigated land within a region or most-affected subregion. The 5 percent level is judged to be sufficient to increase development pressure. Also, small percent changes may be results of imprecision within the modeling analysis.

No specific significance criteria are applied to changes in revenues or costs. Changes in revenues and costs can potentially lead to significant social impacts due to changes in regional income, employment, and related social impacts. Significance criteria for them are discussed in the Socioeconomics Technical Appendix G.

### 1.2.2.3 No Action Alternative

The No Action Alternative provides a base for comparison with each of the action alternatives. The following are the key features and assumptions of the No Action Alternative:

> **2020 Level of Demand for Crop Production**: The crop mix and total acreage projected by DWR in their Bulletin 160-93 for 2020 (Department of Water Resources, 1993) is used as a basis for the No Action Alternative.
>
> **CVP Water Priced at Cost-of-Service Rates**: Reclamation's water rates policy prior to CVPIA was that, upon renewal of water service contracts, users would pay the cost-of-service rate as calculated by Reclamation (unless ability-to-pay relief was granted). This rate is set to recover current costs of operation and maintenance (O&M), accumulated O&M deficit, and principal only on allocated capital costs. In

most cases, this rate is higher than rates set in existing contracts. Because all contracts will have been renewed by 2020, the No Action analysis uses cost-of-service rates (Reclamation, 1993).

**Ability to Pay**: Current Reclamation policy allows irrigation water contractors to request a study of their capacity to pay for project water. If Reclamation determines that payment capacity is insufficient to recover the cost-of-service rate, all or a portion of the capital repayment portion of the rate may be forgiven. This analysis assumes that this policy remains in effect and estimates appropriate water rates using payment capacities from a 1992 planning-level study prepared by Reclamation (1992).

**1994 Bay-Delta Accord**: DWR's Bulletin 160-93 was prepared prior to the 1994 Bay-Delta Accord, but the analysis presented here incorporates the Delta operations of the Accord. Although DWR's land use projections are used as a basis, or starting point, for this assessment, the assumptions underlying its projections are not consistent with this document's No Action assumptions regarding water supply or cost. The No Action agricultural analysis estimated how acreage, production, and water use might change from DWR's baseline in response to these water supply conditions. Results of this analysis are used as a basis of comparison for all of the action alternatives

**Trinity River Basin.** Agricultural land use within the basin is assumed to remain very limited, and generally not dependent on the Trinity River for irrigation water supply.

**Lower Klamath River Basin/Coastal Area.** Agricultural land use within the basin is assumed to remain very limited, and generally not dependent on the Trinity River for irrigation water supply.

**Central Valley.**

Irrigated Land Use. Starting from DWR's 2020 baseline land use, the water supplies estimated in the surface-water and groundwater analyses were used to estimate resulting irrigated land use. Results are summarized for the three Central Valley regions and the San Felipe Unit in Table E-25. Dominant crops in the Sacramento Valley in 2020 include rice, deciduous orchards, grains, and other field crops. The San Joaquin Valley includes a broad mix of crops, with cotton, deciduous orchards, truck crops, and grapes having the largest acreage. The largest acreages in the Tulare Basin include cotton, deciduous orchards, and grapes. Alfalfa hay and grains show significant acreage in all three regions. Irrigated acreage shown for the San Felipe Unit only includes lands directly served by CVP water. Unit acreage is dominated by vegetables and orchards. A relatively low percentage is used for field crops, pasture, and hay.

Value of Production from Irrigated Lands. Table E-26 summarizes the value of production (gross revenue) by region and crop. The Sacramento Valley accounts for just under 20 percent of the value of production, with Tulare Basin at about 38 percent, and San Joaquin Valley at about 43 percent. Value of production shows the large influence of fruit and vegetable crops: truck crops, tomatoes, orchards, and vineyards especially. These crops account for more than two-thirds of the value of irrigated production in the Central Valley. In the San Felipe Unit, they account for over 95 percent of the value of production. Cotton and rice also produce significant revenue in the Central Valley. Although the direct value of other crops such as hay and grains is relatively low, they support linked sectors such as dairies, other livestock, and food processing. These linkages are discussed further in the Socioeconomics Technical Appendix G.

Net Income from Irrigated Lands. Table E-27 shows the estimated net income associated with irrigated crop production in each region. The Sacramento Valley with about 30 percent of acreage produces less than 20 percent of Central Valley net income due to the crop mixes, yields, and prices received. The San Joaquin Valley and Tulare Basin each produce about 40 percent of net income.

Agricultural Water Use. Under the No Action Alternative average condition, approximately 11.7 maf of surface water and 9.3 maf of groundwater is applied to irrigated lands, for a total of about 21 maf. Surface-water application declines in a dry condition, but groundwater pumping increases. Total application increases in a dry condition because less rainfall is available for crop demand—more consumptive demand must be met through irrigation. The opposite occurs in a wet condition. Table E-28 summarizes the applied irrigation water by region.

### 1.2.2.4 Maximum Flow Alternative

Using conditions of the No Action Alternative as the base, the agricultural impacts of reduced CVP delivery were estimated. The estimated reduction in CVP water delivery due to the Trinity River restoration is discussed in detail in the Water Resources/Water Quality Technical Appendix A. Changes in groundwater lifts are approximated using estimates from the Central Valley Groundwater Surface Water Model (CVGSM).

**Trinity River Basin**. No impacts are anticipated.

**Lower Klamath River Basin/Coastal Area**. No impacts are anticipated.

**Central Valley**.

Irrigated Land Use. The water supplies estimated in the water resource analyses were used to estimate the resulting changes in irrigated land use. Results are summarized for the three Central Valley regions and the San Felipe Unit and compared to the No Action results in Table E-29.

Changes from the No Action Alternative are largely determined by the location of water contractors most affected by the reduced CVP water delivery from the Trinity River restoration. The San Joaquin Valley shows the largest decline in acreage, about 8,800 acres, followed by the Tulare Basin which declines 3,800 acres, and the Sacramento Valley, which declines 1,300 acres. The reductions, however, are focused in areas receiving delivery under CVP water service contracts. For example, in the Tehama-Colusa Service Area in the Sacramento Valley, irrigated acreage is estimated to fall by 900 acres (1 percent). In the San Joaquin Valley, WWD irrigated land is estimated to decline by 6,300 acres (1.2 percent). Cotton is estimated to be the crop most affected in the San Joaquin Valley because it is the predominant field crop in the areas losing CVP water deliveries. In the Sacramento Valley, rice accounts for most of the estimated acreage decline for the same reason.

In the San Felipe Unit, acreage declines by about 7,400 acres due to reduced CVP deliveries. This assumes that groundwater is not used to replace surface water on a long-term basis. Most of the decline is in vegetables and permanent crops because these dominate the irrigated acreage. This region does not have the flexibility to focus water supply reductions on field and forage crops. 7,400 acres represents more than 30 percent of land receiving CVP water, but represents about a 7.5 percent decline in total irrigated land in San Benito and Santa Clara Counties.

In the dry condition, irrigated acreage is estimated to increase slightly (less than one half of one percent) in the three Central Valley regions. The increase is relative to the No Action dry condition, not relative to the average Maximum Flow Alternative condition. An interaction of two effects is responsible for this estimate. First, the reduction in CVP water is estimated to be larger on average than in the dry condition (366,000 af on average versus 265,000 in the dry condition). Second, the average year reduction is estimated to induce a small increase in applied water use efficiency. The long-term reduction in applied water per acre carries over into the dry condition, allowing a slightly larger acreage to be irrigated for the same volume of water. In short, the savings from the long-term increase in irrigation efficiency more than offsets the net reduction in dry-year applied water. It must be emphasized that the effect is quite small relative to the change in CVP delivery and relative to total irrigated acres.

Value of Production from Irrigated Lands. The Central Valley reduction in value of production (gross revenue) is estimated to be $15.4 million per year. This estimate does not account for crop price increases expected to occur because production has declined. (Including this price increase, the value of production would decline by $1.4 million per year less). Most of the decline is in cotton and rice, consistent with the change in acreage. Value of production in the San Felipe Unit declines by over $30 million, or 31 percent, on land served by CVP water. The higher loss in the San Felipe Unit is because of the predominance of vegetables, orchards, and vineyards in the region. Table E-30 summarizes the changes from the No Action Alternative in the value of production by region and crop.

Net Income from Irrigated Lands. Table E-31 shows the estimated changes in net farm income associated with the irrigated crops in each region for the average water condition. The table includes estimates of several components:

- Net income from a change in acreage irrigated. This includes net income directly attributed to an increase or decrease in acreage, holding crop prices constant.
- Change in the cost of CVP water.
- Change in the cost of groundwater pumping.
- Change in the cost of irrigation systems and management.
- The effect of changes in crop prices caused by changes in production.

Table E-31 shows that the combined net revenue loss is estimated to be $35 million annually. About 60 percent of the total loss is expected to be in the San Joaquin Valley. The net revenue losses in other regions vary from $2.3 million in the San Felipe Unit to $8.5 million in the Tulare Basin and $3.2 million in the Sacramento Valley.

More than 75 percent of the net revenue loss is due to the shift from CVP water to higher cost groundwater pumping, and the rest is due to the decreased crop production and increased irrigation system cost. Reductions in net revenue are partly offset by a $1.4 million increase for remaining lands due to higher prices.

The net income estimates are not detailed by crop because the analysis treats the farm as an entire operation. Different water sources are not allocated to specific crops, so an increase in water cost cannot be apportioned to individual crops.

Agricultural Water Use. Surface-water diversions and deliveries are summarized in the Water Resources/Water Quality Technical Appendix A. Water use reported here represents an estimate of water actually applied to the field for crop growth. The numbers in Table E-32 represent the changes in CVP delivery and groundwater use.

Of the total 366,000 af losses of CVP water, about 77,000 af is accounted for by 21,300 acres of fallowed lands; 216,000 af is new groundwater pumping; and the remainder, which is about 73,000 af, is estimated to come from reduced irrigation losses. In both the Westlands Water District and the Tehama-Colusa Service Area, over 75 percent of the CVP water losses are expected to be replaced by groundwater pumping. As a result, land subsidence and eventual water quality problems are likely.

San Felipe Unit loses about 15,000 af of CVP supply in the average condition, all of which, by assumption, comes from reduced application to crops.

Other Unquantified Impacts. Besides the direct impact on agricultural income, impacts on consumers of farm commodities, land values, farm financing, and risk are briefly discussed below.

Decreased production of farm goods and increased prices are expected to result in a loss to consumers because more of their income must be spent on the goods, and they may purchase less than they would under the No Action Alternative.

Value of irrigated land primarily depends on the quantity and variability of the water supply available and the profitability of farming. Reductions in the CVP water deliveries and the resultant net farm revenue declines are expected to reduce land value, particularly in the more affected areas including the Westlands Water District and the Tehama-Colusa Service Area.

Variable surface-water supplies can be a substantial economic problem in irrigated agriculture. Farmers often must make important investment, planting, and marketing decisions before knowing their water supply. Increased frequency of shortages in CVP water deliveries and the increased dependence on groundwater pumping would increase the risk associated with farming.

Availability of credit for farming depends largely on the expected profitability of production, the risk or variability of profit, and the collateral available to secure the lender's money. Therefore, changes in conditions that reduce profit, increase risk, or reduce the value of land can be expected to reduce lenders' willingness to lend money or to increase the interest rate they charge.

### 1.2.2.5 Flow Evaluation

**Trinity River Basin.** No impacts are anticipated.

**Lower Klamath River Basin/Coastal Area.** No impacts are anticipated.

**Central Valley.** This impact was analyzed using a similar approach to that described under the Maximum Flow Alternative.

Irrigated Land Use. The water supplies estimated in the surface-water analyses were used to estimate resulting irrigated land use. Results are summarized for the three Central Valley regions and the San Felipe Unit and compared to the No Action results in Table E-33.

Average irrigated land is estimated to decline by 200 acres in the Sacramento Valley, 1,600 acres in the San Joaquin Valley, and 1,100 acres in the Tulare Basin. The reductions are focused in areas receiving CVP water supply, such as the Tehama-Colusa Service Area and Westlands Water District.

In the San Felipe Unit, acreage declines by about 1,400 acres due to reduced CVP deliveries. This assumes that groundwater is not used to replace surface water on a long-term basis. Most of the decline is in vegetables and permanent crops because these dominate the irrigated acreage. This region does not have the flexibility to focus water supply reductions on field and forage crops.

Irrigated acres in the Central Valley increase slightly in the dry condition, for the same reasons described under the Maximum Flow Alternative.

Value of Production from Irrigated Lands. The Central Valley reduction in value of production is estimated to be $3.1 million per year. The affected crops include rice, tomatoes, cotton, and alfalfa. Value of production in the San Felipe Unit is estimated to decline by $5.8 million. Table E-34 summarizes the changes from the No Action Alternative in the value of production by region and crop.

Net Income from Irrigated Lands. Table E-35 shows the estimated change in net farm income associated with the irrigated crops in each region for the average water condition.

Combined net revenue loss is estimated to be $8.5 million annually. The San Joaquin Valley and Tulare Basin each are estimated to lose about $3.5-3.6 million. The Sacramento Valley loses $0.9 million and the San Felipe Unit loses $0.5 million.

About $9.1 million of net revenue loss is due to the increased cost in groundwater pumping, which is offset by $2.3 million of cost reductions from reduced CVP water use. Other revenue losses are due to the decreased crop production and increased irrigation system cost.

The net income estimates are not detailed by crop because the analysis treats the farm as an entire operation. Different water sources are not allocated to specific crops, so an increase in water cost cannot be apportioned to individual crops.

Agricultural Water Use. Surface-water diversions and deliveries are summarized in the Water Resources/Water Quality Technical Appendix A. Water use reported here represents an estimate of water actually applied to the field for crop growth. The numbers in Table E-36 represent the changes in CVP delivery and groundwater use.

Of the total 83,000 af losses of CVP water, 56,000 af is replaced by new groundwater pumping, and the remainder is estimated to come from land fallowing and reduced irrigation losses. Most of the CVP water reduction occurs in Westlands Water District in the San Joaquin Valley and in the Tehama-Colusa Service Area in the Sacramento Valley.

San Felipe Unit loses about 3,000 af of CVP supply in the average condition, all of which, by assumption, comes from reduced application to crops.

Other Unquantified Impacts. Besides the direct impact on agricultural income, impacts on consumers of farm commodities, land values, farm financing, and risk are briefly discussed below.

Decreased production of farm goods and increased prices are expected to result in a loss to consumers because more of their income must be spent on the goods, and they may purchase less than they would under the No Action Alternative.

Value of irrigated land primarily depends on the quantity and variability of the water supply available and the profitability of farming. Reductions in the CVP water deliveries and the resultant net farm revenue declines are expected to reduce land value, particularly in the more affected areas including the Westlands Water District and the Tehama-Colusa Service Area.

Variable surface-water supplies can be a substantial economic problem in irrigated agriculture. Farmers often must make important investment, planting, and marketing decisions before knowing their water supply. Increased frequency of shortages in CVP water deliveries and the increased dependence on groundwater pumping would increase the risk associated with farming.

Availability of credit for farming depends largely on the expected profitability of production, the risk or variability of profit, and the collateral available to secure the lender's money. Therefore, changes in conditions that reduce profit, increase risk, or reduce the value of land can be expected to reduce lenders' willingness to lend money or to increase the interest rate they charge.

## 1.2.2.6 Percent Inflow Alternative

**Trinity River Basin**. No impacts are anticipated.

**Lower Klamath River Basin/Coastal Area**. No impacts are anticipated.

**Central Valley**. This impact was analyzed using a similar approach to that described under the Maximum Flow Alternative.

Irrigated Land Use. The water supplies estimated in the surface-water analyses were used to estimate resulting irrigated land use. Results are summarized for the three Central Valley regions and the San Felipe Unit, and compared to the No Action results in Table E-37.

The irrigated acreage is estimated to decline by 100 acres in the Sacramento Valley (mostly rice), 500 acres in the San Joaquin Valley (mostly cotton), and 600 acres in the Tulare Basin. 400 acres are estimated to be idled in the San Felipe Unit.

Irrigated acres in the Central Valley increase slightly in the dry condition, partly because of an estimated increase in dry condition CVP delivery and partly for the same reasons described under the Maximum Flow Alternative.

Value of Production from Irrigated Lands. The value of production (gross revenue) from crops is estimated to decline $600,000 per year in the San Joaquin Valley and $700,000 per year in the Tulare Basin. No changes are estimated for the Sacramento Valley. Value of production in the San Felipe Unit is estimated to decline by $1.6 million Table E-38 summarizes the changes from the No Action Alternative in the value of production by region and crop.

Net Income from Irrigated Lands. Table E-39 shows the estimated change in net farm income associated with the irrigated crops in each region for the average water condition.

Combined net revenue loss is estimated to be $4.4 million per year. Most of the net revenue loss is due to the increased cost of groundwater pumping.

The net income estimates are not detailed by crop because the analysis treats the farm as an entire operation. Different water sources are not allocated to specific crops, so an increase in water cost cannot be apportioned to individual crops.

Agricultural Water Use. Surface-water diversions and deliveries are summarized in the Water Resources/Water Quality Technical Appendix A. Water use reported here represents an estimate of water actually applied to the field for crop growth. The numbers in Table E-40 represent the changes in CVP delivery and groundwater use.

Of the total 32,000 af loss of CVP water, 21,000 af is replaced by new groundwater pumping, and the remainder is estimated to come from land fallowing and reduced irrigation losses.

Other Unquantified Impacts: Due to the relatively small changes in production and revenue, impacts on consumers, land values, financing, and risk are expected to be small.

### 1.2.2.7 Mechanical Restoration Alternative

The Mechanical Restoration Alternative has no impact on agricultural water delivery, so crop acres, revenue, and water use are the same as for the No Action Alternative.

### 1.2.2.8 State Permit Alternative

**Trinity River Basin**. No impacts are anticipated.

**Lower Klamath River Basin/Coastal Area**. No impacts are anticipated.

**Central Valley**.

Irrigated Land Use. The water supplies estimated in the surface-water analyses were used to estimate resulting irrigated land use. Results are summarized for the three Central Valley regions and the San Felipe Unit, and compared to the No Action results in Table E-41.

Results for Central Valley regions show very small increases or decreases in acreage, but these changes are believed to be within the margin of error of the estimates. No meaningful changes in irrigated acreage are estimated. In the San Felipe Unit, small increases in CVP water delivery is estimated to increase irrigated land by 1,200 acres.

Value of Production from Irrigated Lands. Results for Central Valley regions show very small increases or decreases in value of production (gross revenue) (see Table E-42), but these changes are believed to be within the margin of error of the estimates. A small increase in San Felipe Unit value of production is estimated for the average condition. Increased value of production in the dry condition is estimated for the San Joaquin Valley, Tulare Basin, and San Felipe Unit.

Net Income from Irrigated Lands. Table E-43 shows the estimated change in net farm income associated with the irrigated crops in each region for the average water condition.

Savings in groundwater pumping in the Central Valley results in a net cost savings, especially in the San Joaquin Valley. Total net income increases $2.9 million over all regions.

The net income estimates are not detailed by crop because the analysis treats the farm as an entire operation. Different water sources are not designated to specific crops, so an increase in water cost cannot be apportioned to individual crops.

Agricultural Water Use. Surface-water diversions and deliveries are summarized in the Water Resources/Water Quality Technical Appendix A. Water use reported here represents an estimate of water actually applied to the field for crop growth. The numbers in Table E-44 represent the changes in CVP delivery and groundwater use.

Of the total 39,000 af increase in CVP water applied, 26,000 af are used to reduce groundwater pumping, and the remainder is used to increase crop production and to lower irrigation system cost. An estimated reduction in surface water applied in the Tulare Basin is considered a modeling anomaly, and does not represent a reduction in CVP water delivery. The largest CVP water increase occurs in Westlands Water District in the San Joaquin Valley, followed by the Tehama-Colusa Service Area in the Sacramento Valley. In both regions, over 80 percent of the CVP water increases are used to reduce groundwater pumping. As a result, land subsidence and eventual water quality can be expected to improve in the long run.

San Felipe Unit shows a 2,500 af increase in CVP supply in the average condition and about 9,000 af in the dry condition, all of which, by assumption, is used to increase crop production.

Other Unquantified Impacts. Due to the small magnitude of changes in production and revenue impacts on consumers, land values, financing, and risk are expected to be insignificant.

## 1.2.2.9 Existing Conditions versus Preferred Alternative

Most of the changes in agricultural land and water use between 1995 (i.e., existing conditions) and 2020 under the Preferred Alternative largely result from changes unrelated to the proposed action. CVP water supply declines 563,000 af on average under the Preferred Alternative, but 477,000 af of that also occurs under the No Action Alternative due to increased 2020 demands.

Surface-water delivery between 1995 and 2020 under the Preferred Alternative declines about 32,000 af in the Sacramento Valley; 320,000 af in the San Joaquin Valley; 206,000 af in the Tulare Basin; and 5,000 af in the San Felipe Unit. Impacts to irrigated acres, gross revenue, and groundwater use follow the same pattern, with large impacts relative to existing conditions mostly accounted for by changes that also occur under the No Action Alternative. Impacts to irrigated acres would be less than 2 percent for all Central Valley regions, and would be about 10 percent of CVP-supplied lands in the San Felipe Unit (about 2.5 percent of all crop land in San Benito and Santa Clara Counties).

## 1.2.2.10 Cumulative Impacts

The cumulative impact analysis assesses the effects of implementing the Preferred Alternative along with the CVPIA Preferred Alternative and full CVP water rights deliveries in the Sacramento Valley. Impacts are estimated relative to the No Action Alternative, existing conditions, and the Preferred Alternative. Surface-water deliveries increase in the Sacramento Valley compared to all of these because of the assumed full delivery of water rights and settlement contracts. The increase is offset by reductions in CVP delivery south of the Delta, and so does not directly affect the quantity of Trinity River water delivered in the Central Valley.

**Impacts Relative to the No Action Alternative**. Average surface-water delivery is estimated to increase by about 110,000 af in the Sacramento Valley. Reduction in groundwater pumping would result in only minor changes in total irrigated acreage. The cumulative reduction in surface water delivered south of Delta is estimated to be 357,000 af in the San Joaquin Valley and 79,000 af feet in the Tulare Basin. A portion of this reduction occurs in areas also affected by the CVPIA land retirement program. Irrigated acreage south of the Delta would drop by about 45,000 acres due to land retirement and water supply reductions. Impacts would be focused in the Delta-Mendota and San Luis Service areas of the CVP. Additional land retirement is expected to be implemented in SWP service areas within Kings and Kern Counties. In areas not implementing land retirement, changes in surface- water supply are largely matched by regional changes in groundwater pumping. Irrigated acreage reductions would be more pronounced in areas with limited usable groundwater. In the San Felipe Unit, irrigated acres would decline by about 9,000 acres, with an average gross revenue reduction of about $32 million per year.

Gross revenue from irrigated crops would remain about the same in the Sacramento Valley, but would fall substantially in the San Joaquin Valley and Tulare Basin affected by land retirement and water cutbacks. Potential net revenue impacts from land retirement are mitigated by the payments made to growers who retire land. Substantially higher water costs face CVP water service contractors due to CVPIA water pricing changes and, south of the Delta, due to higher cost groundwater pumping.

**Impacts Relative to Existing Conditions**. Agricultural impacts in the Sacramento Valley and the San Felipe Unit would be similar to those described relative to the No Action Alternative. Higher losses of CVP delivery are estimated south of the Delta, caused by additional deliveries made to urban water rights in the Sacramento Valley. Total reduction in surface water applied for irrigation is estimated to be 643,000 af on average in the San Joaquin Valley and 256,000 af in the Tulare Basin. Although a portion of the reduction is offset by groundwater pumping, over 170,000 acres would still go out of production. Of this, 75,000 acres is due to the land retirement program, 80,000 acres is due to other land conversion between now and 2020, and the remaining 15,000 acres would be caused by water cutbacks. Although 170,000 acres is less than 5 percent of irrigated land in the two regions, the reductions would be most concentrated in CVP water service areas. In the San Felipe Unit, 10,000 additional acres and $35 million in gross revenue would be lost relative to existing conditions.

**Impacts Relative to the Preferred Alternative**. Water supply and irrigated land impacts in the Sacramento Valley would be similar to those described relative to the No Action Alternative. The additional reduction in irrigated land is about 30,000 acres in the San Joaquin Valley and 13,000 acres in the Tulare Basin. In the San Felipe Unit 7,700 additional acres and about $26 million in gross revenue would be lost relative to the Preferred Alternative.

# 1.3 REAL ESTATE

Residential and commercial properties can be found in the general vicinity of the reservoirs and rivers being studied in this EIS. The value of these properties could be affected by changing water elevations and instream flows. As a result, the basic question from a property value perspective is how would fluctuations in reservoir water elevations and river instream flows affect property values. This section provides a qualitative discussion of the potential impacts to residential and commercial property values of varying Trinity, Whiskeytown, and Shasta Reservoir water elevations and Trinity and Sacramento River instream flows associated with the various Trinity River EIS alternatives.

## 1.3.1 Affected Environment

This section provides an analysis of the real estate environment in each geographical area, and will focus on key factors and characteristics that might be significantly affected by Trinity River restoration alternatives.

### 1.3.1.1 Reservoir-oriented Properties

**Trinity River Basin.** Two reservoirs, Trinity Reservoir and Lewiston Reservoir, are located in the Trinity River Basin.

Trinity Reservoir is surrounded by the Shasta-Trinity National Forest and is one of the three reservoirs included in the Shasta-Trinity National Recreation Area. As a result, only a limited amount of development has taken place around the reservoir. The primary areas of development, located on the west side of the reservoir, are Trinity Center and Covington Mill.

Historically, since completion of the dam in 1963 (the following data reflects the 1963-1998 period), end-of-month water levels at Trinity Reservoir have averaged 2,326 feet above mean sea level (msl). Average annual water levels have ranged from 2,360 in 1974 to 2,228 in 1992. Average monthly water levels have ranged from 2,349 (in May) to 2,306 (in November), and for individual months from a high of 2,374 in May 1963 to a low of 2,121 in October 1978. Monthly fluctuation within a given water year (October to September) has averaged 60 feet with a high of 218 feet in 1978 to a low of 26 feet in 1985.

Lewiston is a small reservoir just downstream of the much larger Trinity Reservoir. Lewiston, among other things, acts to regulate releases out of Trinity. Given Lewiston has virtually no development along its shores, this reservoir has been excluded from the property value assessment.

**Lower Klamath River Basin/Coastal Area.** There are no reservoirs along this stretch of the Klamath River or along the coastal area.

**Central Valley.** The Central Valley, comprising both the Sacramento and San Joaquin Valleys, contains a number of federal- and state-run reservoirs. Water levels at most of these reservoirs were anticipated to incur little to no change as a result of the alternatives under consideration. The reservoirs where water level changes were deemed possible include Shasta and Whiskeytown along the northern edge of the Sacramento Valley, and San Luis Reservoir near Los Banos in the San Joaquin Valley.

Whiskeytown Reservoir represents another piece of the Shasta-Trinity National Recreation Area. Little to no property development is found at the reservoir. Because of lack of development and a lack of water level fluctuation as compared to the No Action Alternative (see Environmental Consequences section), impacts at this reservoir were not analyzed in any detail.

Shasta Reservoir is bordered to the north by the Shasta-Trinity National Forest and represents the third reservoir found in the Shasta-Trinity National Recreation Area. The reservoir is moderately developed despite the influence of public lands. The following developments can be found along or in the general proximity of the reservoir: Lakehead, Gregory Creek Acres, O'Brien, Yeoty Mountain, Salt Creek Lodge, Bully Hill, Silverthorn, Shasta Reservoir Subdivision, and Lakeshore.

Historically, since completion of the dam in 1945 (the following data reflects the 1945-1998 period), end-of-month water levels at Shasta Reservoir have averaged 1,015 feet above msl. Average annual water levels have ranged from 1,044 in 1974 to 898 in 1977. Average monthly water levels have ranged from 1,043 (in April) to 993 (in October), and for individual months from a high of 1,067 in May 1974 to a low of 839 in August 1977. Monthly fluctuation within a given water year has averaged 69 feet with a high of 217 feet in 1978 to a low of 34 feet in 1970.

Given that little to no development is found around San Luis Reservoir, this reservoir was excluded from the real estate analysis.

### 1.3.1.2 River-oriented Properties

**Trinity River Basin.** The section of the Trinity River affected by the alternatives consists of the area downstream of Lewiston Reservoir to the confluence with the Klamath River. The last stage of the Trinity River, prior to combining with the Klamath River, is found on the Hoopa Valley Indian Reservation. Since the concept of property values is foreign to the tribes, the real estate analysis excluded this area. A number of relatively small communities are found along the river downstream of Lewiston Dam; they include: Lewiston, Douglas City, Junction City, Big Bar, Del Loma, Burnt Ranch, Salyer, and Willow Creek.

**Lower Klamath River Basin/Coastal Area.** The lower Klamath River, reflecting the area downstream of the confluence with the Trinity River, consists entirely of the Yurok Indian Reservation. Since the concept of property values is foreign to the tribes, the real estate analysis excluded this area.

**Central Valley.** The Central Valley reflects a vast geographic area with numerous towns and cities of various sizes. Since the alternatives under consideration are not expected to create a perceptual change in instream flows, no discernible impacts to Central Valley riverside properties is expected. As a result, Central Valley residential property values impacts will not be addressed in any detail.

# 1.3.2 Environmental Consequences

## 1.3.2.1 Methodology

A literature review on the affect of water bodies on property values was conducted with the objective of obtaining a sufficient number of relevant studies for presentation of a range of possible property value impacts (elaboration on the literature review can be found in Attachment E2). This goal proved overly optimistic since only a few relevant studies were located. The studies that were obtained generally indicated a positive relationship between property values and the existence of and proximity to water bodies. The studies focusing on property value impacts related to reservoir water level fluctuation also revealed a positive relationship—as water levels drop, so do property values. This relationship was assumed to hold for the reservoirs under consideration in this study. Because of the lack of relevant literature, a comparative analysis is presented that includes rankings of a series of factors (e.g., water levels and fish populations) deemed to be of potential interest to the various property owner groups.

## 1.3.2.2 Reservoir-oriented Properties

The Trinity EIS alternatives would influence reservoirs through changes in water level. The greater the Trinity River instream flow, the greater the potential reduction on Trinity, Whiskeytown, and Shasta Reservoir water elevations. Values of nearby properties could be influenced by both the magnitude of a permanent water level reduction (drawdown) and the amount of annual and monthly water level fluctuation.

For this analysis, drawdown is defined as a permanent reduction in average water elevations. If a drawdown were expected, implying water elevations were to be maintained at a lower annual average for the foreseeable future, property owners may be able to adjust by extending docks, planting vegetation in the mud flat zone, etc. The potential for adjustment depends on the magnitude of the drawdown. Should property owners be able to adjust to the drawdown, the property value impact may only be temporary. Should the drawdown be so severe as to preclude the pursuit of certain recreational activities or prevent access to the water for certain communities, then the property value effect could be more of a long-term problem. In reviewing the magnitude of the drawdowns associated with the various affected reservoirs, the assumption was made that drawdowns would not result in long-term impacts and therefore drawdown represents a measure of short-term (S/T) effects.

Annual water level fluctuations occur as a result of varying climatic conditions and therefore vary across the water-year classes (extremely wet to critically dry). Monthly water level fluctuations often occur at reservoirs used to support the changing monthly demands of agriculture and hydropower generation. If annual or monthly fluctuations in water elevations prove to be minor in scale, property value impacts would likely be insignificant. Defining a minor fluctuation may be difficult and would be related to the topography of the reservoir. If the reservoir has shallow water frontages, small water level fluctuations could result in large mud flat zones. Conversely, deep water frontages may not be adversely affected by small fluctuations. Given the topography of a reservoir often varies significantly around its





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circumference with both shallow and deep water frontages occurring at the same reservoir, the actual location of the property could have important implications on potential property value impacts. If the annual and monthly water elevation fluctuations involved large variations, major unavoidable mud flats could result regardless of the topography of the site. Alternatives that result in large annual and monthly water elevation fluctuations, as represented by the range in water levels within and across years, would likely create the largest long-term (L/T) property value impacts.

The degree of impact on property values may also be a function of occurrence probabilities. A given water level change would likely create more adverse effects if it were expected to occur during wet, normal, or dry water years (28, 20, and 28 percent occurrence probabilities, respectively) as opposed to critically dry or extremely wet years (12 percent occurrence probability). Since drought is generally considered a temporary condition, the influence of drawdowns during drought conditions may have a lesser effect as compared to drawdowns during more "normal" conditions.

Methodology: Water level information from the PROSIM hydrologic model was used to evaluate the magnitude of possible drawdowns and annual/monthly fluctuations for each alternative. PROSIM estimates end-of-month reservoir water levels by alternative for each year in the 69-year hydrologic period of record (1922-1990). End-of-month water levels provide the basis for the reservoir property value comparison. While fluctuation in end-of-month water levels is somewhat less than that of daily water levels, a comparison of monthly and daily actual historic water level data indicated the difference to be fairly minor. The PROSIM data were used to calculate average monthly water levels across the entire 69-year period (represents the average water year), and for each of the five water-year classes: critically dry, dry, normal, wet, and extremely wet[1]. The monthly averages were used to calculate annual average water levels for the average year and for each water-year class. In addition, the data were used to calculate annual averages for each of the 69 years in the hydrologic record as well as ranges in monthly water levels for each year.

Water level data were separately evaluated for both the entire year and the high recreation season (defined as May through September). The high recreation season was considered separately to account for potential differences in water levels during this period as compared to the entire year. For some property owners (e.g., seasonal residents), water levels during the recreation season could be far more important than during the remainder of the year.

To address the range of issues described above, water level measures attempting to reflect drawdown, annual fluctuation, and monthly fluctuation are compared across alternatives for

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[1]The actual years associated with each water-year class across the 69-year hydrologic record are as follows:

| | |
|---|---|
| Critically dry | 1923, 1924, 1929, 1931, 1934, 1939, 1944, 1977 |
| Dry | 1922, 1926, 1930, 1932, 1933, 1935, 1937, 1947, 1950, 1955, 1962, 1964, 1976, 1979, 1981, 1985, 1987, 1988, 1990 |
| Normal | 1928, 1936, 1943, 1945, 1948, 1949, 1957, 1959, 1960, 1961, 1966, 1968, 1972, 1989 |
| Wet | 1925, 1927, 1940, 1942, 1946, 1951, 1952, 1953, 1954, 1963, 1965, 1967, 1969, 1970, 1971, 1973, 1975, 1980, 1984, 1986 |
| Extremely wet | 1938, 1941, 1956, 1958, 1974, 1978, 1982, 1983 |

both the full year and high recreation seasons. Estimated water levels and differentials by alternative as compared to the No Action Alternative (federal National Environmental Policy Act [NEPA] comparison) are presented for each water level measure. In addition, to address CEQA requirements, 1995 modeled existing conditions were compared to results for the Preferred Alternative only. Note that for the CEQA analysis, modeled conditions for 1995 were used as opposed to actual 1995 conditions so as to compare modeled output to modeled output (avoids issues of modeling error). The following water level measures were used:

| | | |
|---|---|---|
| 1) Drawdown: | - | average annual water level |
| 2) Annual fluctuation: | - | high, low, and range of average annual water levels across all five water-year classes |
| | - | high, low, and range of average annual water levels across each year in the 69-year hydrologic record |
| 3) Monthly fluctuation: | - | high, low, and range of average monthly water levels for the average year |
| | - | high, low, and range of average monthly water levels across all five water-year classes |
| | - | high, low, and range of individual monthly water levels across the entire 69-year hydrologic period |
| | - | high, low, and average of the monthly range in water levels across each year in the 69-year hydrologic record |

**Trinity River Basin.**

Trinity Reservoir. Tables E-45 and E-46 present water level information across the entire year and for the high recreation season for Trinity Reservoir, respectively. Three pieces of information, separated by commas, are provided in each cell: (1) the water level measure value, (2) the change in value from the No Action Alternative (NEPA comparison) or existing conditions (CEQA comparison), and (3) the rank across alternatives for the NEPA comparison only. The ranks were based on numeric water level differences; no attempt was made to lump changes within a particular range under the same rank. Therefore, a 1-foot differential was enough to distinguish rank between alternatives.

The No Action and Mechanical Restoration Alternatives are both characterized by the same hydrology (instream flows and reservoir water levels) and, therefore, imply the same impacts. This is also true of the Flow Evaluation and Preferred Alternatives. However, the No Action and Mechanical Restoration Alternatives are not the same as the Flow Evaluation and Preferred Alternatives.

Results: From the short-term drawdown perspective, regardless of whether one considers the entire year or only the high-use recreation season, the State Permit Alternative is estimated to result in the greatest gain in average water levels as compared to the No Action Alternative





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(additional 13 feet for full year and 16 feet for high recreation season). However, this gain still does not achieve historical average water levels experienced during the 1963-1998 period. The Flow Evaluation and Percent Inflow Alternatives are also estimated to produce gains in average water levels as compared to the No Action Alternative, although to a lesser degree (in the range of 3-6 additional feet). The Maximum Flow Alternative is the only alternative where average water levels are expected to decline (14-foot drop for full year and 20-foot drop for high season) compared to the No Action Alternative.

From the long-term perspective of annual fluctuation, the Maximum Flow Alternative consistently results in the smallest range between high and low water levels considering either the entire year or the high-use recreation season. The 102-foot range in average annual values across all years associated with the Maximum Flow Alternative falls well below the 159-foot range associated with the No Action Alternative and the historical range in annual fluctuation from 1963-1998 of 138 feet. All alternatives are expected to result in a tighter range in annual fluctuation as compared to the No Action, with the Flow Evaluation and Percent Inflow Alternatives generally tighter than the State Permit Alternative.

From the long-term perspective of monthly fluctuation, again the Maximum Flow Alternative consistently results in the tightest water level ranges regardless of whether one considers the entire year or the high-use recreation season. The monthly fluctuation ranges associated with the Maximum Flow Alternative are noticeably tighter than the No Action Alternative and the actual historical ranges experienced during the 1963-1998 period. Depending on the measure, the Flow Evaluation and Percent Inflow Alternatives either result in a sizable drop or a minor increase in water level ranges compared to the No Action Alternative.

Aggregating ranks across all three categories of water level measures results in the Flow Evaluation Alternative ranking first overall from the entire year and high recreation season perspectives. The Flow Evaluation Alternative came in second of five for the high recreation season. This ranks fourth out of the five alternatives (surpassing only the Maximum Flow Alternative), under the premise that the higher the water level the better. Both the entire year and high season values are much lower than the 2,326 actual historical average water level experienced during the 1963-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the No Action Alternative ranked last with the largest ranges of any alternative from both the full year and high recreation season perspectives. The expected range across individual years of 159 feet from the full year perspective exceeded the historical range of 138 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the No Action Alternative ranked fourth, surpassing only the State Permit Alternative from both full year and high recreation season perspectives. In comparison with historical monthly fluctuation, the No Action Alternative is expected to achieve lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the No Action Alternative is expected to experience a range of 204 feet (high of 2,369 and low of 2,165) compared to the historically experienced range of 253 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the No Action Alternative being ranked last.

*Maximum Flow Alternative.*

Drawdown: Average water level predicted for the Maximum Flow Alternative was estimated at 2,284 for the entire year and 2,281 for the high recreation season. This ranks last out of the five alternatives. Both the entire year and high season values are much lower than the 2,326 actual historical average water level experienced during the 1963-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Maximum Flow Alternative ranked first with the smallest ranges of any alternative from both the full year and high recreation season perspectives. The expected range across individual years of 102 feet from the full year perspective fell well below the No Action Alternative range of 159 feet and the 1963-1998 historical range of 138 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Maximum Flow Alternative ranked first, surpassing all other alternatives from both the full year and high recreation season perspectives. This alternative ranked first in all four monthly fluctuation measures across both full year and high recreation season time frames.

In comparison with historical monthly fluctuation, the Maximum Flow Alternative is expected to achieve far lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the Maximum Flow Alternative is expected to experience a range of 136 feet (high of 2,344 and low of 2,208) compared to the historically experienced range of 253 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Maximum Flow Alternative being ranked second from the full year perspective and tied for first (with the Flow Evaluation Alternative) for the high recreation season.

*Flow Evaluation Alternative.*

Drawdown: Average water level predicted for the Flow Evaluation Alternative was estimated at 2,303 for the entire year and 2,307 for the high recreation season. This ranks second out of the five alternatives. Both the entire year and high season values are much lower than the 2,326 actual historical average water level experienced during the 1963-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Flow Evaluation Alternative ranked second (tied with Percent Inflow Alternative from the full year perspective). The expected range across individual years of 123 feet from the full year perspective fell below the 159-foot range of the No Action Alternative and the 1963-1998 historical range of 138 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Flow Evaluation Alternative ranked second from the full year perspective and third from the high recreation season perspective. The range in monthly water levels across individual months was estimated at 41 feet below the No Action Alternative.

In comparison with historical monthly fluctuation, the Flow Evaluation Alternative is expected to achieve comparable or lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the Flow Evaluation Alternative is expected to experience a range of 163 feet (high of 2,369 and low of 2,206) compared to the historically experienced range of 253 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Flow Evaluation Alternative being ranked first from the full year perspective and tied for first (with the Maximum Flow Alternative) for the high recreation season. From both perspectives, the Flow Evaluation Alternative came in second for five of the seven water level measures.

*Percent Inflow Alternative*.

Drawdown: Average water level predicted for the Percent Inflow Alternative was estimated at 2,301 for the entire year and 2,306 for the high recreation season. This ranks third out of the five alternatives. Both the entire year and high season values are much lower than the 2,326 actual historical average water level experienced during the 1963-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Percent Inflow Alternative ranked tied for second (with the Flow Evaluation Alternative) from the full year perspective and third from the recreation season perspective. The expected range across individual years of 125 feet from the full year perspective fell below the 159-foot range associated with the No Action Alternative and the historical range of 138 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Percent Inflow Alternative ranked third for the entire year and second for the high recreation season. The range in monthly water levels across individual months was estimated at 38 feet below the No Action Alternative.

In comparison with historical monthly fluctuation, the Percent Inflow Alternative is expected to achieve comparable or lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the Percent Inflow Alternative is expected to experience a range of 166 feet (high of 2,369 and low of 2,203) compared to the historically experienced range of 253 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Percent Inflow Alternative being ranked third; tied with the State Permit Alternative from the full year perspective and second from the high recreation season perspective (although two alternatives were tied for first under the high recreation season).

*State Permit Alternative*.

Drawdown: Average water level predicted for the State Permit Alternative was estimated at 2,311 for the entire year and 2,317 for the high recreation season. This ranks first out of the five alternatives. Both the entire year and high season values are still lower than the 2,326 actual historical average water level experienced during the 1963-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the State Permit Alternative ranked next to last, undercutting the ranges of only the No Action Alternative from both the full year and high recreation season perspectives. The expected range across individual years of 151 feet from the full year perspective exceeded the historical range of 138 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the State Permit Alternative ranked last from both entire year and high recreation season perspectives.

In comparison with historical monthly fluctuation, the State Permit Alternative is expected to achieve mixed results, with some ranges higher and some lower. The most pronounced reduction in range occurs within individual monthly values across all years where the State Permit Alternative is expected to experience a range of 201 feet (high of 2,344 and low of 2,168) compared to the historically experienced range of 253 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the State Permit Alternative being ranked third; tied with the Percent Inflow Alternative from the full year perspective and third from the high recreation season perspective (although two alternatives were tied for first under the high recreation season).

*Existing Conditions versus Preferred Alternative*.

As noted under methodology, to meet CEQA requirements, the Preferred Alternative needs to be compared to existing conditions as opposed to the No Action Alternative.

Drawdown: Average water level for the Preferred Alternative basically equated with that of existing conditions from both full year and high recreation use season perspectives.

Annual Fluctuation: From the perspective of both the entire year and high recreation seasons, the range in annual fluctuation associated with the Preferred Alternative was noticeably lower than that estimated under existing conditions. The annual average across individual years for the Preferred Alternative was estimated to be about 30 feet below that of existing conditions for both the full year and high recreation season. In addition, average low water level was higher under the Preferred Alternative.

Monthly Fluctuation: Considering both the entire year and high recreation seasons, two of the four monthly measures resulted in the Preferred Alternative providing substantial improvements in both the range and low water levels as compared to modeled existing conditions. The other two measures did not result in major water level changes.

The Preferred Alternative is generally seen as an improvement over existing conditions at Trinity Reservoir.

**Lower Klamath River Basin/Coastal Area.** There are no reservoirs along this stretch of the Klamath River or along the coastal area.

**Central Valley.** Numerous reservoirs have been constructed on Central Valley rivers. The two reservoirs that were expected to be most affected by the alternatives under consideration are Whiskeytown and Shasta.

Whiskeytown Reservoir. An analysis of Whiskeytown Reservoir property value impacts was not conducted because of the lack of residential development around the reservoir and the relatively minor fluctuation in reservoir water elevations across the various alternatives as compared to the No Action Alternative. The Maximum Flow Alternative was the only alternative that resulted in water levels different from those of the No Action. On average, the monthly water level reduction for the Maximum Flow Alternative was no more than 2 feet below that of the No Action. As a result, impacts to property values around Whiskeytown Reservoir were deemed to be negligible.

Shasta Reservoir. The analysis of Shasta Reservoir property values follows the same methodology used for Trinity Reservoir, namely the ranking of alternatives based on what were deemed to reflect short-term and long-term perspectives. The short term represents the period of time prior to property owners adjusting their properties to drawdowns. The most important short-term water level consideration is assumed to be the magnitude of the drawdown. The long-term perspective allows for people adjusting their properties and assumes the amount of annual and monthly water level fluctuation drives potential property value effects. Exactly the same water level measures are used for the Shasta rankings as were used in the Trinity rankings. Tables E-47 and E-48 present water level information across the entire year and for the high recreation season for Shasta Reservoir, respectively.

Results: From the short-term drawdown perspective, regardless of whether one considers the entire year or only the high-use recreation season, the State Permit Alternative is estimated to result in the only gain, albeit minor, in average water levels as compared to the No Action Alternative. The State Permit average water level of 1,018 slightly exceeds the historical average water level experienced during the 1945-1998 period. The No Action Alternative comes in a close second at 1,016 feet. The Maximum Flow Alternative is the only alternative where average water levels are expected to decline noticeably compared to the No Action (average water level is expected to be 10 feet for both entire year and high recreation season perspectives). As a result, the Maximum Flow Alternative ranks last in terms of drawdown. From the long-term perspective of annual fluctuation, the No Action Alternative consistently results in the smallest range between high and low water levels considering either the entire year or the high-use recreation season. The 109-foot range in average annual values across all years associated with the No Action Alternative falls well below the historical range in annual fluctuation of 146 feet. The State Permit and Percent Inflow Alternatives rank second and third from both entire year and high recreation season perspectives, with ranges only slightly higher than those of the No Action Alternative. The Maximum Flow Alternative ranks last in terms of annual fluctuation.

From the long-term perspective of monthly fluctuation, the State Permit Alternative consistently results in the tightest water level ranges regardless of whether one considers the entire year or the high-use recreation season. The monthly fluctuation ranges associated with the State Permit Alternative are comparable or tighter than the actual historical ranges experienced during the 1945-1998 period. The Percent Inflow and No Action Alternatives rank





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second and third, respectively, over both time frames. Again the Maximum Flow Alternative ranks last.

Aggregating ranks across all three categories of water level measures results in the State Permit Alternative ranking first overall from the entire year and high recreation season perspectives. The No Action Alternative comes in second and the Percent Inflow third across both time periods. The Maximum Flow Alternative ranked last in all categories and time periods.

*No Action (and Mechanical Restoration) Alternatives.*

Drawdown: Average water level predicted for the No Action Alternative was estimated at 1,016 for the entire year and 1,019 for the high recreation season. This ranks second out of the five alternatives. Both the entire year and high season values are slightly higher than the 1,015 actual historical average water level experienced during the 1945-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the No Action Alternative ranked first with the smallest ranges of any alternative from both the full year and high recreation season perspectives. The expected range across individual years of 109 feet from the full year perspective fell well below the historical range of 146 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the No Action Alternative ranked third from both full year and high recreation season perspectives.

In comparison with historical monthly fluctuation, the No Action Alternative is expected to achieve comparable or lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the No Action Alternative is expected to experience a range of 183 feet (high of 1,067 and low of 884) compared to the historically experienced range of 228 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the No Action Alternative being ranked second.

*Maximum Flow Alternative.*

Drawdown: Average water level predicted for the Maximum Flow Alternative was estimated at 1,006 for the entire year and 1,009 for the high recreation season. This ranks fifth out of the five alternatives. Both the entire year and high season values are lower than the 1,015 actual historical average water level experienced during the 1945-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Maximum Flow Alternative ranked last with the largest ranges of any alternative from both the full year and high recreation season perspectives. The expected range across individual years of 193 feet from the full year perspective exceeded the historical range of 146 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Maximum Flow Alternative ranked last exceeding all other alternatives from both the full year and high recreation season perspectives. This alternative ranked last in six of eight monthly fluctuation measures across both time frames.

In comparison with historical monthly fluctuation, the Maximum Flow Alternative is expected to incur considerably higher ranges in monthly fluctuation. The largest increase in range occurs within individual monthly values across all years where the Maximum Flow Alternative is expected to experience a range of 402 feet (high of 1,066 and low of 664) compared to the historically experienced range of 228 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Maximum Flow Alternative being ranked last from both full year and high recreation season perspectives.

*Flow Evaluation Alternative*.

Drawdown: Average water level predicted for the Flow Evaluation Alternative was estimated at 1,013 for the entire year and 1,015 for the high recreation season. This ranks fourth out of the five alternatives. Both the entire year and high season values are comparable to the 1,015 actual historical average water level experienced during the 1945-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Flow Evaluation Alternative ranked fourth from the entire year perspective but tied for third with Percent Inflow for the high recreation season. The expected range across individual years of 125 feet from the full year perspective fell below the historical range of 146 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Flow Evaluation Alternative ranked fourth from both the full year and high recreation season perspectives.

In comparison with historical monthly fluctuation, the Flow Evaluation Alternative is expected to incur higher ranges in monthly fluctuation. The most pronounced increase in range occurs within individual monthly values across all years where the Flow Evaluation Alternative is expected to experience a range of 218 feet (high of 1,066 and low of 848) compared to the historically experienced range of 228 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Flow Evaluation Alternative being ranked fourth from both the full year and high recreation season perspectives.

*Percent Inflow Alternative*.

Drawdown: Average water level predicted for the Percent Inflow Alternative was estimated at 1,015 for the entire year and 1,017 for the high recreation season. This ranks third out of the five alternatives. Both the entire year and high season values are comparable to the 1,015 actual historical average water level experienced during the 1945-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the Percent Inflow Alternative ranked third from both the full year and recreation season perspectives (tied for third with Flow Evaluation Alternative during the recreation season). The expected range across individual years of 111 feet from the full year perspective fell well below the historical range of 146 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the Percent Inflow Alternative ranked second for both the entire year and the high recreation season perspectives.

In comparison with historical monthly fluctuation, the Percent Inflow Alternative is expected to achieve comparable or lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the Percent Inflow Alternative is expected to experience a range of 182 feet (high of 1,066 and low of 884) compared to the historically experienced range of 228 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the Percent Inflow Alternative being ranked third from both the full year and high recreation season perspectives.

*State Permit Alternative*.

Drawdown: Average water level predicted for the State Permit Alternative was estimated at 1,018 for the entire year and 1,020 for the high recreation season. This ranks first out of the five alternatives. Both the entire year and high season values are somewhat higher than the 1,015 actual historical average water level experienced during the 1945-1998 period.

Annual Fluctuation: Reviewing the range between high and low annual averages across water-year classes and all years individually, the State Permit Alternative ranked second to only the No Action Alternative from both the full year and high recreation season perspectives. The expected range across individual years of 111 feet from the full year perspective falls well below the historical range of 146 feet.

Monthly Fluctuation: Based on the range/averages for the four monthly fluctuation measures, the State Permit Alternative ranked first from both entire year and high recreation season perspectives. The State Permit Alternative ranked first in all monthly range categories.

In comparison with historical monthly fluctuation, the State Permit Alternative is expected to achieve lower ranges in monthly fluctuation. The most pronounced reduction in range occurs within individual monthly values across all years where the State Permit Alternative is expected to experience a range of 182 feet (high of 1,067 and low of 885) compared to the historically experienced range of 228 feet.

Aggregating ranks across the drawdown, annual fluctuation, and monthly fluctuation measures resulted in the State Permit Alternative being ranked first from both the full year and high recreation season perspectives.

*Existing Conditions versus Preferred Alternative.*

Drawdown: Water levels for the Preferred Alternative were estimated to average 5-6 feet below that of existing conditions from full year and high recreation season perspectives, respectively.

Annual Fluctuation: From the perspective of both the entire year and high recreation seasons, the range in annual fluctuation associated with the Preferred Alternative was higher than that estimated under existing conditions. In addition, average low water level was lower under the Preferred Alternative.

Monthly Fluctuation: Considering both the entire year and high recreation seasons, three of the four monthly measures resulted in the Preferred Alternative providing substantial detractions in both the range and low water levels as compared to modeled existing conditions.

The Preferred Alternative is generally seen as a deterioration from existing conditions at Shasta Reservoir.

### 1.3.2.3 River- and Ocean-oriented Properties

**Trinity River Basin.** Most of the reviewed literature focused on the property value effects of lakes as opposed to rivers; therefore, there was little to extrapolate from in attempting to discuss impacts on riverside properties. Of the river-oriented studies reviewed (Connor et al., 1973; Epp and Al-Ani, 1979; Rich and Moffitt, 1982; and Garrod and Willis, 1991), none of them dealt with the issue of fluctuating instream flows.

The flood control analysis illustrates the negative impacts to commercial and residential properties for instream flows above flood stage.

Methodology: The purpose of this section is to discuss the potential property value impacts of changing instream flows from the No Action Alternative levels to those levels suggested by the various alternatives. It is hypothesized that the relationship between increased instream flows up to the flood condition would have a positive influence on property values. Instream flows resulting in flood damages along certain sections of the Trinity River may simultaneously create positive effects elsewhere. Therefore, flood conditions may not automatically imply property value losses basinwide (minor flood damages in one location could be offset by widespread gains associated with higher flows).

Given the breakeven point in terms of flow levels between flood damages and property value benefits is unknown, we cannot speculate at what point flows result in negative property value effects basinwide. To avoid this issue, this analysis assumes mitigation for potentially flooded properties. As a result, this analysis focuses upon the more positive aspects associated with instream flows. Given the ambiguity involved in relating property values to instream flows, changes in salmon and steelhead populations and harvests as compared to the No Action Alternative are used to rank the alternatives.

While the estimated populations should only be considered moderately accurate, they were deemed reasonable for ranking alternatives. One of the purposes of greater instream flows is to help restore the native fisheries, implying potential recreational fishing benefits to property owners (another recreational benefit from higher instream flows may be improved boating conditions). While not every property owner is assumed to be an angler, the activity is quite popular among locals. As a result, increased fish populations are assumed to reflect a positive factor associated with living along the river. Sustainable fish populations and harvests are generally seen as one indicator of a "healthy" river. The conclusion was made that the movement toward a healthy river could manifest itself through increased natural fish populations and harvest, thereby positively affecting property values. Table E-49 presents information on Trinity River natural fish harvests by species and alternative, the change in population as compared to the No Action Alternative and existing conditions, and the relative rank. Since flow is just one factor influencing fish populations, separate fish harvests were estimated for alternatives with the same instream flow but different inriver and watershed habitat restoration activities.

Results: Reviewing harvest estimates by alternative, either for salmon or steelhead, results in the same overall ranking of the alternatives. The Maximum Flow Alternative ranks first, estimated to result in over 16,000 additional harvested fish as compared to the No Action Alternative. The Flow Evaluation Alternative is expected to be nearly as productive with over 13,000 additional fish harvested and, therefore, ranks a close second.

The Percent Inflow and Mechanical Restoration Alternatives represent a second tier in alternative ranking. Both alternatives are expected to result in additional harvests in the 2,000-4,000 range as compared to No Action. While still exceeding the No Action Alternative harvest, these alternatives fall considerably short of the harvest levels estimated for the Maximum Flow and Flow Evaluation Alternatives.

The State Permit Alternative results in zero inriver harvest and, therefore, ranks last.

No Action Alternative. This alternative ranks fifth out of the six alternatives, surpassing only the State Permit Alternative in expected inriver natural harvest.

Maximum Flow Alternative. This alternative ranks first, generating more inriver natural harvest than any other alternative. Total harvest estimated for this alternative is 10 times that of the No Action Alternative.

Flow Evaluation Alternative. Inriver natural harvests for the Preferred Alternative were estimated to be approximately equal to those of the Flow Evaluation Alternative. These alternatives rank a close second to the Maximum Flow Alternative, generating over 13,000 additional harvested fish compared to the No Action Alternative.

Percent Inflow Alternative. While this alternative ranks third, it is not nearly as productive as the Maximum Flow and Flow Evaluation Alternatives, generating only an additional 3,400 inriver natural harvested fish over the No Action Alternative.

Mechanical Restoration Alternative. This alternative ranks fourth, generating 2,000 additional inriver natural harvested fish compared to the No Action Alternative.

State Permit Alternative. By assuming zero harvest of inriver natural fish, this alternative clearly ranks last.

Existing Conditions versus Preferred Alternative. In contrast to the NEPA comparison of each alternative to the No Action Alternative, the state-required CEQA analysis compares the Preferred Alternative to existing conditions. The assumption was made by the fisheries team that harvest levels under existing conditions would be essentially equal to those estimated for the No Action Alternative. In addition, harvest levels for the Preferred Alternative were deemed to be equivalent with those estimated for the Flow Evaluation Alternative despite the additional watershed elements associated with the Preferred Alternative. As a result, the CEQA analysis of the Preferred Alternative is equivalent to the NEPA analysis of the Preferred Alternative. The Preferred Alternative is expected to generate over 13,000 additional inriver natural harvested fish as compared to existing conditions.

**Lower Klamath River Basin/Coastal Area.** The lower Klamath River consists of the Yurok Tribe reservation. Due to the communal nature of tribal land ownership and management, individual property values are generally not of primary concern to tribal members; therefore, real estate impacts are not considered for this area.

**Central Valley.** Since the alternatives are not expected to create a perceptually significant change in instream flows, no discernible impact is expected for riverside residential properties.

### 1.3.2.4 Ranking Summary

Table E-50 summarizes the overall ranks by alternative presented for the various reservoirs and inriver reaches. Since the ranking of each alternative depends on the individual indicator, it is impossible to provide a clear overall rank for each alternative.





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**Table E-1A**
**Land Use Impacts—Residential/Municipal & Industrial**
**Comparison of Alternatives**

| | | | Compared to No Action Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Action | Maximum Flow | | Flow Evaluation | | Percent Inflow | | Mechanical Restoration | | State Permit | |
| **Resource Concern** | | | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent |
| **Trinity River Basin** | Dry | – | 155 properties flooded (14 million) | 0.0 | 7 properties flooded (1.6 million) | 0.0 | 19 properties flooded (3.2 million) | 0.0 | NC | 0.0 | – | 0.0 |
| **Lower Klamath Basin/Coastal Area** | Dry | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| **Central Valley** | | | | | | | | | | | | |
| Sacramento Valley | | | | | | | | | | | | |
| Land use | Average | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| | Dry | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| CVP contract delivery (taf) | Average | 105.5 | -13.3 | -12.6 | -3.5 | -3.3 | -0.6 | -0.56 | NC | 0.0 | 2.4 | 2.27 |
| | Dry | 82.2 | -17.8 | -21.6 | -12.2 | -14.8 | 1.5 | 1.82 | NC | 0.0 | 7.9 | 9.60 |
| Cost ($1,000) | Dry[a] | 5,600 | 1,800 | 32.2 | 3,500 | 62.5 | -700 | -12.5 | NC | 0.0 | -1,700 | -30.35 |
| Percent price increase | Average | – | 1.6 | – | 0.4 | – | 0.1 | – | NC | 0.0 | -0.3 | – |
| **San Joaquin Valley** | | | | | | | | | | | | |
| Land use | Average | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| | Dry | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |

**Table E-1A**
**Land Use Impacts—Residential/Municipal & Industrial**
**Comparison of Alternatives**

| | | | Compared to No Action Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **No Action** | **Maximum Flow** | | **Flow Evaluation** | | **Percent Inflow** | | **Mechanical Restoration** | | **State Permit** | |
| **Resource Concern** | | | **Amount** | **Percent** | **Amount** | **Percent** | **Amount** | **Percent** | **Amount** | **Percent** | **Amount** | **Percent** |
| CVP contract delivery (taf) | Average | 27.0 | -2.2 | -8.14 | -0.4 | -1.88 | -0.1 | 0.37 | NC | 0.0 | 0.5 | 1.85 |
| | Dry | 21.2 | -1.2 | -5.66 | -0.4 | -1.88 | 0.4 | 1.88 | NC | 0.0 | 2.1 | 9.9 |
| Cost ($1,000) | Dry | 1,700 | -200 | -11.76 | 0.0 | 0.0 | -100 | – | NC | 0.0 | -300 | -17.64 |
| Percent price increase | Average | – | 0.8 | – | 0.1 | – | 0.0 | -5.88 | NC | 0.0 | -0.0 | – |
| **Bay Area** | | | | | | | | | | | | |
| Land use | Average | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| | Dry | – | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 | NC | 0.0 |
| CVP contract delivery (taf) | Average | 279.4 | -24.8 | -8.87 | -5.1 | -1.82 | 0.7 | 0.25 | NC | 0.0 | 5.1 | 1.83 |
| | Dry | 231.0 | -35.6 | -15.41 | -22.4 | -9.69 | 4.7 | 2.03 | NC | 0.0 | 20.7 | 8.96 |
| Cost ($1,000) | Dry | 181,000 | 51,500 | 28.45 | 34,000 | 18.78 | -6,000 | -3.31 | NC | 0.0 | -23,500 | -12.98 |
| Percent price increase | Average | – | 1.4 | – | 0.2 | – | 0.0 | – | NC | 0.0 | -0.1 | – |

[a] The dry condition cost is in addition to the average cost. Total water supplies in the dry condition include supplies acquired to replace lost CVP supplies in the average condition.
NC = no change

Table E-1B
Land Use Impacts—Agriculture
Comparison of Alternatives

| | | Compared to No Action Alternative | | | | | | | | | | | Preferred Alternative | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Action | Maximum Flow | | Flow Evaluation | | Percent Inflow | | Mechanical Restoration | | State Permit | | | |
| Resource Concern | | | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Existing Conditions Amount | Percent Change from Existing Conditions |
| **Sacramento Valley** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 2,016 | -1.3 | -0.1 | -0.2 | 0.0 | -0.1 | 0.0 | NC | 0.0 | 0.2 | 0.0 | 2,005 | .5 |
| | Dry | 1,992 | 3.1 | 0.2 | 2.3 | 0.1 | 1.2 | 0.1 | NC | 0.0 | 0.5 | 0.0 | 1,966 | 1.4 |
| Surface Water Applied (taf) | Average | 4,523 | -89.3 | -2.0 | -20.4 | -0.5 | -2.7 | -0.1 | NC | 0.0 | 14.0 | 0.3 | 4,534 | -.7 |
| | Dry | 4,167 | -96.3 | -2.3 | -65.3 | -1.6 | 6.5 | 0.2 | NC | 0.0 | 34.6 | 0.8 | 4,187 | -2.0 |
| Groundwater Applied(taf) | Average[b] | 2,574 | 69.4 | 2.7 | 16.3 | 0.6 | 1.6 | 0.1 | NC | 0.0 | -11.4 | -0.4 | 2,665 | -2.8 |
| | Dry[a] | 3,200 | 90.0 | 2.8 | 68.4 | 2.1 | -4.8 | -0.2 | NC | 0.0 | -32.4 | -1 | 3,250 | .5 |
| Value of Production (million $) | Average | 2,138 | -0.7 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | NC | 0.0 | 0.1 | 0.0 | 1,922 | 11.2 |
| | Dry | 2,125 | -0.2 | 0.0 | 0.3 | 0.0 | 0.3 | 0.0 | NC | 0.0 | -0.1 | 0.0 | 1,901 | 11.8 |
| **San Joaquin Valley** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 2,557 | -8.8 | -0.3 | -1.6 | -0.1 | -0.5 | 0.0 | NC | 0.0 | 0.1 | 0.0 | 2,640 | -3.2 |
| | Dry | 2,530 | 4.0 | 0.2 | 2.7 | 0.1 | 1.8 | 0.1 | NC | 0.0 | 7.2 | 0.3 | 2,613 | -3.1 |
| Surface Water Applied (taf) | Average | 4,436 | -214.7 | -4.8 | -33.6 | -0.8 | -2.7 | -0.1 | NC | 0.0 | 46.6 | 1.1 | 4,722 | -6.8 |
| | Dry | 3,726 | -137.1 | -3.7 | -34.8 | -0.9 | 18.7 | 0.5 | NC | 0.0 | 148.1 | 4.0 | 3,955 | -6.7 |
| Groundwater Applied(taf) | Average | 3,439 | 136.7 | 4.0 | 22.4 | 0.7 | -0.3 | 0.0 | NC | 0.0 | -39.6 | -1.2 | 3,729 | -7.2 |
| | Dry | 4,595 | 97.2 | 2.1 | 38.0 | 0.8 | -13.2 | -0.3 | NC | 0.0 | -113.1 | -2.5 | 4,979 | -7.0 |

**Table E-1B**
**Land Use Impacts—Agriculture**
**Comparison of Alternatives**

| | | | Compared to No Action Alternative | | | | | | | | | | Preferred Alternative | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Action | Maximum Flow | | Flow Evaluation | | Percent Inflow | | Mechanical Restoration | | State Permit | | | |
| **Resource Concern** | | | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Existing Conditions Amount | Percent Change from Existing Conditions |
| Value of Production (million $) | Average | 5,195 | -10.7 | -0.2 | -1.9 | 0.0 | -0.6 | 0.0 | NC | 0.0 | 0.0 | 0.0 | 4,494 | 15.6 |
| | Dry | 5,168 | 4.5 | 0.1 | 3.0 | 0.1 | 1.7 | 0.0 | NC | 0.0 | 6.7 | 0.1 | 4,473 | 15.6 |
| **Tulare Basin** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 2,006 | -3.8 | -0.2 | -1.1 | -0.1 | -0.6 | 0.0 | NC | 0.0 | 0.1 | 0.0 | 2,049 | -2.2 |
| | Dry | 1,963 | 9.1 | .5 | 4.8 | 0.2 | 3.7 | 0.2 | NC | 0.0 | 2.4 | 0.1 | 1,995 | -1.3 |
| Surface Water Applied (taf) | Average | 2,673 | -47.5 | -1.8 | -28.9 | -1.1 | -26.7 | -1.0 | NC | 0.0 | -24.2 | -0.9 | 2,850 | -7.2 |
| | Dry | 1,712 | -21.2 | -1.2 | -12.5 | -0.7 | -16.3 | -1.0 | NC | 0.0 | 7.9 | 0.5 | 1,885 | -9.8 |
| Groundwater Applied(taf) | Average | 3,361 | 9.9 | 0.3 | 17.7 | 0.5 | 19.8 | 0.6 | NC | 0.0 | 24.7 | 0.7 | 3,565 | -5.2 |
| | Dry | 4,583 | 25.2 | .5 | 20.5 | 0.4 | 23.7 | 0.5 | NC | 0.0 | 0.0 | 0.0 | 4,766 | -3.4 |
| Value of Production (million $) | Average | 4,557 | -4.0 | -0.1 | -1.1 | 0.0 | -0.7 | 0.0 | NC | 0.0 | 0.1 | 0.0 | 3,868 | 17.8 |
| | Dry | 4,513 | 9.4 | 0.2 | 5.0 | 0.1 | 3.9 | 0.1 | NC | 0.0 | 2.6 | 0.1 | 3,814 | 18.4 |
| **San Felipe Unit** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 24 | -7.4 | -31.1 | -1.4 | -6.0 | -0.4 | -1.6 | NC | 0.0 | 1.2 | 5.2 | 25 | -9.8 |
| | Dry | 17 | -4.8 | -27.7 | -1.5 | -8.5 | 0.3 | 1.7 | NC | 0.0 | 4.7 | 26.9 | 18 | -14.1 |
| Surface Water Applied (taf) | Average | 68 | -14.8 | -21.8 | -2.9 | -4.2 | -0.8 | -1.1 | NC | 0.0 | 2.5 | 3.6 | 70 | -6.9 |
| | Dry | 38 | -9.9 | -26.2 | -3.0 | -7.9 | 0.5 | 1.3 | NC | 0.0 | 9.0 | 23.9 | 40 | -12.9 |

**Table E-1B**
**Land Use Impacts—Agriculture**
**Comparison of Alternatives**

| Resource Concern | | No Action | Maximum Flow Amount | Maximum Flow Percent | Flow Evaluation Amount | Flow Evaluation Percent | Percent Inflow Amount | Percent Inflow Percent | Mechanical Restoration Amount | Mechanical Restoration Percent | State Permit Amount | State Permit Percent | Preferred Alternative: Existing Conditions Amount | Preferred Alternative: Percent Change from Existing Conditions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Compared to No Action Alternative | | | | | | | | | | | |
| Groundwater Applied(taf) | Average | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Dry | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Value of Production (million $) | Average | 98 | -30.3 | -31.1 | -5.8 | -6.0 | -1.6 | -1.6 | NC | 0.0 | 5.0 | 5.2 | 102 | -9.8 |
| | Dry | 63 | -16.2 | -25.8 | -6.2 | -9.9 | 2.3 | 3.6 | NC | 0.0 | 23.7 | 37.8 | 68 | -16.4 |
| **Most Affected Subregions-Tehama-Colusa Subregion** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 88 | -0.9 | -1.0 | -0.2 | -0.2 | 0.0 | 0.0 | NC | 0.0 | 0.1 | 0.2 | 80 | 9.7 |
| | Dry | 81 | -0.6 | -0.8 | -2.0 | -2.4 | -2.7 | -3.3 | NC | 0.0 | -3.3 | -4.2 | 65 | 20.0 |
| Surface Water Applied (taf) | Average | 225 | -70.3 | -31.2 | -15.8 | -7.0 | -2.2 | -1.0 | NC | 0.0 | 11.1 | 4.9 | 201 | 4.3 |
| | Dry | 102 | -73.0 | -71.5 | -50.0 | -49.0 | 3.8 | 3.8 | NC | 0.0 | 26.9 | 26.3 | 86 | -39.5 |
| Groundwater Applied(taf) | Average | 57 | 57.5 | 100.1 | 12.6 | 21.9 | 1.8 | 3.2 | NC | 0.0 | -8.7 | -15.1 | 60 | 15.9 |
| | Dry | 167 | 61.2 | 36.6 | 40.4 | 24.1 | -13.9 | -8.3 | NC | 0.0 | -37.3 | -22.3 | 136 | 53.0 |
| Value of Production (million $) | Average | 80 | -0.5 | -0.6 | -0.1 | -0.1 | 0.0 | 0.0 | NC | 0.0 | 0.1 | 0.1 | 66 | 1937 |
| | Dry | 75 | -0.4 | -0.5 | -1.3 | -1.8 | -1.8 | -2.4 | NC | 0.0 | -2.3 | -3.1 | 58 | 28.3 |
| **Most Affected Subregions-Westlands Subregion** | | | | | | | | | | | | | | |
| Irrigated Land (1,000 acres) | Average | 525 | -6.3 | -1.2 | -1.2 | -0.2 | -0.4 | -0.1 | NC | 0.0 | -0.4 | -0.1 | 501 | 4.5 |
| | Dry | 513 | 2.2 | 0.4 | 1.6 | 0.3 | 0.8 | 0.1 | NC | 0.0 | 0.7 | 0.1 | 496 | 3.6 |
| Surface Water Applied (taf) | Average | 705 | -15.8 | -21.8 | -30.0 | -4.3 | -8.4 | -1.2 | NC | 0.0 | 25.0 | 3.5 | 725 | -6.9 |
| | Dry | 390 | -101.7 | -26.1 | -30.1 | -7.7 | 5.4 | 1.4 | NC | 0.0 | 93.7 | 24.1 | 412 | -12.8 |

**Table E-1B**
**Land Use Impacts—Agriculture**
**Comparison of Alternatives**

| | | Compared to No Action Alternative | | | | | | | | | | | Preferred Alternative | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Action | Maximum Flow | | Flow Evaluation | | Percent Inflow | | Mechanical Restoration | | State Permit | | | |
| **Resource Concern** | | | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent | Existing Conditions Amount | Percent Change from Existing Conditions |
| Groundwater Applied(taf) | Average | 727 | 121.7 | 16.7 | 23.3 | 3.2 | 6.2 | 0.9 | NC | 0.0 | -27.0 | -3.7 | 689 | 8.9 |
| | Dry | 1,098 | 94.0 | 8.6 | 31.9 | 2.9 | -4.1 | -0.4 | NC | 0.0 | -92.4 | -8.4 | 1,088 | 3.9 |
| Value of Production (million $) | Average | 1,501 | -8.4 | -0.6 | -1.7 | -0.1 | -0.5 | 0.0 | NC | 0.0 | -0.5 | 0.0 | 1,059 | 41.1 |
| | Dry | 1,485 | 3.0 | 0.2 | 2.1 | 0.1 | 1.0 | 0.1 | NC | 0.0 | 1.0 | 0.1 | 1,053 | 41.1 |

[a]Average annual values for a dry period (1928-1934)
[b]Average annual values for the 69-year period of simulation.

Note:
NC = no change



[redacted]


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**Table E-1C**
**Land Use Impacts—Real Estate**
**Comparison of Alternatives**

| | Compared to No Action Alternative | | | | | | |
|---|---|---|---|---|---|---|---|
| | **No Action** | **Maximum Flow** | | **Flow Evaluation** | | **Percent Inflow** | |
| **Resource Concern** | | **Amount** | **Percent** | **Amount** | **Percent** | **Amount** | **Percent** |
| **Trinity River Basin** | | | | | | | |
| Trinity Lake (monthly water level/average year): | | | | | | | |
| -S/T: High | 2,311 (2) | 2,293 (5) | 2,306 (4) | 2,309 (3) | 2,311 (2) | 2,311 (2) | 2,322 (1) |
| Low | 2,278 (2) | 2,275 (4) | 2,261 (5) | 2,276 (3) | 2,278 (2) | 2,278 (2) | 2,284 (1) |
| -S/T: Range | 33 (2) | 18 (1) | 45 (4) | 33 (2) | 33 (2) | 33 (2) | 38 (3) |
| Trinity River (sport fish harvest numbers) | 0.0 (5) | +16,380 (1) | +12,980 (2) | +3,430 (3) | +2,010 (4) | -1,565 (4) | -1,820 (7) |
| **Lower Klamath Basin/Coastal Area** | | | | | | | |
| Coastal Area-commercial fishing profits (million $) | 0.0 (5) | +18.04 (1) | +14.37 (2) | +3.69 (3) | +2.27 (4) | -1.3 (6) | Low End: +4.6 (3)<br>High End: -1.97 (8) |
| **Central Valley** | | | | | | | |
| Shasta Lake (monthly water level/average year): | | | | | | | |
| -S/T: High | 1,050 (2) | 1,043 (5) | 1,045 (4) | 1,047 (3) | 1,050 (2) | 1,050 (2) | 1,051 (1) |
| Low | 995 (2) | 983 (5) | 990 (4) | 993 (3) | 995 (2) | 995 (2) | 998 (1) |
| -L/T: Range | 55 (3) | 60 (4) | 55 (3) | 54 (2) | 55 (3) | 55 (3) | 53 (1) |
| Sacramento River/agricultural profits (million $) | 0.0 (2) | -10.1 (5) | -1.6 (4) | -0.2 (3) | 0.0 (2) | 0.0 (2) | +4.7 (1) |

Note: The rank of each alternative is indicated in parenthesis.





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**Table E-2**
**1990 Populations for the Largest Communities in the Trinity River Basin**

| Town | 1990 Population |
|---|---|
| Big Bar | 341 |
| Burnt Ranch | 537 |
| Douglas City | 616 |
| Hayfork | 2,596 |
| Hoopa (Humboldt County) | 2,725 |
| Junction City | 635 |
| Lewiston | 2.550 |
| Sayler | 885 |
| Trinity Center | 327 |
| Weaverville | 3,224 |
| Willow Creek (Humboldt County) | 1.511 |

**Table E-3**
**Parcels Located in Flood Areas along the Trinity River**

| Area | Number of Parcels | Bridges | Location |
|---|---|---|---|
| Lewiston | 90 | None | Site covers 3 miles of Trinity River between the confluence of Rush Creek and Trinity Dam Creek and Trinity Dam Boulevard. |
| Salt Flat | 20 | Salt Flat | Accessible via Goose Ranch Road outside of the City of Lewiston. Parcels are located on the northwest bank of the Trinity River. |
| Bucktail | 60 | Bucktail | Subdivision is located on the Trinity River and is reached by Browns Mountain Road off Lewiston Road. |
| Poker Bar | 120 | Poker Bar | Located on the Trinity River about halfway between the towns of Lewiston and Douglas City. |
| Steel Bridge | 60 | Treadwell | Located on Steel Bridge Road off of Highway 299 about 3 miles upstream (east of Douglas City). The Steel Bridge area occupies the left bank of the Trinity River. |
| Douglas City/ Indian Creek | 40 | None | Site covers 2 miles of the Trinity River between Douglas City and the confluence of Indian Creek. |

Source: State of California Department of Water Resources, 1997.

**Table E-4**
**Population, Urban Applied Water, and Gallons per Capita per Day—Selected Years**

| Year | Population by Hydrologic Study Area, Million Persons | | | | |
|---|---|---|---|---|---|
| | San Francisco | North Coast | Sacramento River | San Joaquin | State |
| 1990 | 5.5 | 0.6 | 2.2 | 1.4 | 30 |
| 1980 | 4.8 | 0.5 | 1.7 | 1.0 | 24 |
| 1972[a] | 4.5 | 0.4 | 1.3 | 0.8 | 21 |
| 1967 | 4.3 | 0.2 | 1.1 | 0.4 | 19 |
| | **Urban Applied Water Normalized Demands (taf)** | | | | |
| | **San Francisco** | **North Coast** | **Sacramento River** | **San Joaquin** | |
| 1990 | 1,186 | 168 | 744 | 495 | |
| 1980[a] | 967 | 153 | 570 | 403 | |
| 1967[b,c] | 823 | 32 | 447 | 170 | |
| | **Gallons per Capita per Day, All Urban Uses** | | | | |
| | **San Francisco** | **North Coast** | **Sacramento River** | **San Joaquin** | |
| 1990 | 193 | 263 | 301 | 309 | |
| 1980[d] | 180 | 298 | 304 | 355 | |
| 1967[c] | 170 | 160 | 350 | 370 | |

Source: Department of Water Resources, 1994a, 1983, 1970.
[a] Some of the increase in Sacramento and San Joaquin Hydrologic Study Areas (HSA) from 1967 is due to an increase in the geographic size of the regions.
[b] Derived from data on population and gallons per capita per day (gpcpd).
[c] Water demands in the Sacramento Valley and North Coast Regions do not include pulp and paper demands.
[d] Derived from data on population and applied water. The size of the Sacramento and San Joaquin River HSAs changed in 1980.

**Table E-5**
**Population of Metropolitan Statistical Areas 1980 and 1990**

| Region | Population, 1,000s | | |
|---|---|---|---|
| | 1980 | 1990 | Percent Increase |
| **Sacramento Region** | | | |
| Sacramento MSA | 1,100 | 1,481 | 34.6 |
| **Central Valley Cities** | | | |
| Fresno MSA | 515 | 667 | 29.5 |
| Stockton MSA | 347 | 481 | 38.6 |
| **Bay Area** | | | |
| Oakland PMSA | 1,762 | 2,083 | 18.2 |
| San Francisco PMSA | 1,489 | 1,604 | 7.7 |
| San Jose PMSA | 1,295 | 1,498 | 15.7 |

Source: USDC, Bureau of the Census, Statistical Abstract of the United States, 1992
MSA = Consolidated Metropolitan Statistical Area; PMSA = Primary Metropolitan Statistical Area

| Table E-6<br>CVP M&I Contract Water Deliveries (af)<br>Fiscal Years 1983-1997 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Contra Costa Canal** | **Folsom D&R** | **Folsom South Canal** | **San Felipe Unit** | **Friant Kern Canal** | **Other** | **Total** |
| 1983 | 131,079 | 23,924 | 20,476 | 0 | 44,786 | 82,968 | **303,233** |
| 1984 | 130,995 | 25,410 | 31,081 | 0 | 53,584 | 85,140 | **326,210** |
| 1985 | 132,291 | 25,860 | 19,779 | 0 | 56,282 | 86,133 | **320,345** |
| 1986 | 116,230 | 30,019 | 19,693 | 0 | 35,355 | 89,758 | **291,055** |
| 1987 | 142,267 | 28,990 | 17,646 | 20,784 | 57,903 | 87,800 | **355,390** |
| 1988 | 126,059 | 34,124 | 36,658 | 75,065 | 45,578 | 82,132 | **399,616** |
| 1989 | 164,612 | 28,607 | 27,283 | 94,615 | 54,880 | 90,397 | **460,394** |
| 1990 | 186,679 | 27,454 | 20,829 | 65,390 | 43,692 | 96,514 | **440,558** |
| 1991 | 153,363 | 40,743 | 25,475 | 53,352 | 60,670 | 84,942 | **418,545** |
| 1992 | 109,576 | 23,360 | 32,939 | 69,530 | 46,479 | 79,632 | **361,516** |
| 1993 | 93,267 | 20,895 | 34,173 | 56,066 | 73,515 | 127,246 | **405,162** |
| 1994 | 134,903 | 30,693 | 47,977 | 81,842 | 53,136 | 91,803 | **440,354** |
| 1995 | 100,593 | 40,357 | 13,593 | 75,311 | 28,375 | 109,289 | **367,518** |
| 1996 | 104,924 | 49,407 | 58,228 | 100,568 | 100,766 | 135,226 | **549,119** |
| 1997 | 113,065 | 49,947 | 86,750 | 80,389 | 39,163 | 139,436 | **508,750** |
| Average[a] | 129,327 | 31,986 | 32,839 | 64,409 | 52,944 | 97,894 | **396,518** |
| Maximum | 186,679 | 49,947 | 86,750 | 100,568 | 100,766 | 139,436 | **549,119** |
| Minimum | 93,267 | 23,360 | 13,593 | 20,784 | 28,375 | 79,632 | **291,055** |

[a]The San Felipe average is 1987-1997.
Source: U.S. Bureau of Reclamation, 1998.

Table E-7
Existing Conditions Water Costs and Water Balance for Provider Groups

| Retail Cost and Price, 1997 Dollars | Shasta Area | Sacramento Area | SCVWD & SBVWD CVP-served | South Bay Aqueduct & SF | Contra Costa Water District | Central Valley Cities with CVP |
|---|---|---|---|---|---|---|
| Retail cost, $/af[a] | $268 | $328 | $631 | $574 | $738 | $328 |
| Retail price, $/af | $216 | $133 | $541 | $475 | $460 | $133 |
| **Average Condition Water Balance (taf/yr)** | | | | | | |
| Demand served | 108 | 458 | 30 | 602 | 140 | 192 |
| CVP contract, exchange and water rights delivered[b] | 46 | 274 | 119 | | 138 | 60 |
| Hetch-Hetchy or SWP contracts delivered | | | | 448 | | |
| Other supplies[c] | 54 | 150 | | 203 | 0 | 127 |
| Shortfall[d] | 8 | 33 | | (155) | 2 | 5 |
| **Dry Condition Water Balance (taf/yr)** | | | | | | |
| Demand served | 112 | 501 | 33 | 652 | 140 | 194 |
| CVP contract, exchange and water rights delivered | 42 | 268 | 96 | 0 | 131 | 52 |
| Other supplies[c] | 58 | 193 | | 512 | 0 | 99 |
| Shortage[c] | 12 | 40 | | 140 | 9 | 43 |

[a]Retail cost includes service charges
[b]Contract and water rights in Central Valley cities includes Delta-Mendota Canal, San Luis Canal, and Stockton East
[c]Data for South Bay includes San Felipe service area

Notes:
SCVWD = Santa Clara Valley Water District
SBVWD = San Benito Valley Water District

**Table E-8**
**Supply Cost Data Used to Estimate Alternative Supply Cost Functions in the Bay Area**

| Type of Supply | Description | Yield (taf/year) CCWD | Yield (taf/year) South Bay | Unit Cost $/af |
|---|---|---|---|---|
| Urban Recycling | Range 1 | 2.95 | 13.32 | 80 |
| Urban WUE | Distribution system losses to 5 percent | 1.53 | 6.93 | 136 |
| Urban WUE | Indoor water use to 60 gpcd | 4.49 | 20.25 | 206 |
| Urban Recycling | Range 2 | 2.95 | 13.32 | 236 |
| Urban WUE | Indoor CII use by 3 percent | 1.30 | 5.86 | 250 |
| Urban WUE | Outdoor use to 0.8 ET, new development | 0.24 | 1.07 | 284 |
| Urban Recycling | Range 3 | 5.90 | 26.64 | 396 |
| Urban WUE | Indoor water use from 60-55 gpcd | 4.60 | 20.78 | 448 |
| Urban WUE | Indoor CII use from 3-5 percent | 0.83 | 3.73 | 465 |
| Urban Recycling | Range 4 | 10.03 | 45.30 | 636 |
| Urban WUE | Outdoor use to 0.8 ET, existing development | 5.90 | 26.64 | 761 |
| Urban WUE | Indoor CII use from 5-11 percent | 1.77 | 7.99 | 806 |

| Table E-9<br>Municipal Water Supply Economics, No Action Alternative[a] | | | |
|---|---|---|---|
| | Sacramento Valley | Bay Area | San Joaquin Valley |
| **Average Condition** | | | |
| Demand (taf/yr) | 933 | 928 | 414 |
| Supplies (taf/yr) | 930 | 937 | 414 |
| Shortfall (taf/yr) | 3.3 | -8.8 | 0.4 |
| New Supplies (taf/yr)[a] | 2.8 | 5.8 | 0.3 |
| New Supply Cost (million $/yr)[b] | $0.5-0.9 | $1.2-2.0 | $0.1 |
| New Supply Cost ($/af)[b] | $200-330 | $210-350 | $240-400 |
| Percent Retail Price Increase[c] | 0.4% | 0.2% | 0.1% |
| Demand Reduction (taf/yr)[d] | 0.4 | 0.2 | 0.1 |
| New 2020 Demand (taf/yr) | 933 | 928 | 414 |
| **Dry Condition (1928-1934 average hydrology)** | | | |
| Demand (taf/yr) | 1,011 | 1,022 | 423 |
| Supplies (taf/yr) | 987 | 765 | 411 |
| Shortfall (taf/yr) | 24 | 257 | 12 |
| Percent RGO Shortage (minimum)[e] | 2.8% | 5.9% | 5.1% |
| Percent RGO Shortage (maximum) | 9.3% | 5.9% | 5.1% |
| Shortfall Allocation (taf/yr) | | | |
| RGO Drought Conservation | 24 | 42 | 12 |
| Comm/Ind Drought Conservation[f] | 0 | 16 | 0 |
| Drought Supplies | 0 | 200 | 0 |
| Drought Cost (million $/yr) | | | |
| Drought Supplies[g] | $0.0 | $132-220 | $0.0 |
| Drought Conservation[h] | $0.5 | $1.2 | $0.9 |
| Comm/Ind Economic Surplus[i] | $0.0 | $3.0 | $0.4 |
| Comm/Ind Sales Revenue[j] | $0.0 | $9.0 | $1.2 |
| RGO Economic Surplus | $2.3 | $10.0 | $7.3 |
| RGO Sales Revenue | $4.4 | $23.8 | $5.2 |
| Water Cost Savings[k] | -$1.6 | -$41.3 | -$4.0 |
| **TOTAL Cost/yr (million $)[g]** | **$5.6** | **$137-225** | **$1.7** |

[a]1997 dollars. Each region only includes the portion of the geographic region potentially affected.
[b]Supplies needed to achieve supply-demand balance. Cost measured at the treatment plant. Costs are plus or minus 25 percent to reflect uncertainty. In the Bay Area, new supplies are needed in just one subregion.
[c]Percent increase in retail price due to acquisition of more expensive supplies.
[d]Demand reduction caused by price increase.
[e]Percent mandatory drought conservation required of residential, government and "other" users (not commerce and industry). Minimum and maximum is the range for water provider groups within this region.
[f]Mandatory drought conservation in commercial/industrial sector is limited to 5 percent of demand.
[g]A range of plus or minus 25 percent is used to reflect uncertainty.
[h]Mandatory drought conservation program costs.
[i]Willingness to pay above water cost that is lost because of mandatory conservation.
[j]Sales revenue lost because of drought conservation.
[k]Costs of water supply saved because of shortage.

**Table E-10**
**M&I Providers Included in the Analysis, 2020 Contract Amounts and Shares, No Action Deliveries, and Change in Deliveries by Alternative—Sacramento Valley**

| | Contract (taf) | Share of Regions' Contracts (percent) | Deliveries (taf) No Action | | Difference from No Action Alternative (taf) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Flow | | Flow Evaluation | | Percent Inflow | | State Permit | |
| **Shasta Subregion** | | | average | dry | average | dry | average | dry | average | dry | average | dry |
| Clear Creek CSD | 10.3 | 9.1 | 9.7 | 7.5 | -1.2 | -1.6 | -0.3 | -1.1 | -0.1 | 0.1 | 0.2 | 0.7 |
| Bella Vista WD | 7.0 | 6.2 | 6.6 | 5.1 | -0.8 | -1.1 | -0.2 | -0.8 | 0.0 | 0.1 | 0.2 | 0.5 |
| Shasta CSD | 1.0 | 0.9 | 0.9 | 0.7 | -0.1 | -0.2 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| Keswick CSD | 0.5 | 0.4 | 0.5 | 0.4 | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| City of Redding | 3.2 | 2.8 | 3.0 | 2.3 | -0.4 | -0.5 | -0.1 | -0.3 | 0.0 | 0.0 | 0.1 | 0.2 |
| City of Shasta Lake | 2.8 | 2.4 | 2.6 | 2.0 | -0.3 | -0.4 | -0.1 | -0.3 | 0.0 | 0.0 | 0.1 | 0.2 |
| Mountain Gate CSD | 0.4 | 0.3 | 0.3 | 0.3 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Shasta County WA | 5.0 | 4.4 | 4.7 | 3.6 | -0.6 | -0.8 | -0.1 | -0.5 | 0.0 | 0.1 | 0.1 | 0.4 |
| City Redding Buckeye | 6.1 | 5.4 | 5.8 | 4.5 | -0.7 | -1.0 | -0.2 | -0.7 | 0.0 | 0.1 | 0.1 | 0.4 |
| Sacramento River Miscellaneous Users | 0.7 | 0.7 | 0.7 | 0.5 | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| Shasta Subregion Total | 36.9 | 32.8 | 34.7 | 26.9 | -4.3 | -5.8 | -1.1 | -4.0 | -0.2 | 0.5 | 0.8 | 2.6 |
| **Sacramento Subregion** | | | | | | | | | | | | |
| San Juan Suburban | 11.2 | 9.9 | 10.4 | 8.2 | -1.3 | -1.8 | -0.4 | -1.2 | -0.1 | 0.2 | 0.2 | 0.8 |
| El Dorado | 7.6 | 6.7 | 7.0 | 5.5 | -0.9 | -1.2 | -0.2 | -0.8 | 0.0 | 0.1 | 0.2 | 0.5 |
| Roseville | 32.0 | 28.4 | 29.8 | 23.3 | -3.8 | -5.0 | -1.0 | -3.4 | -0.2 | 0.5 | 0.7 | 2.3 |
| SMUD | 15.0 | 13.3 | 14.0 | 10.9 | -1.8 | -2.4 | -0.5 | -1.6 | -0.1 | 0.2 | 0.3 | 1.1 |
| West Sacramento | 10.1 | 9.0 | 9.4 | 7.4 | -1.2 | -1.6 | -0.3 | -1.1 | -0.1 | 0.1 | 0.2 | 0.7 |
| Sacramento Subregion Total | 75.9 | 67.2 | 70.8 | 55.3 | -9.0 | -11.9 | -2.4 | -8.1 | -0.4 | 1.1 | 1.6 | 5.4 |
| **Sacramento Valley Total** | **112.8** | **100.0** | **105.5** | **82.2** | **-13.3** | **-17.7** | **-3.5** | **-12.1** | **-0.6** | **1.6** | **2.4** | **8.0** |

**Table E-11**
**M&I Providers Included in the Analysis, 2020 Contract Amounts and Shares, No Action Deliveries, and Change in Deliveries by Alternative—San Joaquin Valley**

| | Contract (taf) | Share of Regions' Contracts (percent) | Deliveries (taf) No Action | | Difference from No Action Alternative (taf) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Flow | | Flow Evaluation | | Percent Inflow | | State Permit | |
| | | | average | dry | average | dry | average | dry | average | dry | average | dry |
| Avenal | 3.5 | 12.0 | 3.2 | 2.5 | -0.3 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 |
| Coalinga | 10.0 | 34.4 | 9.3 | 7.3 | -0.8 | -0.4 | -0.1 | -0.1 | 0.0 | 0.1 | 0.2 | 0.7 |
| Huron | 3.0 | 10.3 | 2.8 | 2.2 | -0.2 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| Tracy | 10.0 | 34.4 | 9.3 | 7.3 | -0.8 | -0.4 | -0.1 | -0.1 | 0.0 | 0.1 | 0.2 | 0.7 |
| Other | 2.6 | 8.9 | 2.4 | 1.9 | -0.2 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| **SanJoaquinValley Total** | **29.1** | **100.0** | **27.0** | **21.2** | **-2.2** | **-1.2** | **-0.4** | **-0.4** | **-0.1** | **0.4** | **0.5** | **2.1** |

**Table E-12**
**M&I Providers Included in the Analysis, 2020 Contract Amounts and Shares, No Action Deliveries, and Change in Deliveries by Alternative—Bay Area**

| | Contract (taf) | Share of Regions' Contracts (percent) | Deliveries, taf No Action | | Difference from No Action Alternative (taf) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Flow | | Flow Evaluation | | Percent Inflow | | State Permit | |
| | | | average | dry | average | dry | average | dry | average | dry | average | dry |
| Contra Costa WD | 167.0 | 56.7 | 161.0 | 138.0 | -15.1 | -30.1 | -3.5 | -20.6 | -0.1 | 2.9 | 2.8 | 11.6 |
| San Felipe Unit | | | | | | | | | | | | |
| San Benito Co. | 8.3 | 2.8 | 7.6 | 6.0 | -0.6 | -0.4 | -0.1 | -0.1 | 0.05 | 0.12 | 0.22 | 0.59 |
| SCVWD | 119.4 | 40.5 | 110.7 | 87.0 | -9.1 | -5.1 | -1.5 | -1.7 | 0.75 | 1.68 | 3.18 | 8.51 |
| San Felipe Total | 127.7 | 43.3 | 118.4 | 93.0 | -9.7 | -5.5 | -1.6 | -1.8 | 0.8 | 1.8 | 3.4 | 9.1 |
| Bay Area Total | 294.7 | 100.0 | 279.4 | 231.0 | -24.8 | -35.6 | -5.1 | -22.4 | 0.7 | 4.7 | 6.2 | 20.7 |

**Table E-13**
**Parcels and Bridges Inundated by Alternative and Site**

| | No Action Alternative/ Existing Conditions | Change from No Action Levels: Maximum Flow | Flow Evaluation | Percent Inflow | State Permit |
|---|---|---|---|---|---|
| **Trinity River Basin** | | | | | |
| **Impacts to Properties** | | | | | |
| Bucktail | No impact | 21 (8 developed/13 undeveloped) | 6 (undeveloped) | 9 (2 developed/7 undeveloped) | No impact |
| Cooper's Bar | No impact | 1 (developed) | No impact | 1 (developed) | No impact |
| Douglas City/Indian Creek | No impact | 11 (10 developed/1 undeveloped) | 1 (developed) | 6 (5 developed/1 undeveloped) | No impact |
| Lewiston | No impact | 2 (developed) | No impact | No impact | No impact |
| Poker Bar | No impact | 79 (40 developed/ 39 undeveloped) | No impact | 8 (developed) | No impact |
| Steel Bridge | No impact | 6 (undeveloped) | No impact | No impact | No impact |
| Salt Flat | No impact | No impact | No impact | No impact | No impact |
| Total Properties Inundated | 0 parcels | 120 parcels (61 developed/59 undeveloped) | 7 parcels (1 developed/6 undeveloped) | 24 parcels (16 developed/8 undeveloped) | 0 parcels |
| **Impacts to Bridges** | | | | | |
| Bucktail Bridge (serves 57 parcels) | No impact | Bridge replacement required | Bridge replacement required | Bridge replacement required | No impact |
| Poker Bar Bridge (serves 77 parcels) | No impact | Bridge significantly impacted but no replacement required[a] | Bridge replacement required | Bridge replacement required | No impact |
| Salt Flat Bridge (serves 27 parcels) | No impact | Bridge replacement required | Bridge replacement required | Bridge replacement required | No impact |
| Treadwell Bridge (serves 8 parcels) | No impact | Bridge replacement required | Bridge replacement required | Bridge replacement required | No impact |
| Total Monetary Damages (million $) | 0 | 14.3 | 5 | 6 | 0 |

[a]Poker Bar Bridge will be significantly impacted; however, it will not be replaced because the 77 parcels served would be purchased.

**Table E-14**
**Municipal Water Supply Economics, Maximum Flow Alternative**
**Minus No Action Alternative[a]**

| | Sacramento Valley | Bay Area | San Joaquin Valley |
|---|---|---|---|
| **Average Condition** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | -13 | -25 | -2 |
| Shortfall (taf/yr) | 13.3 | 24.8 | 2.2 |
| New Supplies (taf/yr)[a] | 11.6 | 13.5 | 1.8 |
| New Supply Cost (million $/yr)[b] | $2.3-3.9 | $6.5-10.7 | $0.4-0.8 |
| New Supply Cost $/af | 0 | $189-315 | 0 |
| Percent Retail Price Increase[c] | 1.6% | 1.4% | 0.8% |
| Demand Reduction (taf/yr)[d] | 1.7 | 1.6 | 0.4 |
| New 2020 Demand (taf/yr) | -2 | -2 | 0 |
| **Dry Condition (1928-1934 average hydrology)** | | | |
| Demand (taf/yr) | -2 | -2 | 0 |
| Supplies (taf/yr) | -6 | -22 | 1 |
| Shortfall (taf/yr) | 5 | 21 | -1 |
| Percent RGO Shortage (mininum)[e] | 0.6% | 0.0% | -0.4% |
| Percent RGO Shortage (maximum) | 1.4% | 0.0% | -0.4% |
| Shortfall Allocation (taf/yr) | | | |
| RGO Drought Conservation | 5 | 0 | -1 |
| Comm/Ind Drought Conservation[f] | 0 | 0 | 0 |
| Drought Supplies | 0 | 21 | 0 |
| Drought Cost (million $/yr) | | | |
| Drought Supplies[g] | $0.0 | $40-67 | $0.0 |
| Drought Conservation[h] | $0.1 | $0.0 | $0.0 |
| Comm/Ind Economic Surplus[i] | $0.0 | $0.0 | $0.0 |
| Comm/Ind Sales Revenue[j] | $0.0 | $0.1 | $0.0 |
| RGO Economic Surplus | $1.2 | $0.1 | -$0.1 |
| RGO Sales Revenue | $0.9 | $0.3 | -$0.1 |
| Water Cost Savings[k] | $0.3 | $2.5 | -$0.1 |
| **TOTAL Cost/yr (million $)[g]** | **$1.8** | **$38-65** | **-$0.2** |

[a]1997 dollars. Each region only includes the portion of the geographic region potentially affected.
[b]Supplies needed to achieve supply-demand balance. Cost measured at the treatment plant. Costs are plus or minus 25 percent to reflect uncertainty. In the Bay Area, new supplies are needed in just one subregion.
[c]Percent increase in retail price due to acquisition of more expensive supplies.
[d]Demand reduction caused by price increase.
[e]Percent mandatory drought conservation required of residential, government and "other" users (not commerce and industry). Minimum and maximum is the range for water provider groups within this region.
[f]Mandatory drought conservation in commercial/industrial sector is limited to 5 percent of demand.
[g]A range of plus or minus 25 percent is used to reflect uncertainty.
[h]Mandatory drought conservation program costs.
[i]Willingness to pay above water cost that is lost because of mandatory conservation.
[j]Sales revenue lost because of drought conservation.
[k]Costs of water supply saved because of shortage.

**Table E- 15**
**2020 Estimated Service Area Connections and Population for Selected Providers and Dollar Cost of Alternatives per Capita per Year in Each**

| | | City of Redding | San Juan Suburban | Roseville | CCWD | Coalinga | Huron | Tracy |
|---|---|---|---|---|---|---|---|---|
| 2020 Service Connections | | 38,846 | 10,444 | 31,738 | 69,263 | 5,996 | 1,397 | 22,419 |
| 2020 Forecast Population | | 122,290 | 36,800 | 82,220 | 241,300 | 19,013 | 10,724 | 74,250 |
| Cost or Benefit of Alternative and Condition per Capita, $ per Capita per Year Alternative/Condition | | | | | | | | |
| Maximum Flow | average | 2.05 | 8.22 | 10.55 | 20.29 | 10.47 | 5.56 | 2.68 |
| | dry | 1.21 | 4.84 | 6.22 | 121.01 | -3.62 | -1.92 | -0.93 |
| Flow Evaluation | average | 0.54 | 2.15 | 2.76 | 3.52 | 1.81 | 0.96 | 0.46 |
| | dry | 2.35 | 9.42 | 12.09 | 79.89 | 0 | 0 | 0 |
| Percent Inflow | average | 0.07 | 0.27 | 0.35 | 0.23 | 0 | 0 | 0 |
| | dry | -0.47 | -1.88 | -2.42 | -14.10 | -1.81 | -0.96 | -0.46 |
| State Permit | average | -0.40 | -1.61 | -2.07 | -2.11 | -1.81 | -0.96 | -0.46 |
| | dry | -1.14 | -4.57 | -5.87 | -55.22 | -5.43 | -2.88 | -1.39 |

**Table E-16**
**Municipal Water Supply Economics, Flow Evaluation Alternative Minus No Action Alternative[a]**

| | Sacramento Valley | Bay Area | San Joaquin Valley |
|---|---|---|---|
| **Average Condition** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | -4 | -5 | 0 |
| Shortfall (taf/yr) | 3.5 | 5.1 | 0.4 |
| New Supplies (taf/yr)[a] | 3.0 | 3.3 | 0.3 |
| New Supply Cost (million $/yr)[b] | $0.6-1.0 | $1.1-1.9 | $0.1 |
| New Supply Cost $/af | 0 | $46-76 | 0 |
| Percent Retail Price Increase [c] | 0.4% | 0.2% | 0.1% |
| Demand Reduction (taf/yr) [d] | 0.5 | 0.2 | 0.1 |
| New 2020 Demand (taf/yr) | 0 | 0 | 0 |
| **Dry Condition (1928-1934 average hydrology)** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | -9 | -19 | 0 |
| Shortfall (taf/yr) | 9 | 19 | 0 |
| Percent RGO Shortage (minimum)[e] | 1.2% | 0.0% | 0.0% |
| Percent RGO Shortage (maximum)[f] | 2.6% | 0.0% | 0.0% |
| Shortfall Allocation (taf/yr) | | | |
| RGO Drought Conservation | 9 | 0 | 0 |
| Comm/Ind Drought Conservation[g] | 0 | 0 | 0 |
| Drought Supplies | 0 | 19 | 0 |
| Drought Cost (million $/yr) | | | |
| Drought Supplies[g] | $0.0 | $27-45 | $0.0 |
| Drought Conservation[h] | $0.2 | $0.0 | $0.0 |
| Comm/Ind Economic Surplus[i] | $0.0 | $0.0 | $0.0 |
| Comm/Ind Sales Revenue[j] | $0.0 | $0.0 | $0.0 |
| RGO Economic Surplus | $2.4 | $0.0 | $0.0 |
| RGO Sales Revenue | $1.5 | $0.0 | $0.0 |
| Water Cost Savings[k] | $0.6 | $2.1 | $0.0 |
| **Total Cost/yr (million $)[g]** | **$3.5** | **$25-43** | **$0.0** |

[a]1997 dollars. Each region only includes the portion of the geographic region potentially affected.
[b]Supplies needed to achieve supply-demand balance. Cost measured at the treatment plant. Costs are plus or minus 25 percent to reflect uncertainty. In the Bay Area, new supplies are needed in just one subregion.
[c]Percent increase in retail price due to acquisition of more expensive supplies.
[d]Demand reduction caused by price increase.
[e]Percent mandatory drought conservation required of residential, government and "other" users (not commerce and industry). Minimum and maximum is the range for water provider groups within this region.
[f]Mandatory drought conservation in commercial/industrial sector is limited to 5 percent of demand.
[g]A range of plus or minus 25 percent is used to reflect uncertainty.
[h]Mandatory drought conservation program costs.
[i]Willingness to pay above water cost that is lost because of mandatory conservation.
[j]Sales revenue lost because of drought conservation.
[k]Costs of water supply saved because of shortage.

**Table E-17**
**Municipal Water Supply Economics, Percent Inflow Alternative**
**Minus No Action Alternative**[a]

| | Sacramento Valley | Bay Area | San Joaquin Valley |
|---|---|---|---|
| **Average Condition** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | -1 | 0 | 0 |
| Shortfall (taf/yr) | 0.6 | 0.3 | 0.1 |
| New Supplies (taf/yr)[a] | 0.5 | 0.1 | 0.1 |
| New Supply Cost (million $/yr)[b] | $0.1 | $0.0 | $0.0 |
| New Supply Cost $/af | 0 | $1-2 | 0 |
| Percent Retail Price Increase[c] | 0.1% | 0.0% | 0.0% |
| Demand Reduction (taf/yr)[d] | 0.1 | 0.0 | 0.0 |
| New 2020 Demand (taf/yr) | 0 | 0 | 0 |
| **Dry Condition (1928-1934 average hydrology)** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | 2 | 5 | 0 |
| Shortfall (taf/yr) | -2 | -5 | 0 |
| Percent RGO Shortage (minimum)[e] | -0.3% | 0.0% | -0.2% |
| Percent RGO Shortage (maximum) | -0.6% | 0.0% | -0.2% |
| Shortfall Allocation (taf/yr) | | | |
| RGO Drought Conservation | -2 | 0 | -1 |
| Comm/Ind Drought Conservation[f] | 0 | 0 | 0 |
| Drought Supplies | 0 | -5 | 0 |
| Drought Cost (million $/yr) | | | |
| Drought Supplies[g] | $0.0 | -$5 to -$8 | $0.0 |
| Drought Conservation[h] | $0.0 | $0.0 | $0.0 |
| Comm/Ind Economic Surplus[i] | $0.0 | $0.0 | $0.0 |
| Comm/Ind Sales Revenue[j] | $0.0 | $0.0 | $0.0 |
| RGO Economic Surplus | -$0.4 | $0.0 | -$0.1 |
| RGO Sales Revenue | -$0.4 | $0.0 | -$0.1 |
| Water Cost Savings[k] | -$0.1 | -$0.6 | $0.0 |
| **Total Cost/yr (million $)**[g] | **-$0.7** | **-$4 to -$8** | **-$0.1** |

[a]1997 dollars. Each region only includes the portion of the geographic region potentially affected.
[b]Supplies needed to achieve supply-demand balance. Cost measured at the treatment plant. Costs are plus or minus 25 percent to reflect uncertainty. In the Bay Area, new supplies are needed in just one subregion.
[c]Percent increase in retail price due to acquisition of more expensive supplies.
[d]Demand reduction caused by price increase.
[e]Percent mandatory drought conservation required of residential, government and "other" users (not commerce and industry). Minimum and maximum is the range for water provider groups within this region.
[f]Mandatory drought conservation in commercial/industrial sector is limited to 5 percent of demand.
[g]A range of plus or minus 25 percent is used to reflect uncertainty.
[h]Mandatory drought conservation program costs.
[i]Willingness to pay above water cost that is lost because of mandatory conservation.
[j]Sales revenue lost because of drought conservation.
[k]Costs of water supply saved because of shortage.

**Table E-18**
**Municipal Water Supply Economics, State Permit Alternative**
**Minus No Action Alternative[a]**

| | Sacramento Valley | Bay Area | San Joaquin Valley |
|---|---|---|---|
| **Average Condition** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | 2 | 5 | 1 |
| Shortfall (taf/yr) | -2.4 | -5.1 | -0.5 |
| New Supplies (taf/yr)[a] | -2.1 | -2.7 | -0.3 |
| New Supply Cost (million $/yr)[b] | -$0.5 to -$0.7 | -$0.7 to -$1.1 | -$0.1 |
| New Supply Cost $/af | 0 | -$37 to -$62 | 0 |
| Percent Retail Price Increase[c] | -0.3% | -0.1% | -0.1% |
| Demand Reduction (taf/yr)[d] | -0.3 | -0.1 | -0.1 |
| New 2020 Demand (taf/yr) | 0 | 0 | 0 |
| **Dry Condition (1928-1934 average hydrology)** | | | |
| Demand (taf/yr) | 0 | 0 | 0 |
| Supplies (taf/yr) | 6 | 18 | 2 |
| Shortfall (taf/yr) | -5 | -18 | -2 |
| Percent RGO Shortage (minimum)[e] | -0.8% | 0.0% | -0.8% |
| Percent RGO Shortage (maximum) | -1.6% | 0.0% | -0.8% |
| Shortfall Allocation (taf/yr) | | | |
| RGO Drought Conservation | -5 | 0 | -2 |
| Comm/Ind Drought Conservation[f] | 0 | 0 | 0 |
| Drought Supplies | 0 | -18 | 0 |
| Drought Cost (million $/yr) | | | |
| Drought Supplies[g] | $0.0 | -$19 to -$32 | $0.0 |
| Drought Conservation[h] | -$0.1 | $0.0 | $0.0 |
| Comm/Ind Economic Surplus[i] | $0.0 | $0.0 | $0.0 |
| Comm/Ind Sales Revenue[j] | $0.0 | $0.0 | $0.0 |
| RGO Economic Surplus | -$1.0 | $0.0 | -$0.2 |
| RGO Sales Revenue | -$1.0 | $0.0 | -$0.2 |
| Water Cost Savings[k] | -$0.4 | -$2.5 | -$0.1 |
| **Total Cost/yr (million $)[g]** | **-$1.7** | **-$17 to -$30** | **-$0.3** |

[a]1997 dollars. Each region only includes the portion of the geographic region potentially affected.
[b]Supplies needed to achieve supply-demand balance. Cost measured at the treatment plant. Costs are plus or minus 25 percent to reflect uncertainty. In the Bay Area, new supplies are needed in just one subregion.
[c]Percent increase in retail price due to acquisition of more expensive supplies.
[d]Demand reduction caused by price increase.
[e]Percent mandatory drought conservation required of residential, government and "other" users (not commerce and industry). Minimum and maximum is the range for water provider groups within this region.
[f]Mandatory drought conservation in commercial/industrial sector is limited to 5 percent of demand.
[g]A range of plus or minus 25 percent is used to reflect uncertainty.
[h]Mandatory drought conservation program costs.
[i]Willingness to pay above water cost that is lost because of mandatory conservation.
[j]Sales revenue lost because of drought conservation.
[k]Costs of water supply saved because of shortage.

**Table E-19**
**Area and Commercial Forest Land in National Forests**

| National Forest | Area (thousand acres) | Commercial Forest Land[a] (thousand acres) | Percent of Total |
|---|---|---|---|
| Shasta | 1.085 | 558 | 51 |
| Six Rivers | 958 | 536 | 56 |
| Trinity | 1,053 | 483 | 46 |

[a] Land capable of producing 20 cubic feet or more per acre per year of industrial wood, and not withdrawn by statue, ordinance, or administrative order from timber utilization.

| Table E-20<br>Ranking of Central Valley Counties<br>by Total Value of Production in 1993 | | | | | |
|---|---|---|---|---|---|
| 1993 CA Rank | County | 1993 Production ($1,000) | Percent of Total CA Value | Cumulative Percent | Leading Crops |
| 1 | Fresno | 3,014,412 | 13.1 | 13.1 | Grapes, cotton, tomatoes, milk, cattle and calves |
| 2 | Tulare | 2,359,551 | 10.2 | 23.3 | Milk, grapes, oranges, cattle and calves, cotton and seed |
| 3 | Kern | 1,884,749 | 8.2 | 31.5 | Grapes, cotton and seed, almonds, citrus, carrots |
| 5 | Merced | 1,201,025 | 5.2 | 36.7 | Milk, almonds, chickens, cotton, alfalfa |
| 6 | Stanislaus | 1,147,126 | 5 | 4.7 | Milk, almonds, chickens, walnuts, cattle and calves |
| 7 | San Joaquin | 1,053,364 | 4.6 | 46.3 | Milk, grapes, almonds, tomatoes, walnuts |
| 12 | Kings | 836,860 | 3.6 | 49.9 | Cotton lint, milk, cattle and calves, cotton and seed, turkeys |
| 13 | Madera | 615,047 | 2.7 | 52.6 | Grapes, almonds, cotton lint, milk, pistachios |
| 18 | Sutter | 292,108 | 1.3 | 53.9 | Rice, almonds, processing tomatoes, wheat, rice seed |
| 19 | Butte | 278,030 | 1.2 | 55.1 | Almonds, rice, walnuts, prunes, kiwi fruit |
| 20 | Colusa | 273,518 | 1.2 | 56.3 | Rice, almonds, processing tomatoes, wheat, rice seed |
| 21 | Glenn | 249,134 | 1.1 | 57.4 | Rice, almonds, dairy products, prunes, cattle and calves |
| 23 | Yolo | 235,805 | 1 | 58.4 | Tomatoes, alfalfa, hay, rice, safflower, wheat |
| 24 | Sacramento | 228,651 | 1 | 59.4 | Milk, pears, cattle and calves, wine grapes, ornamental nursery stock |
| 28 | Solano | 177,705 | 0.8 | 60.2 | Processing tomatoes, sugar beets, cattle and calves, nursery stock, alfalfa hay |
| 32 | Yuba | 177,452 | 0.5 | 60.7 | Rice, peaches, prunes, walnuts, cattle and calves |
| 34 | Tehama | 100,365 | 0.4 | 61.1 | Walnuts, prunes, almonds, cattle and calves, pasture and range |
| Total Central Valley | | $14,064,902 | | | |
| Total California | | $23,094,133 | | | |

Source: California Department of Food and Agriculture (DFA), 1994; County Agricultural Commissioners, 1994.

**Table E-21**
**Crop Mix, Value per Acre, and Total Value of Crops Produced on Land Receiving Some CVP Water (1988)**

| Commodity | Acres[a] | $ Value per Acre[b] | Million $ Value of Production |
|---|---|---|---|
| Cereals | 383,053 | 414.40 | 158.7 |
| Forage | 225,583 | 511.29 | 115.3 |
| Miscellaneous field crops | 689,743 | 954.95 | 658.7 |
| Vegetables | 283,504 | 2,321.93 | 658.7 |
| Seeds | 46,984 | 717.99 | 33.7 |
| Fruits | 407,257 | 3,320.35 | 1,352.2 |
| Nuts | 148,417 | 1,706.40 | 253.3 |
| Family garden and nurseries | 7,448 | 14,927.50 | 111.2 |
| **Total** | **2,191,989** | **1,524.38** | **3,341.4** |

[a] Total acreage includes about 70,000 multiple-cropped acres.
[b] Average value per acre.
Source: U.S. Bureau of Land Management, 1998, 1988 Summary Statistics. U.S. Bureau of Reclamation, 1988, Water, Land, and Related Data.

| Table E-22<br>Central Valley Agricultural Land Use, Water Use, and Revenue | | | | |
|---|---|---|---|---|
| **Item** | **Sacramento Valley** | **San Joaquin Valley** | **Tulare Basin** | **Total** |
| **Land Use, Average 1987-1990** | | | | |
| Irrigated Land (1,000 acres)[a] | 2,013 | 2,695 | 2,041 | 6,749 |
| **Water Use[a], Average 1987-1990** | | | | |
| Total Applied Water (1,000 af) | 6,907.8 | 8,271.5 | 6,116.9 | 21,296.1 |
| CVP Water Service Contract Delivery (1,000 af)[b] | 658.8 | 1,841.9 | 713.6 | 3,215.2 |
| Total ETAW (1,000 af)[c] | 4,492.6 | 5,918.9 | 4,523.4 | 14,934.9 |
| Total Surface Water (1,000 af) | 4,697.9 | 5,071.4 | 2,364.4 | 12,133.5 |
| **Gross Revenue** ($ millions)[d] | | | | |
| Product Sales | 1,569 | 5,144 | 3,306 | 10,019 |
| Total Income[e] | 1,759 | 5,317 | 3,443 | 10,519 |
| **Net Return** ($ millions)[f] | 486 | 1,146 | 737 | 2,369 |

[a]Estimated for the Central Valley Project Improvement Act Draft Programmatic Environmental Impact Statement, September, 1997.
[b]Does not include water rights settlement and exchange deliveries.
[c]ETAW = Evapotranspiration of applied water.
[d]1992 estimates United States Bureau of Census, 1994.
[e]Includes government payments and California Conservation Corps (CCC) loans and direct sales and other private use.
[f]Total income minus production expenses.

Table E-23

Agriculture Alternative Summary, Average Year (1922-1990)

| | | | Changes Compared to No Action Alternative | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No Action | Existing | Maximum Flow | | Flow Evaluation | | Percent Inflow | | State Permit | |
| | Alternative | Condition | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent |
| **Irrigated Acreage** | | | | | | | | | | |
| Sacramento Valley | 2,016 | 2,005 | -1.3 | -0.1 | -0.2 | 0.0 | -0.1 | 0.0 | 0.2 | 0.0 |
| San Joaquin Valley | 2,557 | 2,640 | -8.8 | -0.3 | -1.6 | -0.1 | -0.5 | 0.0 | 0.1 | 0.0 |
| Tulare Basin | 2,006 | 2,049 | -3.8 | -0.2 | -1.1 | -0.1 | -0.6 | 0.0 | 0.1 | 0.0 |
| San Felipe Unit | 24 | 25 | -7.4 | -31.1 | -1.4 | -6.0 | -0.4 | -1.6 | 1.2 | 5.2 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 88 | 80 | -0.9 | -1.0 | -0.2 | -0.2 | 0.0 | 0.0 | 0.1 | 0.2 |
| Westlands Water District | 525 | 501 | -6.3 | -1.2 | -1.2 | -0.2 | -0.4 | -0.1 | -0.4 | -0.1 |
| **Value of Production** | | | | | | | | | | |
| Sacramento Valley | 2,138 | 1,922 | -0.7 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| San Joaquin Valley | 5,195 | 4,494 | -10.7 | -0.2 | -1.9 | 0.0 | -0.6 | 0.0 | 0.0 | 0.0 |
| Tulare Basin | 4,557 | 3,868 | -4.0 | -0.1 | -1.1 | 0.0 | -0.7 | 0.0 | 0.1 | 0.0 |
| San Felipe Unit | 98 | 102 | -30.3 | -31.1 | -5.8 | -6.0 | -1.6 | -1.6 | 5.0 | 5.2 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 80 | 66 | -0.5 | -0.6 | -0.1 | -0.1 | 0.0 | 0.0 | 0.1 | 0.1 |
| Westlands Water District | 1,501 | 1,059 | -8.4 | -0.6 | -1.7 | -0.1 | -0.5 | 0.0 | -0.5 | 0.0 |
| **Surface Water Applied** | | | | | | | | | | |
| Sacramento Valley | 4,523 | 4,534 | -89.3 | -2.0 | -20.4 | -0.5 | -2.7 | -0.1 | 14.0 | 0.3 |
| San Joaquin Valley | 4,436 | 4,722 | -214.7 | -4.8 | -33.6 | -0.8 | -2.7 | -0.1 | 46.6 | 1.1 |
| Tulare Basin | 2,673 | 2,850 | -47.5 | -1.8 | -28.9 | -1.1 | -26.7 | -1.0 | -24.2 | -0.9 |
| San Felipe Unit | 68 | 70 | -14.8 | -21.8 | -2.9 | -4.2 | -0.8 | -1.1 | 2.5 | 3.6 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 225 | 201 | -70.3 | -31.2 | -15.8 | -7.0 | -2.2 | -1.0 | 11.1 | 4.9 |
| Westlands Water District | 705 | 725 | -153.8 | -21.8 | -30.0 | -4.3 | -8.4 | -1.2 | 25.0 | 3.5 |
| **Groundwater Applied** | | | | | | | | | | |
| Sacramento Valley | 2,574 | 2,665 | 69.4 | 2.7 | 16.3 | 0.6 | 1.6 | 0.1 | -11.4 | -0.4 |
| San Joaquin Valley | 3,439 | 3,729 | 136.7 | 4.0 | 22.4 | 0.7 | -0.3 | 0.0 | -39.6 | -1.2 |
| Tulare Basin | 3,361 | 3,565 | 9.9 | 0.3 | 17.7 | 0.5 | 19.8 | 0.6 | 24.7 | 0.7 |
| San Felipe Unit | * | | * | * | * | * | * | * | * | * |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 57 | 60 | 57.5 | 100.1 | 12.6 | 21.9 | 1.8 | 3.2 | -8.7 | -15.1 |
| Westlands Water District | 727 | 689 | 121.7 | 16.7 | 23.3 | 3.2 | 6.2 | 0.9 | -27.0 | -3.7 |





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## Table E-24

**Agriculture Alternative Summary, Dry Year (1928-1934)**

| | No Action | Existing | Changes Compared to No Action Alternative | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Maximum Flow | | Flow Evaluation | | Percent Inflow | | State Permit | |
| | Alternative | Condition | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent |
| **Irrigated Acreage** | | | | | | | | | | |
| Sacramento Valley | 1,992 | 1,966 | 3.1 | 0.2 | 2.3 | 0.1 | 1.2 | 0.1 | 0.5 | 0.0 |
| San Joaquin Valley | 2,530 | 2,613 | 4.0 | 0.2 | 2.7 | 0.1 | 1.8 | 0.1 | 7.2 | 0.3 |
| Tulare Basin | 1,963 | 1,995 | 9.1 | 0.5 | 4.8 | 0.2 | 3.7 | 0.2 | 2.4 | 0.1 |
| San Felipe Unit | 17 | 18 | -4.8 | -27.7 | -1.5 | -8.5 | 0.3 | 1.7 | 4.7 | 26.9 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 81 | 65 | -0.6 | -0.8 | -2.0 | -2.4 | -2.7 | -3.3 | -3.3 | -4.2 |
| Westlands Water District | 513 | 496 | 2.2 | 0.4 | 1.6 | 0.3 | 0.8 | 0.1 | 0.7 | 0.1 |
| **Value of Production** | | | | | | | | | | |
| Sacramento Valley | 2,125 | 1,901 | -0.2 | 0.0 | -0.3 | 0.0 | 0.3 | 0.0 | -0.1 | 0.0 |
| San Joaquin Valley | 5,168 | 4,473 | 4.5 | 0.1 | 3.0 | 0.1 | 1.7 | 0.0 | 6.7 | 0.1 |
| Tulare Basin | 4,513 | 3,814 | 9.4 | 0.2 | 5.0 | 0.1 | 3.9 | 0.1 | 2.6 | 0.1 |
| San Felipe Unit | 63 | 68 | -16.2 | -25.8 | -6.2 | -9.9 | 2.3 | 3.6 | 23.7 | 37.8 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 75 | 58 | -0.4 | -0.5 | -1.3 | -1.8 | -1.8 | -2.4 | -2.3 | -3.1 |
| Westlands Water District | 1,485 | 1,053 | 3.0 | 0.2 | 2.1 | 0.1 | 1.0 | 0.1 | 1.0 | 0.1 |
| **Surface Water Applied** | | | | | | | | | | |
| Sacramento Valley | 4,167 | 4,187 | -96.3 | -2.3 | -65.3 | -1.6 | 6.5 | 0.2 | 34.6 | 0.8 |
| San Joaquin Valley | 3,726 | 3,955 | -137.1 | -3.7 | -34.8 | -0.9 | 18.7 | 0.5 | 148.1 | 4.0 |
| Tulare Basin | 1,712 | 1,885 | -21.2 | -1.2 | -12.5 | -0.7 | -16.3 | -1.0 | 7.9 | 0.5 |
| San Felipe Unit | 38 | 40 | -9.9 | -26.2 | -3.0 | -7.9 | 0.5 | 1.3 | 9.0 | 23.9 |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 102 | 86 | -73.0 | -71.5 | -50.0 | -49.0 | 3.8 | 3.8 | 26.9 | 26.3 |
| Westlands Water District | 390 | 412 | -101.7 | -26.1 | -30.1 | -7.7 | 5.4 | 1.4 | 93.7 | 24.1 |
| **Groundwater Applied** | | | | | | | | | | |
| Sacramento Valley | 3,200 | 3,250 | 90.0 | 2.8 | 68.4 | 2.1 | -4.8 | -0.2 | -32.4 | -1.0 |
| San Joaquin Valley | 4,595 | 4,979 | 97.2 | 2.1 | 38.0 | 0.8 | -13.2 | -0.3 | -113.1 | -2.5 |
| Tulare Basin | 4,583 | 4,766 | 25.2 | 0.5 | 20.5 | 0.4 | 23.7 | 0.5 | 0.0 | 0.0 |
| San Felipe Unit | * | * | * | * | * | * | * | * | * | * |
| Most Affected Subregions | | | | | | | | | | |
| Tehama-Colusa Service Area | 167 | 136 | 61.2 | 36.6 | 40.4 | 24.1 | -13.9 | -8.3 | -37.3 | -22.3 |
| Westlands Water District | 1,098 | 1,088 | 94.0 | 8.6 | 31.9 | 2.9 | -4.1 | -0.4 | -92.4 | -8.4 |

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# TABLE E-25
# IRRIGATED ACREAGE IN NO ACTION ALTERNATIVE

| Crop | Average | Dry | Wet |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 164.5 | 159.3 | 164.6 |
| Alfalfa | 115.2 | 113.1 | 115.4 |
| Sugar Beets | 79.5 | 79.1 | 79.6 |
| Other Field Crops | 264.1 | 261.0 | 264.5 |
| Rice | 470.7 | 465.2 | 472.4 |
| Truck Crops | 105.1 | 105.0 | 105.1 |
| Tomatoes | 145.3 | 144.9 | 145.3 |
| Deciduous Orchard | 348.8 | 348.8 | 348.8 |
| Small Grain | 271.4 | 264.8 | 272.1 |
| Grapes | 37.5 | 37.5 | 37.5 |
| Subtropical Orchard | 13.7 | 13.7 | 13.7 |
| **Subtotal** | **2,016** | **1,992** | **2,019** |
| **San Joaquin Valley** | | | |
| Pasture | 146.5 | 144.5 | 146.5 |
| Alfalfa | 191.0 | 187.7 | 191.2 |
| Sugar Beets | 42.6 | 42.4 | 42.6 |
| Other Field Crops | 272.5 | 269.7 | 272.7 |
| Rice | 14.3 | 14.2 | 14.4 |
| Truck Crops | 311.5 | 311.2 | 311.5 |
| Tomatoes | 150.7 | 149.7 | 150.8 |
| Deciduous Orchard | 471.6 | 471.6 | 471.6 |
| Small Grain | 163.4 | 158.8 | 164.3 |
| Grapes | 279.0 | 279.0 | 279.0 |
| Cotton | 464.7 | 452.4 | 465.2 |
| Subtropical Orchard | 49.4 | 49.4 | 49.4 |
| **Subtotal** | **2,557** | **2,530** | **2,559** |
| **Tulare Basin** | | | |
| Pasture | 9.5 | 8.5 | 9.6 |
| Alfalfa | 180.9 | 172.6 | 181.9 |
| Sugar Beets | 19.2 | 19.0 | 19.2 |
| Other Field Crops | 176.5 | 170.6 | 177.0 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 205.4 | 205.2 | 205.4 |
| Tomatoes | 6.0 | 5.9 | 6.0 |
| Deciduous Orchard | 263.5 | 263.5 | 263.5 |
| Small Grain | 107.9 | 101.8 | 109.0 |
| Grapes | 243.9 | 243.9 | 243.9 |
| Cotton | 644.0 | 622.4 | 646.6 |
| Subtropical Orchard | 149.6 | 149.6 | 149.6 |
| **Subtotal** | **2,006** | **1,963** | **2,012** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 1.8 | 1.3 | 1.5 |
| Other Field Crops | 3.2 | 1.9 | 2.8 |
| Vegetables | 11.8 | 7.0 | 10.4 |
| Tree and Vine | 7.1 | 7.1 | 7.1 |
| **Subtotal** | **23.9** | **17.3** | **21.9** |
| **Total** | **6,603** | **6,503** | **6,612** |

NOTE:
All values in thousand acres.

## TABLE E-26
## GROSS REVENUE IN
## NO ACTION ALTERNATIVE

| Crop | Average | Dry | Wet |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 23,952 | 23,393 | 23,961 |
| Alfalfa | 65,082 | 64,572 | 65,109 |
| Sugar Beets | 60,043 | 59,734 | 60,075 |
| Other Field Crops | 124,864 | 123,443 | 125,010 |
| Rice | 400,630 | 395,812 | 401,991 |
| Truck Crops | 397,415 | 397,286 | 397,431 |
| Tomatoes | 218,110 | 217,864 | 218,206 |
| Deciduous Orchard | 370,393 | 370,393 | 370,393 |
| Small Grain | 83,691 | 81,678 | 83,873 |
| Grapes | 64,733 | 64,733 | 64,733 |
| Subtropical Orchard | 19,641 | 19,641 | 19,641 |
| **Subtotal** | **1,828,554** | **1,818,548** | **1,830,423** |
| **San Joaquin Valley** | | | |
| Pasture | 32,187 | 32,008 | 32,168 |
| Alfalfa | 113,012 | 112,011 | 112,974 |
| Sugar Beets | 35,011 | 34,873 | 35,020 |
| Other Field Crops | 163,541 | 161,862 | 163,580 |
| Rice | 11,551 | 11,488 | 11,570 |
| Truck Crops | 1,869,267 | 1,867,873 | 1,869,197 |
| Tomatoes | 225,735 | 224,394 | 225,717 |
| Deciduous Orchard | 670,565 | 670,565 | 670,565 |
| Small Grain | 77,001 | 74,819 | 77,391 |
| Grapes | 552,684 | 552,684 | 552,684 |
| Cotton | 503,403 | 489,586 | 503,162 |
| Subtropical Orchard | 182,094 | 182,094 | 182,094 |
| **Subtotal** | **4,436,050** | **4,414,257** | **4,436,122** |
| **Tulare Basin** | | | |
| Pasture | 2,220 | 1,996 | 2,239 |
| Alfalfa | 111,498 | 106,595 | 112,185 |
| Sugar Beets | 16,250 | 16,049 | 16,276 |
| Other Field Crops | 107,302 | 103,497 | 107,647 |
| Rice | 7 | 8 | 8 |
| Truck Crops | 1,256.134 | 1,254,526 | 1,256,326 |
| Tomatoes | 9,193 | 9,059 | 9,206 |
| Deciduous Orchard | 410,831 | 410,831 | 410,831 |
| Small Grain | 62,079 | 58,423 | 62,660 |
| Grapes | 620,796 | 620,796 | 620,796 |
| Cotton | 712,805 | 685,270 | 716,061 |
| Subtropical Orchard | 584,397 | 584,397 | 584,397 |
| **Subtotal** | **3,893,512** | **3,851,447** | **3,898,633** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 451 | 338 | 398 |
| Other Field Crops | 2.266 | 1,344 | 2,001 |
| Vegetables | 82.984 | 49.229 | 73,283 |
| Tree and Vine | 11.846 | 11,846 | 11,846 |
| **Subtotal** | **97,547** | **62,757** | **87,528** |
| **Total** | **10,255,663** | **10,147,010** | **10,252,706** |

NOTE:
All values in million dollars per year.

## TABLE E-27
## NET REVENUE IN THE
## NO ACTION ALTERNATIVE

| Component | Sacramento Valley | San Joaquin Valley | Tulare Basin | San Felipe Unit | Total |
|---|---|---|---|---|---|
| Average Condition | 313.3 | 653.6 | 610.6 | 9.3 | 1586.8 |
| Dry Condition | 312.6 | 652.9 | 607.3 | 6.4 | 1579.2 |
| Wet Condition | 313.6 | 653.5 | 611.1 | 8.5 | 1586.6 |

NOTE:
All values in million dollars per year (1997).

## TABLE E-28
## IRRIGATION WATER APPLIED
## IN THE NO ACTION ALTERNATIVE

| Source | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Surface Water | 4,523 | 4,167 | 4,714 |
| Groundwater | 2,574 | 3,200 | 2,407 |
| Total Applied | 7,096 | 7,367 | 7,122 |
| **San Joaquin Valley** | | | |
| Surface Water | 4,436 | 3,726 | 4,822 |
| Groundwater | 3,439 | 4,595 | 2,884 |
| Total Applied | 7,875 | 8,321 | 7,706 |
| **Tulare Basin** | | | |
| Surface Water | 2,673 | 1,712 | 3,225 |
| Groundwater | 3,361 | 4,583 | 2,683 |
| Total Applied | 6,034 | 6,295 | 5,907 |
| **San Felipe Unit** | | | |
| CVP Water | 68 | 38 | 68 |
| **Total** | | | |
| Surface Water | 11,699 | 9,644 | 12,829 |
| Groundwater | 9,374 | 12,377 | 7,974 |
| Total Applied | 21,073 | 22,021 | 20,803 |

NOTES:
All values in 1,000 acre-feet per year.
Non-CVP supplies are not estimated for the San Felipe Unit.

## TABLE E-29
## IRRIGATED ACREAGE IN MAXIMUM FLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | -0.5 | 0.5 | 0.2 |
| Alfalfa | -0.1 | 0.5 | 0.3 |
| Sugar Beets | 0.0 | 0.1 | 0.1 |
| Other Field Crops | -0.2 | 0.9 | 0.4 |
| Rice | -0.3 | -0.1 | -0.2 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.2 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.1 | 1.1 | 0.5 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-1.3** | **3.1** | **1.3** |
| **San Joaquin Valley** | | | |
| Pasture | -0.2 | 0.1 | 0.2 |
| Alfalfa | -1.3 | 0.6 | -0.9 |
| Sugar Beets | -0.1 | 0.0 | 0.0 |
| Other Field Crops | -0.8 | 0.3 | -0.4 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | -0.1 | 0.0 | -0.1 |
| Tomatoes | -0.5 | 0.1 | -0.4 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.3 | 0.7 | -0.1 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -5.5 | 2.3 | -3.9 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-8.8** | **4.0** | **-5.6** |
| **Tulare Basin** | | | |
| Pasture | -0.1 | 0.1 | -0.1 |
| Alfalfa | -0.8 | 1.6 | -0.6 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.6 | 1.2 | -0.4 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.3 | 1.3 | -0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -2.0 | 4.8 | -1.6 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-3.8** | **9.1** | **-2.9** |
| **San Felipe Unit** | | | |
| Pasture and Hay | -0.5 | -0.4 | -0.3 |
| Other Field Crops | -1.0 | -0.5 | -0.6 |
| Vegetables | -3.7 | -1.7 | -2.3 |
| Tree and Vine | -2.2 | -2.2 | -2.2 |
| **Subtotal** | **-7.4** | **-4.8** | **-5.5** |
| **Total** | **-21.3** | **11.4** | **-12.8** |

NOTE:
All values in thousand acres.

## TABLE E-30
## GROSS REVENUE IN MAXIMUM FLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | -0.1 | 0.0 | 0.0 |
| Alfalfa | -0.1 | 0.0 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | -0.1 | 0.0 | 0.2 |
| Rice | -0.3 | -0.1 | -0.2 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.2 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.0 | 0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.7** | **-0.2** | **0.6** |
| **San Joaquin Valley** | | | |
| Pasture | -0.1 | 0.0 | 0.1 |
| Alfalfa | -0.9 | 0.4 | -0.6 |
| Sugar Beets | -0.1 | 0.0 | 0.0 |
| Other Field Crops | -0.6 | 0.2 | -0.3 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | -0.8 | 0.3 | -0.5 |
| Tomatoes | -0.9 | 0.2 | -0.6 |
| Deciduous Orchard | -0.1 | -0.1 | -0.1 |
| Small Grain | -0.2 | 0.4 | -0.1 |
| Grapes | -0.1 | -0.1 | -0.1 |
| Cotton | -7.2 | 3.2 | -5.1 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-10.7** | **4.5** | **-7.5** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | -0.6 | 1.2 | -0.4 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.4 | 0.8 | -0.3 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | -0.1 | 0.3 | -0.1 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.2 | 0.9 | -0.1 |
| Grapes | -0.1 | -0.1 | -0.1 |
| Cotton | -2.6 | 6.3 | -2.1 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-4.0** | **9.4** | **-3.1** |
| **San Felipe Unit** | | | |
| Pasture and Hay | -0.1 | -0.1 | -0.1 |
| Other Field Crops | -0.7 | -0.3 | -0.4 |
| Vegetables | -25.8 | -12.1 | -16.1 |
| Tree and Vine | -3.7 | -3.7 | -3.7 |
| **Subtotal** | **-30.3** | **-16.2** | **-20.3** |
| **Total** | **-45.7** | **-2.4** | **-30.3** |

NOTE:
All values in million dollars per year.

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## TABLE E-31
## CHANGE IN NET REVENUE IN MAXIMUM FLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Component | Sacramento Valley | San Joaquin Valley | Tulare Basin | San Felipe Unit | Total |
|---|---|---|---|---|---|
| Fallowed Land | -0.1 | -1.2 | -0.5 | -2.9 | -4.8 |
| CVP Water Cost | 1.8 | 8.0 | 0.7 | 0.6 | 11.2 |
| Groundwater Pumping | -4.4 | -27.4 | -7.2 | 0.0 | -39.0 |
| Irrigation Cost | -0.7 | -1.4 | -2.0 | 0.0 | -4.1 |
| Total Reduction | -3.5 | -22.1 | -9.0 | -2.3 | -36.8 |
| Increase from Higher Crop Prices | 0.3 | 0.6 | 0.5 | 0.0 | 1.4 |
| Combined Net Revenue Change | -3.2 | -21.5 | -8.5 | -2.3 | -35.4 |

NOTE:
All values in million dollars per year (1997).

## TABLE E-32
## IRRIGATION WATER APPLIED IN MAXIMUM FLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| **Source** | **Average (1922-90)** | **Dry (1928-34)** | **Wet (1967-71)** |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Surface Water | -89 | -96 | -23 |
| Groundwater | 69 | 90 | 11 |
| Total Applied | -20 | -6 | -12 |
| **San Joaquin Valley** | | | |
| Surface Water | -215 | -137 | -37 |
| Groundwater | 137 | 97 | -29 |
| Total Applied | -78 | -40 | -66 |
| **Tulare Basin** | | | |
| Surface Water | -48 | -21 | -32 |
| Groundwater | 10 | 25 | -2 |
| Total Applied | -38 | 4 | -34 |
| **San Felipe Unit** | | | |
| CVP Water | -15 | -10 | -15 |
| **Total** | | | |
| Surface Water | -366 | -265 | -107 |
| Groundwater | 216 | 212 | -20 |
| Total Applied | -150 | -52 | -127 |

NOTES:
All values in 1,000 acre-feet per year.
Non-CVP supplies are not estimated for the San Felipe Unit.

# TABLE E-33
# IRRIGATED ACREAGE IN FLOW EVALUATION ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | -0.1 | 0.8 | 0.3 |
| Alfalfa | 0.0 | 0.2 | 0.3 |
| Sugar Beets | 0.0 | 0.1 | 0.1 |
| Other Field Crops | 0.0 | 0.6 | 0.5 |
| Rice | -0.1 | -0.3 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.1 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.9 | 0.5 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.2** | **2.3** | **1.8** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 0.2 | 0.1 |
| Alfalfa | -0.2 | 0.3 | 0.0 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | 0.3 | 0.1 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | -0.1 | 0.1 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.1 | 0.3 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -1.0 | 1.5 | 0.1 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-1.6** | **2.7** | **0.3** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.1 | 0.0 |
| Alfalfa | -0.2 | 0.9 | -0.1 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.2 | 0.6 | 0.0 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | -0.1 | 0.5 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.5 | 2.6 | -0.2 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-1.1** | **4.8** | **-0.3** |
| **San Felipe Unit** | | | |
| Pasture and Hay | -0.1 | -0.1 | 0.1 |
| Other Field Crops | -0.2 | -0.2 | 0.2 |
| Vegetables | -0.7 | -0.8 | 0.7 |
| Tree and Vine | -0.4 | -0.4 | -0.4 |
| **Subtotal** | **-1.4** | **-1.5** | **0.5** |
| **Total** | **-4.3** | **8.3** | **2.3** |

NOTE:
All values in thousand acres.

# TABLE E-34
# GROSS REVENUE IN FLOW EVALUATION ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 0.0 | 0.0 | 0.1 |
| Alfalfa | 0.0 | 0.0 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | 0.0 | 0.0 | 0.3 |
| Rice | -0.1 | -0.3 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.2 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.0 | 0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.1** | **-0.3** | **1.0** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 0.1 | 0.0 |
| Alfalfa | -0.2 | 0.3 | 0.0 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | 0.2 | 0.1 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | -0.1 | 0.2 | 0.0 |
| Tomatoes | -0.2 | 0.2 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -1.3 | 1.9 | 0.1 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-1.9** | **3.0** | **0.1** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | -0.2 | 0.7 | 0.0 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | 0.4 | 0.0 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.2 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.3 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.7 | 3.3 | -0.3 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-1.1** | **5.0** | **-0.4** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | -0.1 | 0.1 |
| Vegetables | -5.0 | -5.4 | 4.7 |
| Tree and Vine | -0.7 | -0.7 | -0.7 |
| **Subtotal** | **-5.8** | **-6.2** | **4.2** |
| **Total** | **-9.0** | **1.4** | **4.9** |

NOTE:
All values in million dollars per year.

RDD-SFO/992570005.xls (LLH143)

## TABLE E-35
## CHANGE IN NET REVENUE IN FLOW EVALUATION ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Component | Sacramento Valley | San Joaquin Valley | Tulare Basin | San Felipe Unit | Total |
|---|---|---|---|---|---|
| Fallowed Land | 0.0 | -0.2 | -0.1 | -0.6 | -1.0 |
| CVP Water Cost | 0.4 | 1.6 | 0.2 | 0.1 | 2.3 |
| Groundwater Pumping | -1.2 | -4.8 | -3.1 | 0.0 | -9.1 |
| Irrigation Cost | -0.1 | -0.3 | -0.6 | 0.0 | -1.1 |
| Total Reduction | -1.0 | -3.7 | -3.6 | -0.5 | -8.8 |
| Increase from Higher Crop Prices | 0.1 | 0.1 | 0.1 | 0.0 | 0.3 |
| Combined Net Revenue Change | -0.9 | -3.6 | -3.5 | -0.5 | -8.5 |

NOTE:
All values in million dollars per year (1997).

## TABLE E-36
## IRRIGATION WATER APPLIED IN FLOW EVALUATION ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Source | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Surface Water | -20 | -65 | 0 |
| Groundwater | 16 | 68 | 3 |
| Total Applied | -4 | 3 | 2 |
| **San Joaquin Valley** | | | |
| Surface Water | -34 | -35 | 2 |
| Groundwater | 22 | 38 | -7 |
| Total Applied | -11 | 3 | -5 |
| **Tulare Basin** | | | |
| Surface Water | -29 | -12 | -34 |
| Groundwater | 18 | 21 | 26 |
| Total Applied | -11 | 8 | -9 |
| **San Felipe Unit** | | | |
| CVP Water | -3 | -3 | -3 |
| **Total** | | | |
| Surface Water | -86 | -116 | -36 |
| Groundwater | 56 | 127 | 21 |
| Total Applied | -29 | 11 | -14 |

NOTES:
All values in 1,000 acre-feet per year.
Non-CVP supplies are not estimated for the San Felipe Unit.

## TABLE E-37
## IRRIGATED ACREAGE IN PERCENT INFLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 0.0 | 0.8 | 0.3 |
| Alfalfa | 0.0 | -0.1 | 0.3 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | 0.0 | 0.3 | 0.5 |
| Rice | 0.0 | -0.5 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.1 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.6 | 0.5 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.1** | **1.2** | **1.8** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 0.2 | 0.2 |
| Alfalfa | -0.1 | 0.3 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | 0.0 | 0.2 | 0.2 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.1 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.1 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.3 | 0.8 | 0.7 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.5** | **1.8** | **1.4** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | -0.2 | 0.8 | 0.0 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | 0.5 | 0.1 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.4 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.3 | 2.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.6** | **3.7** | **0.1** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 0.0 | 0.0 | 0.2 |
| Other Field Crops | -0.1 | 0.1 | 0.3 |
| Vegetables | -0.2 | 0.3 | 1.2 |
| Tree and Vine | -0.1 | -0.1 | -0.1 |
| **Subtotal** | **-0.4** | **0.3** | **1.6** |
| **Total** | **-1.5** | **7.0** | **4.9** |

NOTE:
All values in thousand acres.

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## TABLE E-38
## GROSS REVENUE IN PERCENT INFLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 0.0 | 0.1 | 0.1 |
| Alfalfa | 0.0 | 0.0 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | 0.0 | 0.2 | 0.3 |
| Rice | 0.0 | -0.5 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.2 | 0.2 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.3 | 0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.0** | **0.3** | **1.0** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 0.1 | 0.1 |
| Alfalfa | 0.0 | 0.2 | 0.1 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | 0.0 | 0.2 | 0.1 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.1 | 0.1 |
| Tomatoes | 0.0 | 0.1 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.1 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.4 | 1.0 | 1.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.6** | **1.7** | **1.5** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | -0.1 | 0.5 | 0.0 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | -0.1 | 0.3 | 0.1 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.2 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.0 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.4 | 2.6 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **-0.7** | **3.9** | **0.1** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 0.0 | 0.0 | 0.0 |
| Other Field Crops | 0.0 | 0.1 | 0.2 |
| Vegetables | -1.3 | 2.4 | 8.4 |
| Tree and Vine | -0.2 | -0.2 | -0.2 |
| **Subtotal** | **-1.6** | **2.3** | **8.4** |
| **Total** | **-2.9** | **8.2** | **11.0** |

NOTE:
All values in million dollars per year.

## TABLE E-39
## CHANGE IN NET REVENUE IN PERCENT INFLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Component | Sacramento Valley | San Joaquin Valley | Tulare Basin | San Felipe Unit | Total |
|---|---|---|---|---|---|
| Fallowed Land | 0.0 | -0.1 | -0.1 | -0.2 | -0.3 |
| CVP Water Cost | 0.1 | 0.5 | 0.2 | 0.0 | 0.7 |
| Groundwater Pumping | -0.5 | -1.4 | -2.6 | 0.0 | -4.4 |
| Irrigation Cost | 0.0 | -0.1 | -0.4 | 0.0 | -0.5 |
| Total Reduction | -0.4 | -1.1 | -2.9 | -0.2 | -4.5 |
| Increase from Higher Crop Prices | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 |
| Combined Net Revenue Change | -0.4 | -1.0 | -2.8 | -0.2 | -4.4 |

NOTE:
All values in million dollars per year (1997).

## TABLE E-40
## IRRIGATION WATER APPLIED IN PERCENT INFLOW ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| **Source** | **Average (1922-90)** | **Dry (1928-34)** | **Wet (1967-71)** |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Surface Water | -3 | 7 | 0 |
| Groundwater | 2 | -5 | 5 |
| Total Applied | -1 | 2 | 4 |
| **San Joaquin Valley** | | | |
| Surface Water | -3 | 19 | 13 |
| Groundwater | 0 | -13 | -10 |
| Total Applied | -3 | 5 | 3 |
| **Tulare Basin** | | | |
| Surface Water | -27 | -16 | -24 |
| Groundwater | 20 | 24 | 19 |
| Total Applied | -7 | 7 | -4 |
| **San Felipe Unit** | | | |
| CVP Water | -1 | 0 | -1 |
| **Total** | | | |
| Surface Water | -33 | 9 | -11 |
| Groundwater | 21 | 6 | 14 |
| Total Applied | -12 | 15 | 2 |

NOTES:
All values in 1,000 acre-feet per year.
Non-CVP supplies are not estimated for the San Felipe Unit.

## TABLE E-41
## IRRIGATED ACREAGE IN STATE PERMIT ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 0.0 | 0.8 | 0.4 |
| Alfalfa | 0.0 | -0.3 | 0.3 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | 0.0 | 0.1 | 0.5 |
| Rice | 0.0 | -0.6 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.1 | 0.1 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.4 | 0.5 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.2** | **0.5** | **1.9** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 1.0 | 0.7 |
| Alfalfa | 0.1 | 1.5 | 1.1 |
| Sugar Beets | 0.0 | 0.1 | 0.1 |
| Other Field Crops | 0.0 | 1.0 | 0.8 |
| Rice | 0.0 | 0.1 | 0.1 |
| Truck Crops | 0.0 | 0.1 | 0.1 |
| Tomatoes | 0.0 | 0.3 | 0.2 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.3 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.1 | 2.9 | 2.2 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.1** | **7.2** | **5.4** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | 0.0 | 0.5 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | 0.0 | 0.4 | 0.2 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.1 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | 0.1 | 1.3 | 0.4 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.1** | **2.4** | **0.9** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 0.1 | 0.2 | 0.3 |
| Other Field Crops | 0.2 | 0.9 | 0.5 |
| Vegetables | 0.6 | 3.2 | 2.0 |
| Tree and Vine | 0.4 | 0.4 | 0.4 |
| **Subtotal** | **1.2** | **4.7** | **3.2** |
| **Total** | **1.7** | **14.8** | **11.5** |

NOTE:
All values in thousand acres.

**TABLE E-42**
**GROSS REVENUE IN STATE PERMIT ALTERNATIVE**
**AS COMPARED TO NO ACTION ALTERNATIVE**

| Crop | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Pasture | 0.0 | 0.1 | 0.1 |
| Alfalfa | 0.0 | -0.2 | 0.2 |
| Sugar Beets | 0.0 | 0.0 | 0.1 |
| Other Field Crops | 0.0 | 0.1 | 0.3 |
| Rice | 0.0 | -0.6 | 0.0 |
| Truck Crops | 0.0 | 0.0 | 0.0 |
| Tomatoes | 0.0 | 0.1 | 0.2 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.2 | 0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.1** | **-0.1** | **1.0** |
| **San Joaquin Valley** | | | |
| Pasture | 0.0 | 0.3 | 0.2 |
| Alfalfa | 0.1 | 1.0 | 0.7 |
| Sugar Beets | 0.0 | 0.1 | 0.1 |
| Other Field Crops | 0.0 | 0.7 | 0.6 |
| Rice | 0.0 | 0.1 | 0.1 |
| Truck Crops | 0.0 | 0.6 | 0.4 |
| Tomatoes | 0.0 | 0.5 | 0.4 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.1 | 0.2 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | -0.1 | 3.5 | 2.7 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.0** | **6.7** | **5.2** |
| **Tulare Basin** | | | |
| Pasture | 0.0 | 0.0 | 0.0 |
| Alfalfa | 0.0 | 0.4 | 0.1 |
| Sugar Beets | 0.0 | 0.0 | 0.0 |
| Other Field Crops | 0.0 | 0.3 | 0.2 |
| Rice | 0.0 | 0.0 | 0.0 |
| Truck Crops | 0.0 | 0.2 | 0.0 |
| Tomatoes | 0.0 | 0.0 | 0.0 |
| Deciduous Orchard | 0.0 | 0.0 | 0.0 |
| Small Grain | 0.0 | 0.1 | 0.1 |
| Grapes | 0.0 | 0.0 | 0.0 |
| Cotton | 0.1 | 1.6 | 0.6 |
| Subtropical Orchard | 0.0 | 0.0 | 0.0 |
| **Subtotal** | **0.1** | **2.6** | **0.9** |
| **San Felipe Unit** | | | |
| Pasture and Hay | 0.0 | 0.1 | 0.1 |
| Other Field Crops | 0.1 | 0.6 | 0.4 |
| Vegetables | 4.3 | 22.4 | 14.0 |
| Tree and Vine | 0.6 | 0.6 | 0.6 |
| **Subtotal** | **5.0** | **23.7** | **15.0** |
| **Total** | **5.3** | **32.9** | **22.1** |

NOTE:
All values in million dollars per year.

## TABLE E-43
## CHANGE IN NET REVENUE IN STATE PERMIT ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Component | Sacramento Valley | San Joaquin Valley | Tulare Basin | San Felipe Unit | Total |
|---|---|---|---|---|---|
| Fallowed Land | 0.0 | 0.0 | 0.0 | 0.4 | 0.5 |
| CVP Water Cost | -0.3 | -1.3 | 0.0 | -0.1 | -1.6 |
| Groundwater Pumping | 0.4 | 5.0 | -1.5 | 0.0 | 3.8 |
| Irrigation Cost | 0.1 | 0.2 | 0.0 | 0.0 | 0.3 |
| Total Reduction | 0.2 | 3.9 | -1.5 | 0.3 | 2.9 |
| Increase from Higher Crop Prices | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combined Net Revenue Change | 0.2 | 3.9 | -1.5 | 0.3 | 2.9 |

NOTE:
All values in million dollars per year (1997).

## TABLE E-44
## IRRIGATION WATER APPLIED IN STATE PERMIT ALTERNATIVE AS COMPARED TO NO ACTION ALTERNATIVE

| Source | Average (1922-90) | Dry (1928-34) | Wet (1967-71) |
|---|---|---|---|
| **Sacramento Valley** | | | |
| Surface Water | 14 | 35 | 0 |
| Groundwater | -11 | -32 | 7 |
| Total Applied | 3 | 2 | 7 |
| **San Joaquin Valley** | | | |
| Surface Water | 47 | 148 | 13 |
| Groundwater | -40 | -113 | 11 |
| Total Applied | 7 | 35 | 25 |
| **Tulare Basin** | | | |
| Surface Water | -24 | 8 | -32 |
| Groundwater | 25 | 0 | 35 |
| Total Applied | 1 | 8 | 3 |
| **San Felipe Unit** | | | |
| CVP Water | 2 | 9 | 2 |
| **Total** | | | |
| Surface Water | 39 | 200 | -16 |
| Groundwater | -26 | -145 | 53 |
| Total Applied | 13 | 54 | 38 |

NOTES:
All values in 1,000 acre-feet per year.
Non-CVP supplies are not estimated for the San Felipe Unit.

Table E-45
Trinity Reservoir Property Value Impact Ranking—Full Year Comparison

| Reservoir Water Levels<br>Data in each cell reflect: Item Value, Difference from No Action Alternative or Existing Conditions, and Rank (in parenthesis) | | NEPA Comparison to No Action Alternative | | | | | CEQA Comparison to Existing Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | No Action/Mechanical Restoration Alternatives | Maximum Flow Alternative | Flow Evaluation Alternative | Percent Inflow Alternative | State Permit Alternative | Existing Conditions | Preferred Alternative |
| **Drawdown** | | | | | | | | |
| Annual Average (average year): | | 2,298, 0, (4) | 2,284, -14, (5) | 2,303, +5, (2) | 2,301, +3, (3) | 2,311, +13, (1) | 2,302 | 2,303, +1 |
| **Annual Fluctuation** | | | | | | | | |
| Annual Average (across water-year classes): | High: | 2,328, 0, (4) | 2,299, -29, (5) | 2,329, +1, (3) | 2,330, +2, (2) | 2,334, +6, (1) | 2,331 | 2,329, -2 |
| | Low: | 2,253, 0, (4) | 2,269, +16, (3) | 2,271, +18, (2) | 2,275, +22, (1) | 2,275, +22, (1) | 2,265 | 2,271, +6 |
| | Range: | 75, 0, (5) | 30, -45, (1) | 58, -17, (3) | 55, -20, (2) | 59, -16, (4) | 66 | 58, -8 |
| Annual Average (across individual years): | High: | 2,346, 0, (1) | 2,331, -15, (2) | 2,346, 0, (1) | 2,346, 0, (1) | 2,346, 0, (1) | 2,346 | 2,346, 0 |
| | Low: | 2,187, 0, (5) | 2,229, +42, (1) | 2,223, +36, (2) | 2,221, +34, (3) | 2,195, +8, (4) | 2,192 | 2,223, +31 |
| | Range: | 159, 0, (5) | 102,-57, (1) | 123, -36, (2) | 125, -34, (3) | 151, -8, (4) | 154 | 123, -31 |
| Annual Fluctuation - Overall Rank (rank sum - range): | | 10, (4) | 2, (1) | 5, (2) | 5, (2) | 8, (3) | n/a | n/a |
| **Monthly Fluctuation** | | | | | | | | |
| Monthly Average (average year): | High: | 2,321, 0, (4) | 2,293, -28, (5) | 2,327, +6, (2) | 2,322, +1, (3) | 2,336, +15, (1) | 2,327 | 2,327, 0 |
| | Low: | 2,281, 0, (4) | 2,275, -6, (5) | 2,283, +2, (3) | 2,284, +3, (2) | 2,290, +9, (1) | 2,282 | 2,283, +1 |
| | Range: | 40, 0, (3) | 18, -22, (1) | 44, +4, (4) | 38, -2, (2) | 46, +6, (5) | 45 | 44, -1 |
| Monthly Average (across water-year classes): | High: | 2,358, 0, (4) | 2,315, -43, (5) | 2,359, +1, (3) | 2,361, +3, (2) | 2,367, +9, (1) | 2,366 | 2,359, -7 |
| | Low: | 2,213, 0, (5) | 2,248, +35, (1) | 2,236, +23, (2) | 2,235, +22, (3) | 2,227, +14, (4) | 2,221 | 2,236, +15 |
| | Range: | 145, 0, (5) | 67,-78, (1) | 123, -22, (2) | 126, -19, (3) | 140, -5, (4) | 145 | 123, -22 |
| Monthly Values (across all years): | High: | 2,369, 0, (1) | 2,344, -25, (2) | 2,369, 0, (1) | 2,369, 0, (1) | 2,369, 0, (1) | 2,369 | 2,369, 0 |
| | Low: | 2,165, 0, (5) | 2,208, +43, (1) | 2,206, +41, (2) | 2,203, +38, (3) | 2,168, +3, (4) | 2,169 | 2,206, +37 |
| | Range: | 204, 0, (5) | 136, -68, (1) | 163, -41, (2) | 166, -38, (3) | 201,-3, (4) | 200 | 163, -37 |
| Monthly Range within Each Year (across all years) | High: | 145, 0, (4) | 101,-44, (1) | 126, -19, (3) | 125, -20, (2) | 174, +29, (5) | 170 | 126, -44 |
| | Low: | 31, 0, (4) | 12, -19, (1) | 26, -5, (3) | 25, -6, (2) | 31, 0, (4) | 24 | 26, +2 |
| | Average: | 61, 0, (3) | 36, -25, (1) | 60, -1, (2) | 62, +1, (4) | 64, +3, (5) | 66 | 60, -6 |
| Monthly Fluctuation - Overall Rank (rank sum - range/average): | | 16, (4) | 4, (1) | 10, (2) | 12, (3) | 18, (5) | n/a | n/a |
| **Rank Sum: Drawdown, Annual Fluctuation, Monthly Fluctuation** | | **12, (4)** | **7, (2)** | **6, (1)** | **8, (3)** | **8, (3)** | **n/a** | **n/a** |





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**Table E-46**
**Trinity Reservoir Property Value Impact Ranking—High Recreation Season (May-September) Comparison**

| Reservoir Water Levels<br>Data in each cell reflect: Item Value, Difference from No Action Alternative or Existing Conditions, and Rank (in parenthesis) | | NEPA Comparison to No Action Alternative | | | | | CEQA Comparison to Existing Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | No Action/ Mechanical Restoration Alternatives | Maximum Flow Alternative | Flow Evaluation Alternative | Percent Inflow Alternative | State Permit Alternative | Existing Conditions | Preferred Alternative |
| **Drawdown** | | | | | | | | |
| Annual Average (average year): | | 2,301, 0, (4) | 2,281, -20, (5) | 2,307, +6, (2) | 2,306, +5, (3) | 2,317, +16, (1) | 2,307 | 2,307, 0 |
| **Annual Fluctuation** | | | | | | | | |
| Annual Average (across water-year classes): | High: | 2,349, 0, (3) | 2,298, -51, (5) | 2,348, -1, (4) | 2,351, +2, (2) | 2,355, +6, (1) | 2,354 | 2,348, -6 |
| | Low: | 2,233, 0, (5) | 2,264, +31, (1) | 2,261, +28, (2) | 2,260, +27, (3) | 2,259, +26, (4) | 2,245 | 2,261, +16 |
| | Range: | 116, 0, (5) | 34, -82, (1) | 87, -29, (2) | 91, -25, (3) | 96, -20, (4) | 109 | 87, -22 |
| Annual Average (across individual years): | High: | 2,357, 0, (1) | 2,334, -23, (2) | 2,357, 0, (1) | 2,357, 0, (1) | 2,357, 0, (1) | 2,357 | 2,357, 0 |
| | Low: | 2,183, 0, (5) | 2,220, +37, (2) | 2,223, +40, (1) | 2,219, +36, (3) | 2,195, +12, (4) | 2,194 | 2,223, +29 |
| | Range: | 174, 0, (5) | 114, -60, (1) | 134, -40, (2) | 138 , -36, (3) | 162, -12, (4) | 163 | 134, -29 |
| Annual Fluctuation - Overall Rank (rank sum - range): | | 10, (5) | 2,(1) | 4, (2) | 6, (3) | 8, (4) | n/a | n/a |
| **Monthly Fluctuation** | | | | | | | | |
| Monthly Average (average year): | High: | 2,321, 0, (4) | 2,288, -33, (5) | 2,324, +3, (2) | 2,322, +1, (3) | 2,336, +15, (1) | 2,327 | 2,324, -3 |
| | Low: | 2,283, 0, (4) | 2,275, -8, (5) | 2,285, +2, (3) | 2,287, +4, (2) | 2,295, +12, (1) | 2,288 | 2,285, -3 |
| | Range: | 38, 0, (3) | 13, -25, (1) | 39, +1, (4) | 35, -3, (2) | 41,+3, (5) | 39 | 39, 0 |
| Monthly Average (across water-year classes): | High: | 2,358, 0, (4) | 2,305, -53, (5) | 2,359, +1, (3) | 2,361, +3, (2) | 2,367, +9, (1) | 2,366 | 2,359, -7 |
| | Low: | 2,213, 0, (5) | 2,255,+42, (1) | 2,236, +23, (2) | 2,235, +22, (3) | 2,227, +14, (4) | 2,221 | 2,236, +15 |
| | Range: | 145, 0, (5) | 50,-95, (1) | 123, -22, (2) | 126, -19, (3) | 140, -5, (4) | 145 | 123, -22 |
| Monthly Values (across all years): | High: | 2,369, 0, (1) | 2,338, -31, (2) | 2,369, 0, (1) | 2,369, 0, (1) | 2,369, 0, (1) | 2,369 | 2,369, 0 |
| | Low: | 2,165, 0, (5) | 2,208, +43, (2) | 2,212, +47, (1) | 2,206, +41, (3) | 2,170, +5, (4) | 2,173 | 2,212, +39 |
| | Range: | 204, 0, (5) | 130, -74, (1) | 157, -47, (2) | 163, -41, (3) | 199, -5, (4) | 196 | 157, -39 |
| Monthly Range within Each Year (across all years): | High: | 67, 0, (2) | 44, -23, (1) | 77, +10, (4) | 71, +4, (3) | 82, +15, (5) | 70 | 77, +7 |
| | Low: | 8, 0, (2) | 4, -4, (1) | 20, +12, (5) | 14, +6, (3) | 17, +9, (4) | 14 | 20, +6 |
| | Average: | 38, 0, (2) | 16, -22, (1) | 41, +3, (3) | 38, 0, (2) | 43, +5, (4) | 40 | 41, +1 |
| Monthly Fluctuation - Overall Rank (rank sum - range/average): | | 15, (4) | 4, (1) | 11, (3) | 10, (2) | 17, (5) | n/a | n/a |
| **Rank Sum: Drawdown, Annual Fluctuation, Monthly Fluctuation** | | **13, (4)** | **7, (1)** | **7, (1)** | **8, (2)** | **10, (3)** | **n/a** | **n/a** |

**Table E-47**
**Shasta Reservoir Property Value Impact Ranking—Full Year Comparison**

| Reservoir Water Levels<br>Data in each cell reflect: Item Value, Difference from No Action Alternative or Existing Conditions, and Rank (in parenthesis) | | NEPA Comparison to No Action Alternative | | | | | CEQA Comparison to Existing Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | No Action/ Mechanical Restoration Alternatives | Maximum Flow Alternative | Flow Evaluation Alternative | Percent Inflow Alternative | State Permit Alternative | Existing Conditions | Preferred Alternative |
| **Drawdown** | | | | | | | | |
| Annual Average (average year): | | 1,016, 0, (2) | 1,006, -10, (5) | 1,013, -3, (4) | 1,015, -1, (3) | 1,018, +2, (1) | 1,018 | 1,013, -5 |
| **Annual Fluctuation** | | | | | | | | |
| Annual Average (across water-year classes): | High: | 1,031, 0, (2) | 1,025, -6, (4) | 1,029, -2, (3) | 1,031, 0, (2) | 1,032, +1, (1) | 1,032 | 1,029, -3 |
| | Low: | 985, 0, (1) | 956, -29, (4) | 977, -8, (3) | 982, -3, (2) | 985, 0, (1) | 986 | 977, -9 |
| | Range: | 46, 0, (1) | 69, +23, (5) | 52, +6, (4) | 49, +3, (3) | 47, -1, (2) | 46 | 52, +6 |
| Annual Average (across individual years): | High: | 1,038, 0, (1) | 1,037, -1, (2) | 1,037, -1, (2) | 1,038, 0, (1) | 1,038, 0, (1) | 1,038 | 1,037, -1 |
| | Low: | 929, 0, (1) | 844, -85, (4) | 912, -17, (3) | 927, -2, (2) | 927, -2, (2) | 930 | 912, -18 |
| | Range: | 109, 0, (1) | 193, +84, (4) | 125, +16, (3) | 111, +2, (2) | 111, +2, (2) | 108 | 125, +17 |
| Annual Fluctuation - Overall Rank (rank sum - range): | | 2, (1) | 9, (5) | 7, (4) | 5, (3) | 4, (2) | n/a | n/a |
| **Monthly Fluctuation** | | | | | | | | |
| Monthly Average (average year): | High: | 1,046, 0, (2) | 1,041, -5, (5) | 1,044, -2, (4) | 1,045, -1, (3) | 1,047, +1, (1) | 1,047 | 1,044, -3 |
| | Low: | 994, 0, (2) | 977, -17, (5) | 989, -5, (4) | 993, -1, (3) | 997, +3, (1) | 996 | 989, -7 |
| | Range: | 52, 0, (2) | 64, +12, (4) | 55, +3, (3) | 52, 0, (2) | 50, -2, (1) | 51 | 55, +4 |
| Monthly Average (across water-year classes): | High: | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066 | 1,066, 0 |
| | Low: | 940, 0, (2) | 871, -69, (4) | 925, -15, (3) | 940, 0, (2) | 944, +4, (1) | 945 | 925, -20 |
| | Range: | 126, 0, (2) | 195, +69, (4) | 141, +15, (3) | 126, 0, (2) | 122, -4, (1) | 121 | 141, +20 |
| Monthly Values (across all years): | High: | 1,067, 0, (1) | 1,066, -1, (2) | 1,066, -1, (2) | 1,066, -1, (2) | 1,067, 0, (1) | 1,067 | 1,066, -1 |
| | Low: | 884, 0, (2) | 664, -220, (4) | 848, -36, (3) | 884, 0, (2) | 885, +1, (1) | 891 | 848, -43 |
| | Range: | 183, 0, (2) | 402, +219, (4) | 218, +35, (3) | 182, -1, (1) | 182, -1, (1) | 176 | 218, +42 |
| Monthly Range within Each Year (across all years): | High: | 172, 0, (2) | 318, +146, (5) | 207, +35, (4) | 173, +1, (3) | 156, -16, (1) | 175 | 207, +32 |
| | Low: | 39, 0, (1) | 47, +8, (3) | 48, +9, (4) | 40, +1, (2) | 40, +1, (2) | 38 | 48, +10 |
| | Average: | 67, 0, (2) | 86, +19, (3) | 88, +21, (4) | 67, 0, (2) | 65, -2, (1) | 65 | 88, +23 |
| Monthly Fluctuation - Overall Rank (rank sum - range/average): | | 8, (3) | 15, (5) | 13, (4) | 7, (2) | 4, (1) | n/a | n/a |
| **Rank Sum: Drawdown, Annual Fluctuation, Monthly Fluctuation** | | **6, (2)** | **15, (5)** | **12, (4)** | **8, (3)** | **4, (1)** | n/a | n/a |

**Table E-48**
**Shasta Reservoir Property Value Impact Ranking—High Recreation Season (May - September) Comparison**

| Reservoir Water Levels | | NEPA Comparison to No Action Alternative | | | | | CEQA Comparison to | |
|---|---|---|---|---|---|---|---|---|
| Data in each cell reflect: Item Value, Difference from No Action Alternative or Existing Conditions, and Rank (in parenthesis) | | No Action/ Mechanical Restoration Alternatives | Maximum Flow Alternative | Flow Evaluation Alternative | Percent Inflow Alternative | State Permit Alternative | Existing Conditions | Preferred Alternative |
| **Drawdown** | | | | | | | | |
| Annual Average (average year): | | 1,019, 0, (2) | 1,009, -10, (5) | 1,015, -4, (4) | 1,017, -2, (3) | 1,020, +1, (1) | 1,021 | 1,015, -6 |
| **Annual Fluctuation** | | | | | | | | |
| Annual Average (across water-year classes): | High: | 1,044, 0, (2) | 1,042, -2, (3) | 1,044, 0, (2) | 1,044, 0, (2) | 1,045, +1, (1) | 1,044 | 1,044, 0 |
| | Low: | 969, 0, (1) | 925, -44, (5) | 955, -14, (4) | 965, -4, (3) | 968, -1, (2) | 971 | 955, -16 |
| | Range: | 75, 0, (1) | 117, +42, (5) | 89, +14, (4) | 79, +4, (3) | 76,+1, (2) | 73 | 89, +16 |
| Annual Average (across individual years): | High: | 1,048, 0, (1) | 1,043, -5, (3) | 1,044, -4, (2) | 1,048, 0, (1) | 1,048, 0, (1) | 1,048 | 1,044, -4 |
| | Low: | 918, 0, (1) | 818, -100, (4) | 914, -4, (2) | 913, -5, (3) | 918, 0, (1) | 921 | 914, -7 |
| | Range: | 130, 0, (1) | 225, +95, (3) | 130, 0, (1) | 135, +5, (2) | 130, 0, (1) | 127 | 130, +3 |
| Annual Fluctuation - Overall Rank (rank sum - range): | | 2, (1) | 8, (4) | 5, (3) | 5, (3) | 3, (2) | n/a | n/a |
| **Monthly Fluctuation** | | | | | | | | |
| Monthly Average (average year): | High: | 1,046, 0, (2) | 1,041, -5, (5) | 1,043, -3, (4) | 1,045, -1, (3) | 1,047, +1, (1) | 1,047 | 1,043, -4 |
| | Low: | 994, 0, (2) | 977, -17, (5) | 990, -4, (4) | 993, -1, (3) | 997, +3, (1) | 996 | 990, -6 |
| | Range: | 52, 0, (2) | 64, +12, (4) | 53, +1, (3) | 52, 0, (2) | 50, -2, (1) | 51 | 53, +2 |
| Monthly Average (across water-year classes): | High: | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066, 0, (1) | 1,066 | 1,066, 0 |
| | Low: | 940, 0, (2) | 871, -69, (4) | 925, -15, (3) | 940, 0, (2) | 944, +4, (1) | 945 | 925, -20 |
| | Range: | 126, 0, (2) | 195, +69, (4) | 141, +15, (3) | 126, 0, (2) | 122, -4, (1) | 121 | 141, +20 |
| Monthly Values (across all years): | High: | 1,067, 0, (1) | 1,066, -1, (2) | 1,066, -1, (2) | 1,066, -1, (2) | 1,067, 0, (1) | 1,067 | 1,066, -1 |
| | Low: | 886, 0, (2) | 693, -193, (4) | 851, -35, (3) | 886, 0, (2) | 887, +1, (1) | 900 | 851, -49 |
| | Range: | 181, 0, (2) | 373, +192, (4) | 215, +34, (3) | 180, -1, (1) | 180, -1, (1) | 167 | 215, +48 |
| Monthly Range within Each Year (across all years): | High: | 89, 0, (3) | 215, +126, (5) | 204, +115, (4) | 86, -3, (2) | 78, -11, (1) | 75 | 204, +129 |
| | Low: | 38, 0, (2) | 43, +5, (5) | 42, +4, (4) | 39, +1, (3) | 36, -2, (1) | 37 | 42, +5 |
| | Average: | 52, 0, (3) | 63, +11, (4) | 72, +20, (5) | 51, -1, (2) | 50, -2, (1) | 51 | 72, +21 |
| Monthly Fluctuation - Overall Rank (rank sum - range): | | 9, (3) | 16, (5) | 14, (4) | 7, (2) | 4, (1) | n/a | n/a |
| **Rank Sum: Drawdown, Annual Fluctuation, Monthly Fluctuation** | | **6, (2)** | **14, (5)** | **11, (4)** | **8, (3)** | **4, (1)** | **n/a** | **n/a** |

| Table E-49<br>Trinity River Property Value Impact Ranking | | | | | | |
|---|---|---|---|---|---|---|
| **Alternatives** | **Inriver Salmon Harvest (Chinook & Coho)** | **Change from No Action/ Existing Conditions** | **Rank** | **Inriver Steelhead Harvest** | **Change from No Action/ Existing Conditions** | **Rank** |
| **NEPA Comparison to No Action Alternative** | | | | | | |
| No Action | 820 | 0 | 5 | 1,000 | 0 | 5 |
| Maximum Flow | 7,800 | +6,980 | 1 | 10,400 | +9,400 | 1 |
| Flow Evaluation/ Preferred Alternative | 6,400 | +5,580 | 2 | 8,700 | +7,700 | 2 |
| Percent Inflow | 2,250 | +1,430 | 3 | 3,000 | +2,000 | 3 |
| Mechanical Restoration | 1,630 | +810 | 4 | 2,200 | +1,200 | 4 |
| State Permit | 0 | -820 | 7 | 0 | -1,000 | 6 |
| **CEQA Comparison to Existing Conditions** | | | | | | |
| Existing Conditions | 820 | 0 | n/a | 1,000 | 0 | n/a |
| Preferred Alternative | 6,400 | +5,580 | n/a | 8,700 | +7,700 | n/a |

| Table E-50<br>Property Value Impact NEPA Ranking Summary | | | | | | |
|---|---|---|---|---|---|---|
| | Alternatives | | | | | |
| | No Action | Maximum Flow | Flow Evaluation | Percent Inflow | Mechanical Restoration | State Permit |
| **Reservoir Ranking**[a] | | | | | | |
| Trinity River Basin<br>- Trinity Reservoir | 4 | 2 | 1 | 3 (tie) | 4 | 3 (tie) |
| Central Valley<br>- Shasta Reservoir | 2 | 5 | 4 | 3 | 2 | 1 |
| **Rivers Ranking** | | | | | | |
| Trinity River Basin<br>- Trinity River | 5 | 1 | 2 | 3 | 4 | 6 |

[a]Data in each cell reflects overall ranks

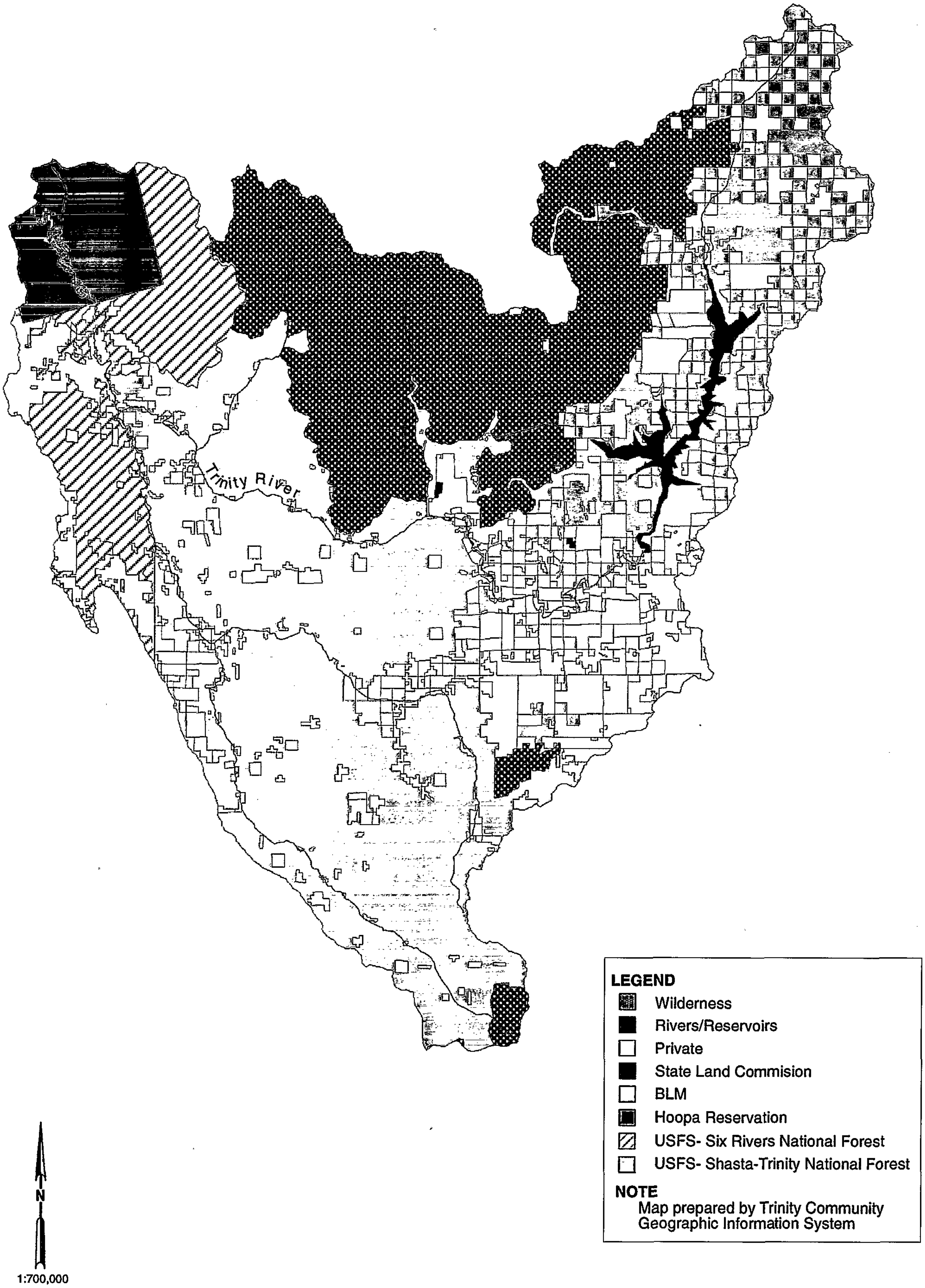



**FIGURE E-1**
**TRINITY RIVER BASIN LAND OWNERSHIP**
TRINITY RIVER MAINSTEM FISHERY RESTORATION EIS/EIR

2865_731 (10/8/99)

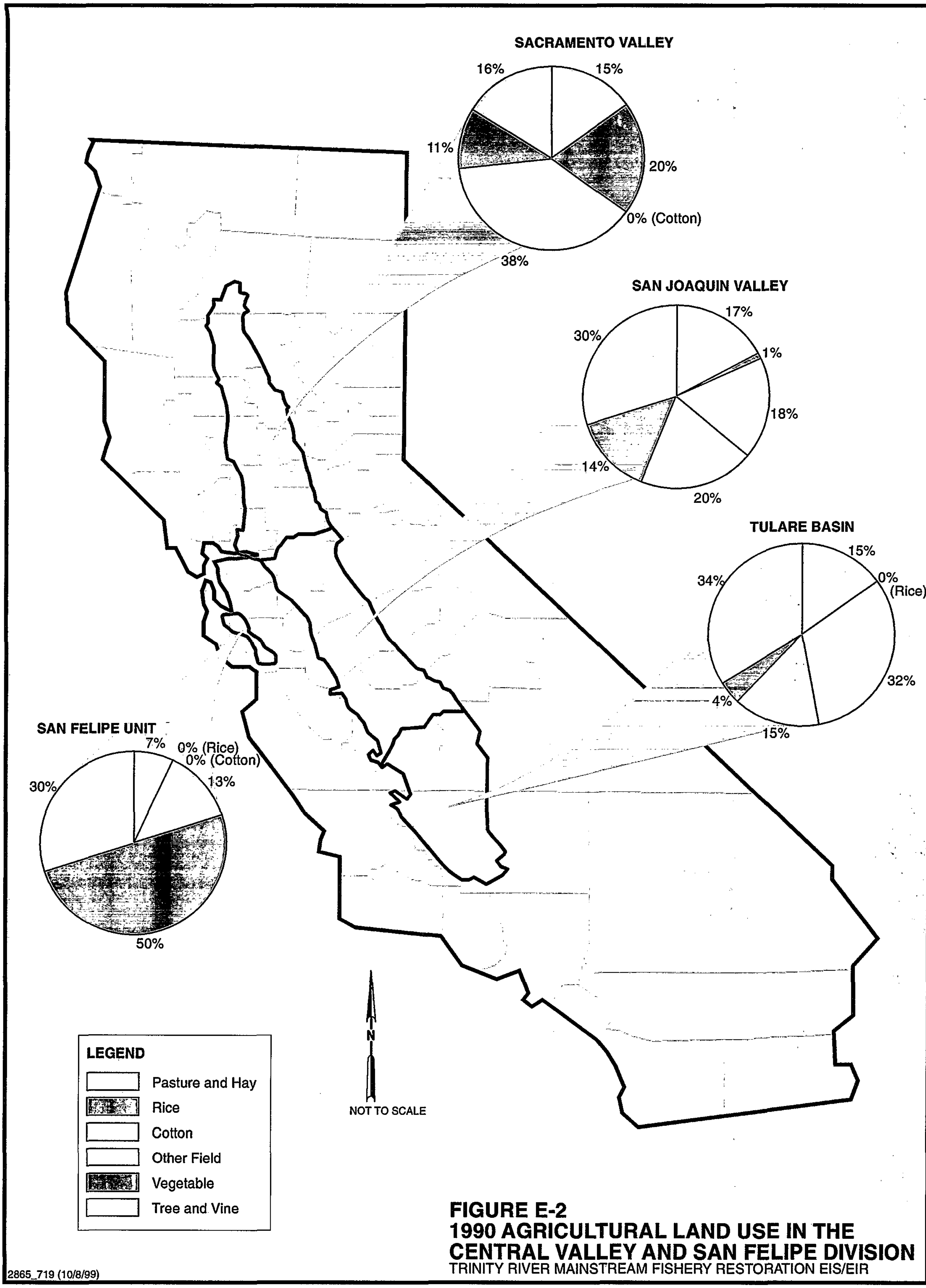
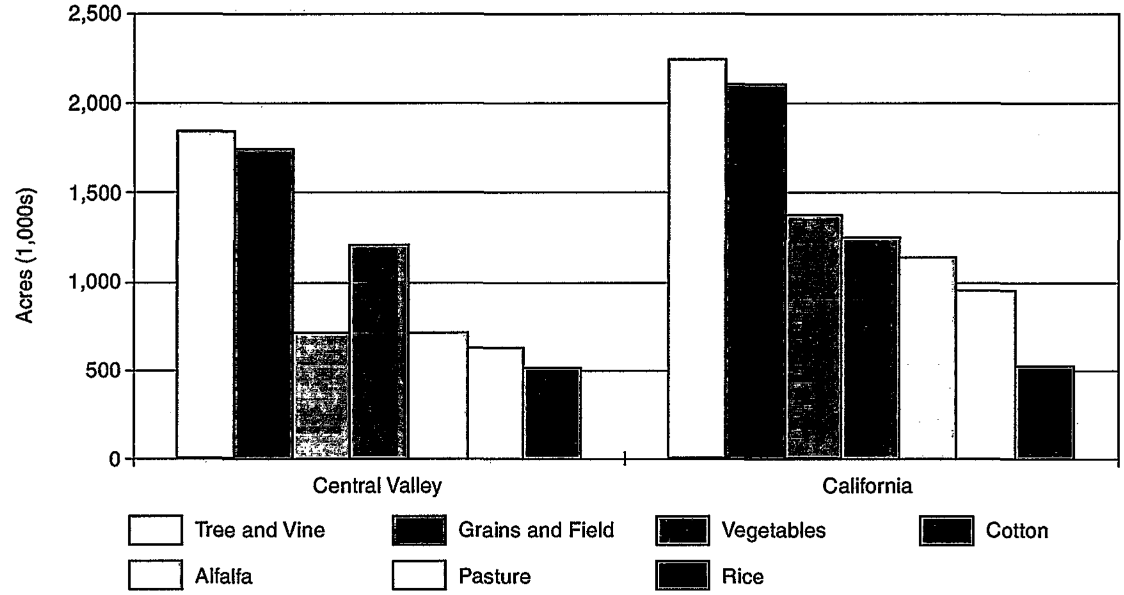



**FIGURE E-2**
**1990 AGRICULTURAL LAND USE IN THE CENTRAL VALLEY AND SAN FELIPE DIVISION**
TRINITY RIVER MAINSTREAM FISHERY RESTORATION EIS/EIR



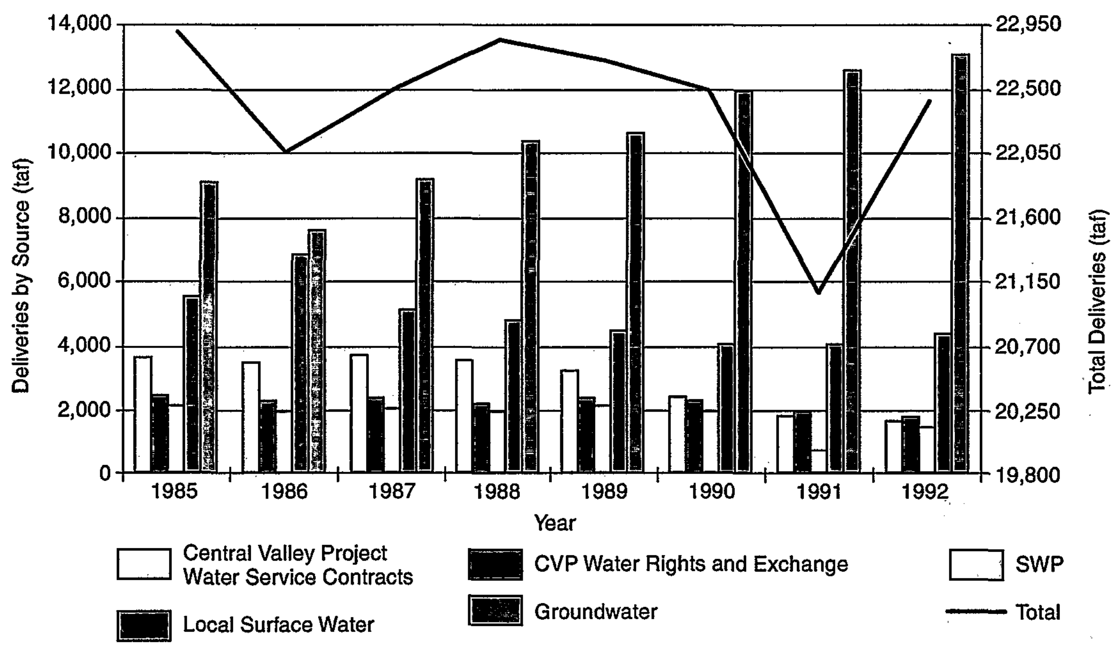




**FIGURE E-3**
**1990 NORMALIZED IRRIGATED ACRES AND CENTRAL VALLEY IRRIGATION WATER DELIVERIES BY SOURCE FROM 1985-1992**
TRINITY RIVER MAINSTEM FISHERY RESTORATION EIS/EIR

2865_37 (10/8/99)

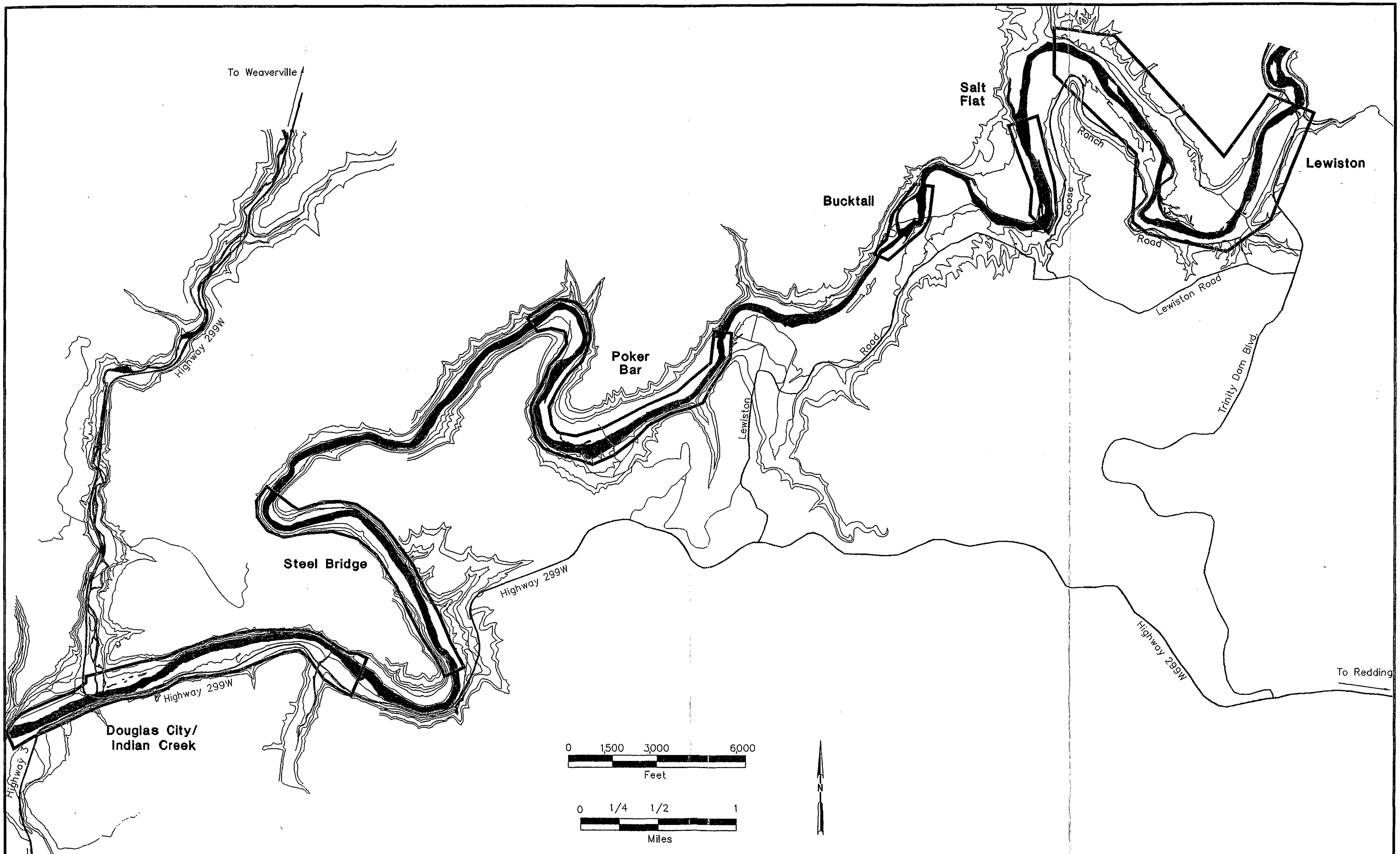



**FIGURE E-4**
**FLOOD DAMAGE STUDY SITE LOCATIONS**
TRINITY RIVER MAINSTREAM FISHERY RESTORATION EIS/EIR

# LAND USE ATTACHMENTS

- E1 • CVPM Output Files
- E2 • Summary of Literature Review
- E1 • Flood Damage Assessment of Proposed Trinity River Fish and Wildlife Restoration Flow Alternatives

**ATTACHMENT E1**

**CVPM Output Files**

TABLE A-1

IRRIGATED ACREAGE IN THE NO-ACTION ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 26.6 | 26.3 | 26.5 |
| REG2 | 195.0 | 193.6 | 194.7 |
| REG3 | 293.9 | 289.7 | 294.6 |
| REG3B | 87.6 | 80.3 | 87.8 |
| REG4 | 275.6 | 274.1 | 276.2 |
| REG5 | 364.1 | 362.6 | 365.2 |
| REG6 | 280.2 | 278.3 | 280.3 |
| REG7 | 91.5 | 90.7 | 91.5 |
| REG8 | 284.5 | 282.6 | 284.6 |
| REG9 | 424.8 | 419.2 | 425.6 |
| REG10 | 430.0 | 428.5 | 430.5 |
| REG11 | 174.2 | 174.0 | 174.4 |
| REG12 | 200.7 | 200.0 | 199.9 |
| REG13 | 534.6 | 532.6 | 535.3 |
| REG14 | 525.5 | 512.2 | 524.7 |
| REG15 | 603.6 | 585.2 | 605.1 |
| REG16 | 111.4 | 110.7 | 111.5 |
| REG17 | 260.3 | 254.3 | 260.4 |
| REG18 | 592.5 | 577.0 | 594.8 |
| REG19 | 258.5 | 252.6 | 259.4 |
| REG20 | 202.9 | 199.1 | 203.9 |
| REG21 | 368.2 | 361.5 | 368.9 |

NOTES:
1. All acreage values in thousand.

TABLE A-2

IRRIGATED ACREAGE IN STATE PERMIT ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 26.6 | 26.3 | 26.6 |
| REG2 | 195.0 | 193.6 | 194.7 |
| REG3 | 294.0 | 289.9 | 294.8 |
| REG3B | 87.7 | 86.8 | 87.9 |
| REG4 | 275.6 | 274.1 | 276.2 |
| REG5 | 364.1 | 362.6 | 365.2 |
| REG6 | 280.2 | 278.7 | 280.2 |
| REG7 | 91.5 | 90.6 | 91.5 |
| REG8 | 284.5 | 282.6 | 284.6 |
| REG9 | 424.8 | 420.5 | 425.6 |
| REG10 | 430.2 | 428.9 | 430.2 |
| REG11 | 174.2 | 174.0 | 174.4 |
| REG12 | 200.7 | 200.0 | 199.9 |
| REG13 | 534.6 | 532.5 | 535.3 |
| REG14 | 526.1 | 522.8 | 524.2 |
| REG15 | 603.5 | 584.8 | 605.1 |
| REG16 | 111.4 | 110.7 | 111.5 |
| REG17 | 260.2 | 254.4 | 260.4 |
| REG18 | 592.5 | 577.1 | 594.8 |
| REG19 | 258.5 | 251.7 | 259.4 |
| REG20 | 203.0 | 199.3 | 203.8 |
| REG21 | 368.2 | 362.9 | 368.9 |

NOTES:
1. All acreage values in thousand.

TABLE A-3

IRRIGATED ACREAGE IN MAXIMUM FLOW ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 26.6 | 26.3 | 26.6 |
| REG2 | 194.9 | 193.5 | 194.6 |
| REG3 | 291.1 | 287.0 | 292.2 |
| REG3B | 84.9 | 84.0 | 85.4 |
| REG4 | 275.6 | 273.9 | 276.0 |
| REG5 | 364.9 | 363.0 | 365.7 |
| REG6 | 280.7 | 280.0 | 281.3 |
| REG7 | 91.6 | 90.7 | 91.5 |
| REG8 | 284.5 | 282.6 | 284.6 |
| REG9 | 424.7 | 417.9 | 425.6 |
| REG10 | 429.3 | 427.5 | 430.2 |
| REG11 | 174.2 | 174.0 | 174.4 |
| REG12 | 200.7 | 200.0 | 200.0 |
| REG13 | 533.5 | 531.5 | 534.1 |
| REG14 | 518.2 | 494.1 | 522.3 |
| REG15 | 603.6 | 585.3 | 605.1 |
| REG16 | 111.4 | 111.0 | 111.5 |
| REG17 | 260.3 | 254.4 | 260.4 |
| REG18 | 592.5 | 577.4 | 594.9 |
| REG19 | 258.5 | 252.8 | 259.4 |
| REG20 | 202.9 | 199.0 | 203.8 |
| REG21 | 367.5 | 360.5 | 370.0 |

NOTES:
1. All acreage values in thousand.

TABLE A-4

IRRIGATED ACREAGE IN PERCENT INFLOW ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 26.6 | 26.3 | 26.6 |
| REG2 | 195.0 | 193.6 | 194.7 |
| REG3 | 293.8 | 289.6 | 294.6 |
| REG3B | 87.6 | 80.3 | 87.8 |
| REG4 | 275.6 | 274.1 | 276.2 |
| REG5 | 364.1 | 362.6 | 365.2 |
| REG6 | 280.1 | 278.4 | 280.3 |
| REG7 | 91.5 | 90.7 | 91.5 |
| REG8 | 284.5 | 282.6 | 284.6 |
| REG9 | 424.8 | 419.3 | 425.6 |
| REG10 | 430.0 | 428.5 | 430.5 |
| REG11 | 174.2 | 174.0 | 174.4 |
| REG12 | 200.7 | 200.0 | 199.9 |
| REG13 | 534.6 | 532.6 | 535.3 |
| REG14 | 525.3 | 512.4 | 524.9 |
| REG15 | 603.6 | 585.2 | 605.1 |
| REG16 | 111.4 | 110.7 | 111.5 |
| REG17 | 260.2 | 254.4 | 260.4 |
| REG18 | 592.5 | 577.1 | 594.8 |
| REG19 | 258.5 | 252.6 | 259.4 |
| REG20 | 202.9 | 199.1 | 203.9 |
| REG21 | 368.2 | 361.5 | 368.9 |

NOTES:
1. All acreage values in thousand.

TABLE A-5

IRRIGATED ACREAGE IN FLOW EVALUATION ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 26.6 | 26.3 | 26.6 |
| REG2 | 195.0 | 193.6 | 194.7 |
| REG3 | 293.6 | 289.5 | 294.4 |
| REG3B | 87.5 | 80.4 | 87.8 |
| REG4 | 275.6 | 274.1 | 276.1 |
| REG5 | 364.1 | 362.6 | 365.2 |
| REG6 | 280.1 | 278.4 | 280.4 |
| REG7 | 91.5 | 90.7 | 91.5 |
| REG8 | 284.5 | 282.6 | 284.6 |
| REG9 | 424.8 | 418.6 | 425.6 |
| REG10 | 429.9 | 428.2 | 430.5 |
| REG11 | 174.2 | 174.0 | 174.4 |
| REG12 | 200.7 | 200.0 | 199.9 |
| REG13 | 534.6 | 532.6 | 535.3 |
| REG14 | 525.4 | 512.0 | 524.8 |
| REG15 | 603.5 | 584.7 | 605.1 |
| REG16 | 111.4 | 110.7 | 111.5 |
| REG17 | 260.2 | 254.4 | 260.4 |
| REG18 | 592.5 | 577.1 | 594.8 |
| REG19 | 258.5 | 251.8 | 259.4 |
| REG20 | 202.9 | 198.8 | 203.9 |
| REG21 | 368.1 | 360.8 | 370.7 |

NOTES:
1. All acreage values in thousand.

TABLE A-6

GROSS REVENUE IN THE NO-ACTION ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 9,619 | 9,590 | 9,603 |
| REG2 | 217,973 | 217,684 | 217,876 |
| REG3 | 346,512 | 343,541 | 347,114 |
| REG3B | 78,139 | 74,002 | 78,269 |
| REG4 | 300,045 | 299,272 | 300,418 |
| REG5 | 367,997 | 367,206 | 368,838 |
| REG6 | 253,324 | 252,782 | 253,418 |
| REG7 | 71,763 | 71,327 | 71,775 |
| REG8 | 344,852 | 344,401 | 344,890 |
| REG9 | 490,816 | 488,747 | 491,131 |
| REG10 | 1,170,110 | 1,169,315 | 1,170,600 |
| REG11 | 238,865 | 238,926 | 238,943 |
| REG12 | 265,827 | 265,578 | 265,426 |
| REG13 | 818,771 | 817,853 | 819,238 |
| REG14 | 1,474,287 | 1,457,682 | 1,473,157 |
| REG15 | 789,278 | 772,392 | 790,631 |
| REG16 | 257,960 | 257,577 | 258,016 |
| REG17 | 650,715 | 645,558 | 650,814 |
| REG18 | 1,120,436 | 1,106,458 | 1,122,523 |
| REG19 | 503,855 | 497,868 | 504,783 |
| REG20 | 694,705 | 690,420 | 695,768 |
| REG21 | 1,215,985 | 1,208,712 | 1,216,724 |

NOTES:
1. All values in thousand dollars.

TABLE A-7

GROSS REVENUE IN STATE PERMIT ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 9,620 | 9,583 | 9,609 |
| REG2 | 217,973 | 217,663 | 217,877 |
| REG3 | 346,650 | 343,641 | 347,235 |
| REG3B | 78,174 | 77,818 | 78,286 |
| REG4 | 300,043 | 299,193 | 300,424 |
| REG5 | 367,985 | 367,154 | 368,829 |
| REG6 | 253,318 | 252,898 | 253,383 |
| REG7 | 71,764 | 71,311 | 71,777 |
| REG8 | 344,847 | 344,341 | 344,891 |
| REG9 | 490,844 | 489,227 | 491,160 |
| REG10 | 1,170,346 | 1,169,497 | 1,170,329 |
| REG11 | 238,862 | 238,891 | 238,943 |
| REG12 | 265,821 | 265,541 | 265,428 |
| REG13 | 818,762 | 817,712 | 819,244 |
| REG14 | 1,475,077 | 1,471,423 | 1,472,468 |
| REG15 | 789,253 | 771,814 | 790,646 |
| REG16 | 257,959 | 257,570 | 258,016 |
| REG17 | 650,711 | 645,604 | 650,812 |
| REG18 | 1,120,420 | 1,106,363 | 1,122,537 |
| REG19 | 503,835 | 496,813 | 504,784 |
| REG20 | 694,743 | 690,690 | 695,657 |
| REG21 | 1,216,002 | 1,210,289 | 1,216,749 |

NOTES:
1. All values in thousand dollars.

TABLE A-8

GROSS REVENUE IN MAXIMUM FLOW ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 9,625 | 9,591 | 9,621 |
| REG2 | 217,959 | 217,663 | 217,859 |
| REG3 | 344,333 | 341,326 | 345,105 |
| REG3B | 76,715 | 76,324 | 76,976 |
| REG4 | 300,090 | 299,180 | 300,290 |
| REG5 | 368,647 | 367,537 | 369,206 |
| REG6 | 253,688 | 253,848 | 254,015 |
| REG7 | 71,780 | 71,336 | 71,790 |
| REG8 | 344,901 | 344,455 | 344,918 |
| REG9 | 490,874 | 488,254 | 491,174 |
| REG10 | 1,169,620 | 1,168,584 | 1,170,339 |
| REG11 | 238,900 | 238,948 | 238,968 |
| REG12 | 265,860 | 265,603 | 265,456 |
| REG13 | 818,060 | 817,204 | 818,458 |
| REG14 | 1,464,844 | 1,433,985 | 1,470,016 |
| REG15 | 789,497 | 772,762 | 790,690 |
| REG16 | 257,980 | 257,766 | 258,030 |
| REG17 | 650,748 | 645,656 | 650,837 |
| REG18 | 1,120,597 | 1,107,036 | 1,122,626 |
| REG19 | 503,910 | 498,240 | 504,784 |
| REG20 | 694,661 | 690,351 | 695,731 |
| REG21 | 1,215,324 | 1,207,715 | 1,218,084 |

NOTES:
1. All values in thousand dollars.

TABLE A-9

GROSS REVENUE IN PERCENT INFLOW ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 9,620 | 9,590 | 9,609 |
| REG2 | 217,973 | 217,684 | 217,876 |
| REG3 | 346,448 | 343,475 | 347,060 |
| REG3B | 78,125 | 74,057 | 78,263 |
| REG4 | 300,040 | 299,266 | 300,413 |
| REG5 | 367,995 | 367,204 | 368,837 |
| REG6 | 253,317 | 252,802 | 253,429 |
| REG7 | 71,765 | 71,328 | 71,777 |
| REG8 | 344,853 | 344,400 | 344,889 |
| REG9 | 490,830 | 488,799 | 491,146 |
| REG10 | 1,170,110 | 1,169,309 | 1,170,597 |
| REG11 | 238,865 | 238,925 | 238,943 |
| REG12 | 265,826 | 265,576 | 265,430 |
| REG13 | 818,774 | 817,851 | 819,238 |
| REG14 | 1,474,084 | 1,457,868 | 1,473,326 |
| REG15 | 789,280 | 772,414 | 790,626 |
| REG16 | 257,961 | 257,580 | 258,016 |
| REG17 | 650,713 | 645,616 | 650,812 |
| REG18 | 1,120,430 | 1,106,488 | 1,122,527 |
| REG19 | 503,843 | 497,903 | 504,773 |
| REG20 | 694,705 | 690,422 | 695,767 |
| REG21 | 1,215,984 | 1,208,697 | 1,216,720 |

NOTES:
1. All values in thousand dollars.

TABLE A-10

GROSS REVENUE IN FLOW EVALUATION ALTERNATIVE

| CVPM Subregion | Average Year (1922-90) | Dry Year (1928-34) | Wet Year (1967-71) |
|---|---|---|---|
| REG1 | 9,620 | 9,591 | 9,609 |
| REG2 | 217,973 | 217,689 | 217,873 |
| REG3 | 346,311 | 343,347 | 346,940 |
| REG3B | 78,096 | 74,139 | 78,248 |
| REG4 | 300,011 | 299,239 | 300,386 |
| REG5 | 367,998 | 367,209 | 368,838 |
| REG6 | 253,306 | 252,823 | 253,440 |
| REG7 | 71,766 | 71,330 | 71,777 |
| REG8 | 344,854 | 344,409 | 344,886 |
| REG9 | 490,828 | 488,452 | 491,135 |
| REG10 | 1,170,069 | 1,169,091 | 1,170,563 |
| REG11 | 238,866 | 238,932 | 238,941 |
| REG12 | 265,827 | 265,585 | 265,428 |
| REG13 | 818,772 | 817,878 | 819,219 |
| REG14 | 1,474,211 | 1,457,424 | 1,473,213 |
| REG15 | 789,276 | 771,927 | 790,579 |
| REG16 | 257,961 | 257,583 | 258,014 |
| REG17 | 650,714 | 645,620 | 650,810 |
| REG18 | 1,120,441 | 1,106,529 | 1,122,519 |
| REG19 | 503,830 | 496,986 | 504,747 |
| REG20 | 694,689 | 690,066 | 695,772 |
| REG21 | 1,215,952 | 1,207,950 | 1,218,765 |

NOTES:
1. All values in thousand dollars.

## ATTACHMENT E2

## Summary of Literature Review

A literature review was conducted on the affect of water resources on property values. A considerable amount of research has been conducted on this topic. Unfortunately, most of the research has been oriented towards proving a relationship between the existence of the water body and property values. Generally speaking, the research has dealt with the impact on property values of flood plain location, water quality issues, reservoir existence, and proximity to the reservoir. The reservoir oriented studies have generally shown that reservoir availability does positively influence property values, and the effect diminishes with distance.

The hedonic price method (HPM) is perhaps the most common analytical approach for estimating the impacts of housing characteristics on property values. This approach attempts to discern a statistically significant price differential between properties affected and unaffected by a particular housing characteristic. Selling price is generally used as the dependent variable within a statistical regression. Water oriented explanatory variables have typically included the availability of a water body and/or the distance to a water body. As a result, most water based models constructed to date can answer such questions as: 1) does the water body affect property values?, 2) does the price effect vary by distance?, or 3) at what distance from the water body does the price effect taper off? These water based HPM applications typically do not include reservoir water levels or instream flows as explanatory variables, and therefore cannot answer the types of questions being posed in the EIS, namely what is the impact of fluctuations in reservoir water elevation and river instream flows on property values.

The primary objective of the reservoir literature search was to locate studies depicting changes in water levels on property values. The intent was to obtain a large enough series of studies from similar reservoirs such that a range of potential property value impacts could be estimated. Unfortunately, only four studies were found which even attempted to include water level variables within the analysis:

1) Knetsch, 1964 attempted to include both reservoir size and water level variables within the analysis, but dropped both due to insignificance.

2) Khatri-Chhetri and Hite, 1990 estimated two models as a function of reservoir level deviation. Both models indicated reservoir level deviation had a negative influence on selling price, however, the variable proved statistically significant in only one of the models. In the model with a significant variable, the authors justified model re-estimation after removing observations with extreme water level fluctuations which occurred in one particular year. Application of both linear and log-linear function forms resulted in statistically significant reservoir level variables. The log-linear function indicated that for every one foot decrease in water elevation, as compared to full pool, selling prices decline by approximately 3.1 percent.

3) Lansford and Jones recently published two hedonic price method articles based on models developed for Lakes Austin and Travis in Texas (Lansford and Jones, 1995 A & B). The models included variables reflecting average deviation in water level as compared to long term averages for the three months prior to date of sale. In the Lake Austin study, the variable proved insignificant. The authors speculate that insignificance was caused by lack of water level variation. In the Lake Travis study, the water level variable indicated a

significant, positive relationship. For a typical 2,200 square foot residence, 2000 feet from the reservoir, property values decline approximately $652 per foot as water elevations decline from the long term average. These results can vary substantially depending on housing and locational characteristics.

In addition to reviewing studies which attempted to deal with reservoir water level fluctuation, we also reviewed studies which addressed reservoir size. Some studies pooled property value impacts over a series of reservoirs and therefore were able to consider size of reservoir as an explanatory variable (e.g. David, 1968; Feather et al., 1992). These studies showed no significant impact of reservoir size on property values.

A great deal of care must go into application of property value modeling results from one site to another. Physical characteristics of the reservoir, site locational characteristics with respect to work, shopping, etc., lot and structure characteristics all can play an important role in determining market value and price. Unfortunately, only a few of these characteristics are normally incorporated into a model. Unless the unmodeled characteristics align between the modeled site and the site of application (study site), it is not recommended to apply results or models between sites.

In addition to cautions associated with transferring modeling results between sites on technical grounds, one must be aware of the potential for double counting of benefits between recreation and property value analyses. Given a sizable amount of the property value effect could be due to problems with recreational access, the analysis of recreation may duplicate much of the impacts reflected in the property value analysis.

Given the problems associated with trying to transfer results from one site to another in combination with the lack of appropriate studies, the decision was made not to pursue a quantitative analysis. Alternatively, a ranking of the alternatives will be presented for each reservoir based on both a short-term and long-term perspective.

ATTACHMENT E3

**Flood Damage Assessment of Proposed Trinity River Fish and Wildlife Restoration Flow Alternatives**

# FLOOD DAMAGE ASSESSMENT OF PROPOSED TRINITY RIVER FISH AND WILDLIFE RESTRORATION FLOW ALTERNATIVES

**Prepared for:**

**Trinity County Planning Department**
**Under Agreement No. TFG 97-04**

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**September 1999**

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## 1.0 INTRODUCTION

This report presents the methods and results of an analysis that evaluates flooding impacts associated with proposed Trinity River EIS/EIR flow alternatives. The main purpose of this investigation was to evaluate the relative differences in potential flood damages associated between each of the proposed Trinity EIS/EIR flow alternatives. Results of this analysis include a summary of damages sustained during a suite of peak flow events (e.g. 10-, 50-, and 100-year floods) at several locations along the Trinity River for each of the flow alternatives. This study draws heavily on the assumptions and results presented in the California Department of Water Resource's (DWR) report entitled, "Trinity River Damage Assessment, Lewiston to Douglas City" (Technical Information Record ND-97-3, May 1997). The results of this analysis, presented below, clearly show the differences in damages between each of the proposed Trinity River EIS/EIR flow alternatives under existing levels of flood protection.

## 2.0 APPROACH

The approach to this analysis was to develop flood-damage probability curves for each of the core Trinity River EIS/EIR flow alternatives at locations along the upper Trinity River. Trinity River EIS/EIR flow alternatives included in this analysis were the No Action, Flow Evaluation Study, Percent Inflow, Maximum Flow, and State Permit Alternatives. The river locations for which flood-damage probability curves were developed are consistent with those studied in the DWR's Damage Assessment report and include (from upstream to downstream): Lewiston; Salt Flat; Bucktail; Poker Bar; Steel Bridge; and Douglas City. A cumulative flood-damage probability curve, summarizing damage estimates for floods at each river location along the upper reach of the Trinity River (Lewiston to Douglas City) was also prepared.

Flood-damage probability curves were developed in the following manner:

1. Develop flood-frequency curves for each of the Trinity River EIS/EIR flow alternatives at each river location.

2. Generate flow-damage curves for each river location from Tables 2 through 8 presented in the DWR's Damage Assessment report.

3. Combine the flow-damage curves and flood-frequency curves into flood-damage probability curves for each flow alternative at each river location.

4. Combine the flood-damage probability curves for each river location into a single cumulative flood-damage probability curve, representative of the upper river between Lewiston and Douglas City.

The specific methods, assumptions, and data used to carry out these steps are presented in detail below.

## 3.0 METHODOLOGY AND RESULTS

As part of this study, there were two approaches used to generate flood frequency curves for the flow alternatives. The No Action, State Permit, Maximum Flow, and Flow Evaluation Study alternative release schedules are all heavily controlled by project operations. Thus, flood frequency analyses for these alternatives rely on the proposed release schedules and corresponding water year-type frequencies. In contrast, the Percent Inflow alternative release schedule is based more closely on a natural or unimpaired flow pattern. Thus, a more standard flood frequency analysis was completed for this alternative based on historical unimpaired flow data.

It is also important to point out here that each alternative has a specific operational constraints over the maximum release that can be made from Lewiston Dam to the Trinity River. These constraints are as follows:

- The maximum peak flow release to the Trinity River under the No Action alternative is 8500 cfs;
- The maximum peak flow release to the Trinity River under the Flow Evaluation Study alternative is 11,000 cfs;
- The maximum peak flow release to the Trinity River under the Percent Inflow alternative is 11,000 cfs; and
- The maximum peak flow release to the Trinity River under the Maximum Flow alternative is 30,000 cfs.

### 3.1 Flood-Frequency Curves: No Action, State Permit, Maximum Flow and Flow Evaluation Study Alternatives

Each Trinity River EIS/EIR flow alternative has five different water year-type release/diversion patterns. Selected water year-types for each of the Trinity River EIS/EIR flow alternatives are based on the probability of exceedence ranges presented in Table 1.

**TABLE 1: Trinity River EIS/EIR Flow Alternative Water-Year Types and Associated Probability of Exceedence Ranges**

| Water-year Type | Probability Exceedence Range | Average Probability of Exceedence |
|---|---|---|
| extremely wet | <12% | 6% |
| wet | 12%-40% | 26% |
| normal | 40%-60% | 50% |
| dry | 60%-88% | 74% |
| critically dry | >88% | 94% |

Flood-frequency curves for the No Action, State Permit, Maximum Flow, and Flow Evaluation Study alternatives were developed using average probability of exceedence values for representative year-types as plotting positions; 6% for the extremely wet year, 26% for the wet year, 50% for the average year, 74% for the dry year, and 94% for the critically dry year-type (see Table 1). Annual peak flows at Lewiston by representative year-type under each of the proposed Trinity River EIS/EIR flow alternatives are presented in Table 2. According to the prescribed Trinity River EIS/EIR flow alternative release schedules, all annual peak flows are expected to occur during the month of May.

**TABLE 2: Flood-Frequency Data for the Lewiston River Location**

| Year-Type | Probability of Exceedence | No Action (cfs) | Flow Evaluation Study (cfs) | Maximum Flow (cfs) | State Permit (cfs) |
|---|---|---|---|---|---|
| Ex. Wet | 6% | 5413 | 11,000 | 30,000 | 250 |
| Wet | 26% | 2000 | 8500 | 6785 | 250 |
| Average | 50% | 2000 | 6000 | 5429 | 250 |
| Dry | 74% | 2000 | 4500 | 3800 | 250 |
| Crit. Dry | 94% | 2000 | 1500 | 2000 | 250 |

Note: DWR indicates that the current FEMA 100-year (1% probability of exceedence) flow at Lewiston is 8500 cfs. This data was also included in the flood frequency analysis for the No Action Alternative at Lewiston.

While completing the flood-frequency analysis at Lewiston, probabilities were converted to reduced variates and distributions of reduced variate versus both normal and log-normal peak flow values were evaluated for the "best-fit" to a linear relationship. Linear "best-fit" equations were then used to estimate the peak flow rates for the 1%, 2%, 10%, 20%, and 50% probability events (the 100-, 50-, 10- 5-, and 2-year flows, respectively) for each Trinity River EIS/EIR flow alternative at Lewiston. Estimates of peak flows at Lewiston are presented in Table 3. Again, peak flows (especially for low frequency events) never exceed the operational maximum release rate from Lewiston Dam discussed above.

In order to estimate the peak flows at successive downstream locations, tributary accretions for corresponding peak flows were added, first, to the peak flow estimates made at Lewiston, and then in succession, to each downstream location. Important assumptions related to estimating tributary accretions for the No Action, State Permit, Flow Evaluation Study, and Maximum Flow alternatives include:

- Accretions from Rush Creek are assumed to be equal to those from Grass Valley Creek while peak flows from Indian Creek were assumed to be one-half of those from Grass Valley Creek (tributary flow relationships are consistent with those used in DWR's Damage Assessment report).

- Because all annual flow alternative peak flows are scheduled to occur during the month of May, flood frequency analyses of tributaries were completed on historic peak flows that occurred during the month of May.

- Tributary peak flows occurring in May will coincide with annual peak flows on the mainstem Trinity River.

A flood frequency curve was developed for Grass Valley Creek using the log-Pearson Type III distribution and peak flow values for the Month of May during the period 1976 through 1996. Flood frequency study methods were consistent with, "the Guidelines for Determining Flood Flow Frequency", Bulletin 17-B of the Hydrology Committee of the Water Resources Council, 1982. Some peak flow estimates were derived from mean daily flows (MDQ) for periods of missing (peak flow) record using available peak flow to MDQ relationships. Selected peak flow estimates for Grass Valley Creek during the month of May are presented below in Table 4.

**TABLE 4: Selected Peak Flow Estimates for Grass Valley Creek for the Month of May**

| Probability of Exceedence | Peak Flow Event | Estimated Flow (cfs) |
|---|---|---|
| 1% | 100-year event | 1181 |
| 2% | 50-year event | 775 |
| 10% | 10-year event | 275 |
| 20% | 5-year event | 169 |
| 50% | 2-year event | 80 |

Peak flow estimates for stations downstream of Lewiston were calculated by adding tributary accretions to estimates of the corresponding 1%, 2%, 10%, 20%, and 50% peak flows at stations immediately upstream of each tributary. Flood-frequency curves were then generated for each Trinity River EIS/EIR alternative at every location downstream of Lewiston. Peak flow estimates for selected flood events at each river location are also presented in Table 3. For comparison, the current FEMA estimated 100-year flow at each river location is also presented in Table 3.

### 3.2 Flood-Frequency Curves: Percent Inflow Alternative

Peak flow estimates for the Percent Inflow alternative reflect natural flood releases from Trinity and Lewiston Lakes and peak flow accretions from Rush, Grass Valley, and Indian Creeks. Some of the assumptions that went into estimating these peak flow values include: 40% of the total annual peak flow rate would be released from Lewiston Lake to the River (again, with an 11,000 cfs cap); annual tributary peak flows coincide (are sychronized) with peak flows on the mainstem Trinity River[1]; floods of a given recurrence occur on each of the subject watersheds occur during the same event and; the only peak flow accretions to the mainstem Trinity River come from Rush, Grass Valley, and Indian Creeks. All other assumptions remain as stated above.

To estimate peak flow values of a given recurrence on the Trinity River under the Percent Inflow alternative, a flood frequency analysis was performed on the unimpaired annual peak flow record for the Lewiston gage (1912 through 1960). Estimating peak flow values for corresponding recurrence intervals on Grass Valley Creek was completed by flood frequency analysis on the 1976 through 1998 annual peak flow record for the Fawn Lodge gage. Flood frequency analyses were completed using the log-Pearson Type III distribution and annual peak flow values. Again, flood frequency study methods were consistent with, "the Guidelines for Determining Flood Flow Frequency", Bulletin 17-B of the Hydrology Committee of the Water Resources Council, 1982. Selected annual peak flow estimates for The Trinity River at Lewiston and Grass Valley Creek are presented below in Table 5.

[1] Other investigators have indicated that tributary floods and high flow releases to the Trinity River do not usually have similar timing. As a conservative assumption to this investigation, I am assuming that flood releases from Lewiston Lake would be in sync with tributary flood flows.

**TABLE 5: Selected Annual Peak Flow Estimates for the Trinity River and Grass Valley Creek**

| Probability of Exceedence | Peak Flow Event | Estimated Flow Trinity R. @ Lewiston (cfs) | 40% of Flow Trinity R. @ Lewiston (cfs) | Estimated Flow Grass Valley Creek (cfs) |
|---|---|---|---|---|
| 1% | 100-year event | 72,620 | 29,048 | 6131 |
| 2% | 50-year event | 60,798 | 24,319 | 4951 |
| 10% | 10-year event | 36,311 | 14,524 | 2538 |
| 20% | 5-year event | 26,853 | 10,741 | 1650 |
| 50% | 2-year event | 14,828 | 5931 | 651 |

Peak flow estimates for stations downstream of Lewiston were calculated by adding tributary accretions to estimates of the corresponding 1%, 2%, 10%, 20%, and 50% peak flows at stations immediately upstream of each tributary. Flood-frequency curves were then regenerated at every location downstream of Lewiston. Peak flow estimates pursuant to operational release constraints from Lewiston Dam are presented in Table 3.

### 3.3 Flow-Damage Curves

As indicated above, summaries of damages at each river location under a variety of peak flows were presented in DWR's Damage Assessment report. These data were used to develop flow-damage curves as part of this investigation. Some interpolation was exercised between known data points. Data used to generate flow-damage curves for each station are presented in Table 6.

### 3.4 Flood-Damage Probability Curves

Flow-damage curves and flood frequency curves were combined[2] to produce flood-damage probability curves for each Trinity River EIS/EIR flow alternative at each location (see Figures 1 through 6). A cumulative flood-damage probability curve (Figure 7) was also prepared by summing the damages at each river station by probability value. For comparison, the damage estimates associated with the current FEMA 100-year flood at each river location are plotted and labeled on Figures 1 through 6.

Some of the conclusions that can be drawn from the flood-damage probability curves include:

- None of the peak flows analyzed under the State Permit Alternative (100-year and less) reach values that will incur damage at any location between Lewiston and Douglas City (see maximum State Permit Alternative flows presented in Table 3 versus minimum damage flows presented in Table 5). Thus, no flood-damage probability curves are presented for the State Permit Alternative on Figures 1 through 7.

- None of the peak flows analyzed under the No Action, Flow Evaluation Study, and Percent Inflow alternatives are high enough to incur damage at Lewiston. Only peak releases associated with the Maximum Flow alternative will cause damage near this location.

- As presented on each of the flood-damage probability curves, damages will occur more frequently under the Percent Inflow, Maximum Flow, and Flow Study alternatives than under the No Action

[2] The mathematical expressions of these curves (or segments of curves) were combined to derive an equation for each respective flood-damage probability curve.

Alternative. In fact, the cumulative flood-damage probability curve (Figure 7) suggests that damages will begin to be sustained along the upper Trinity River (at current levels of flood protection) under the Percent Inflow alternative at an exceedence probability around 70% (recurrence of about every 1 ½ years) and at exceedence probabilities between 40% and 50% under the Maximum Flow and Flow Study alternatives (equivalent to recurrence intervals of between 2 ½ and 2 years, respectively).

- Damages between Lewiston and Douglas City appear to be most severe under the Percent Inflow alternative, especially during less frequent (high magnitude) peak flows.

- Unless additional flood hazard reduction efforts are implemented along the upper Trinity River, $1,000,000 in damages may occur approximately every 60 years under the No Action alternative, every 7 years under the Flow Study alternative, every 3 ½ years under the Maximum Flow alternative, and less than every 3 years under the Percent Inflow alternative (see Figure 7).

## 4.0 LIMITATIONS

This study was completed solely in an effort to compare and contrast the likely damages associated with each of the proposed Trinity River EIS/EIR flow alternatives as part of the EIS/EIR alternative assessment process. Due to the limited availability and questionable validity of peak flow data for each of the proposed flow alternatives, flood-frequency analyses and results presented herein should be strictly limited to evaluating the relative differences in possible damages between proposed flow alternatives. These results should not be used to assist in planning, managing, mitigating, or designing flood control structures/practices on the Trinity River. Similarly, although based on professional judgement, there are numerous assumptions and limitations in this analysis that may introduce error to the peak flow estimates. Until better data is available and a consensus is reached over many of the methods and assumptions used in this analysis, these results should be considered preliminary and subject to revision. Some of the issues and questions identified during this analysis, which warrant further evaluation and/or discussion include:

- Discrepencies between current FEMA 100-year flow estimates and flood-frequency estimates for 100-year events based on peak flow estimates for Trinity River EIS/EIR flow alternatives. Intuitively, one would expect the No Action Alternative estimates to be consistent with current FEMA estimates. Much of this discrepancy, especially at river locations downstream of Lewiston, appears to be associated with much higher FEMA estimates for Grass Valley Creek accretions (annual peak flow of 6131cfs; see Table 5) than those estimated in this study (restricted to peak flow of 1181 cfs during the month of May; see Table 4).

- The peak flows associated with the Trinity River EIS/EIR flow alternatives are the highest flows proposed to be released for a one-week period. All of the peak releases for the No Action, State Permit, Flow Evaluation Study, and Maximum Flow alternatives are scheduled for the month of May and represent average weekly release rates. It is unclear how much variability there will be in operations and flow magnitude during peak release periods. There is also concern over how long-term wet periods may lead to unavoidable Safety-of-Dams releases, possibly during early parts of the year coincident with annual peak tributary flow.

- For the most part, this study is consistent with the DWR damage assessment report. Direct comparison of Table 2 ("Trinity River Discharges") in the DWR report to Table 3 of this study is probably not valid as it is unclear what flood event (flood probability) is represented by the flows in Table 2 of the DWR report.

- Tributary flow relationships between Rush/Indian Creeks and Grass Valley Creek were taken from the DWR's Damage Assessment report. No rigorous evaluation of these relationships was performed as part of this study.

## 5.0 REFERENCES CITED

Culp, J.E. and Mendenhall, W.D., 1997, Trinity River Damage Assessment, Lewiston to Douglas City. State of California, Department of Water Resources, Northern District, Technical Information Record ND-97-3, 23p.

United States Department of Interior, Geological Survey (USGS), 1982, Guidelines for determining flood flow frequency. Bulletin #17B of the Hydrology Subcommittee, Interagency Advisory Committee on Water Data.

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## TABLE 3: Peak Flow Estimates on the Trinity River Under Proposed Trinity River EIS/EIR Flow Alternatives
## (Lewiston to Douglas City, CA)

| Location | Tributary Accretion | Existing Peak Flow Event | FEMA Study Estimated Flow (cfs) | NO ACTION Estimated Flow (cfs) | FLOW EVALUATION Estimated Flow (cfs) | PERCENT INFLOW Estimated Flow (cfs) | MAXIMUM FLOW Estimated Flow (cfs) | STATE PERMIT Estimated Flow (cfs) |
|---|---|---|---|---|---|---|---|---|
| Lewiston | | 100-year | 8,500 | 8,500 | 11,000 | 11,000 | 30,000 | 250 |
| | | 50-year | | 7,289 | 11,000 | 11,000 | 30,000 | 250 |
| | | 10-year | | 4,139 | 10,316 | 11,000 | 18,423 | 250 |
| | | 5-year | | 2,709 | 8,486 | 10,741 | 11,128 | 250 |
| | | 2-year | | 2,000 | 5,722 | 5,931 | 5,197 | 250 |
| | Rush Creek | (see Table 4) | | | | | | |
| Salt Flat | | 100-year | 20,500 | 9,681 | 12,181 | 17,131 | 31,181 | 1,431 |
| | | 50-year | | 8,064 | 11,775 | 15,951 | 30,775 | 1,025 |
| | | 10-year | | 4,414 | 10,591 | 13,538 | 18,698 | 525 |
| | | 5-year | | 2,878 | 8,655 | 12,391 | 11,297 | 419 |
| | | 2-year | | 2,080 | 5,802 | 6,582 | 5,277 | 330 |
| Bucktail | | 100-year | 20,500 | 9,681 | 12,181 | 17,131 | 31,181 | 1,431 |
| | | 50-year | | 8,064 | 11,775 | 15,951 | 30,775 | 1,025 |
| | | 10-year | | 4,414 | 10,591 | 13,538 | 18,698 | 525 |
| | | 5-year | | 2,878 | 8,655 | 12,391 | 11,297 | 419 |
| | | 2-year | | 2,080 | 5,802 | 6,582 | 5,277 | 330 |
| | Grass Valley Cr. | (see Table 4) | | | | | | |
| Poker Bar | | 100-year | 32,500 | 10,862 | 13,362 | 23,262 | 32,362 | 2,612 |
| | | 50-year | | 8,839 | 12,550 | 20,902 | 31,550 | 1,800 |
| | | 10-year | | 4,689 | 10,866 | 16,076 | 18,973 | 800 |
| | | 5-year | | 3,047 | 8,824 | 14,041 | 11,466 | 588 |
| | | 2-year | | 2,160 | 5,882 | 7,233 | 5,357 | 410 |
| Steel Bridge | | 100-year | 32,500 | 10,862 | 13,362 | 23,262 | 32,362 | 2,612 |
| | | 50-year | | 8,839 | 12,550 | 20,902 | 31,550 | 1,800 |
| | | 10-year | | 4,689 | 10,866 | 16,076 | 18,973 | 800 |
| | | 5-year | | 3,047 | 8,824 | 14,041 | 11,466 | 588 |
| | | 2-year | | 2,160 | 5,882 | 7,233 | 5,357 | 410 |
| | Indian Creek | (1/2 of values presented in Table 4) | | | | | | |
| Douglas City | | 100-year | 38,500 | 11,453 | 13,953 | 26,328 | 32,953 | 3,203 |
| | | 50-year | | 9,227 | 12,938 | 23,378 | 31,938 | 2,188 |
| | | 10-year | | 4,827 | 11,004 | 17,345 | 19,111 | 938 |
| | | 5-year | | 3,132 | 8,909 | 14,866 | 11,550 | 673 |
| | | 2-year | | 2,200 | 5,922 | 7,559 | 5,397 | 450 |

Note: Source of FEMA Study data is DWR's report entitled, "Trinity River Damage Assessment, Lewiston to Douglas City", Technical Information Record ND-97-3, May 1997

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# TABLE 6: Summary of Estimated Damages Along the Upper Trinity River

| Location | Discharge (cfs) | Damage ($) |
|---|---|---|
| Lewiston | 14,000 | $0 |
| | 30,000 | $260,000 |
| | 71,600 | $2,850,000 |
| Salt Flat | 6,500 | $0 |
| | 9,000 | $900,000 |
| | 15,140 | $900,000 |
| | 20,500 | $1,900,000 |
| | 30,500 | $1,900,000 |
| | 75,740 | $2,440,000 |
| Bucktail | 6,500 | $1,000 |
| | 9,000 | $34,000 |
| | 11,500 | $53,000 |
| | 14,500 | $204,000 |
| | 20,500 | $2,920,000 |
| | 30,500 | $2,930,000 |
| | 75,740 | $2,930,000 |
| Poker Bar | 7,000 | $3,000 |
| | 15,000 | $48,500 |
| | 19,280 | $1,200,000 |
| | 31,000 | $5,400,000 |
| | 79,880 | $7,900,000 |
| Steel Bridge | 7,000 | $0 |
| | 9,500 | $0 |
| | 12,000 | $500,000 |
| | 19,280 | $650,000 |
| | 31,000 | $1,800,000 |
| | 32,500 | $2,000,000 |
| | 79,880 | $5,000,000 |
| Douglas City | 7,250 | $0 |
| | 9,750 | $80,000 |
| | 21,350 | $220,000 |
| | 31,250 | $1,700,000 |
| | 38,500 | $2,300,000 |
| | 81,950 | $3,100,000 |

Source of Information:

DWR's report entitled, "Trinity River Damage Assessment, Lewiston to Douglas Technical Information, Record ND-97-3, May 1997

**FIGURE 1** ***DRAFT***

## Flood Damage Probability Curves at Lewiston Dam (for Proposed Trinity River Flow Alternatives)

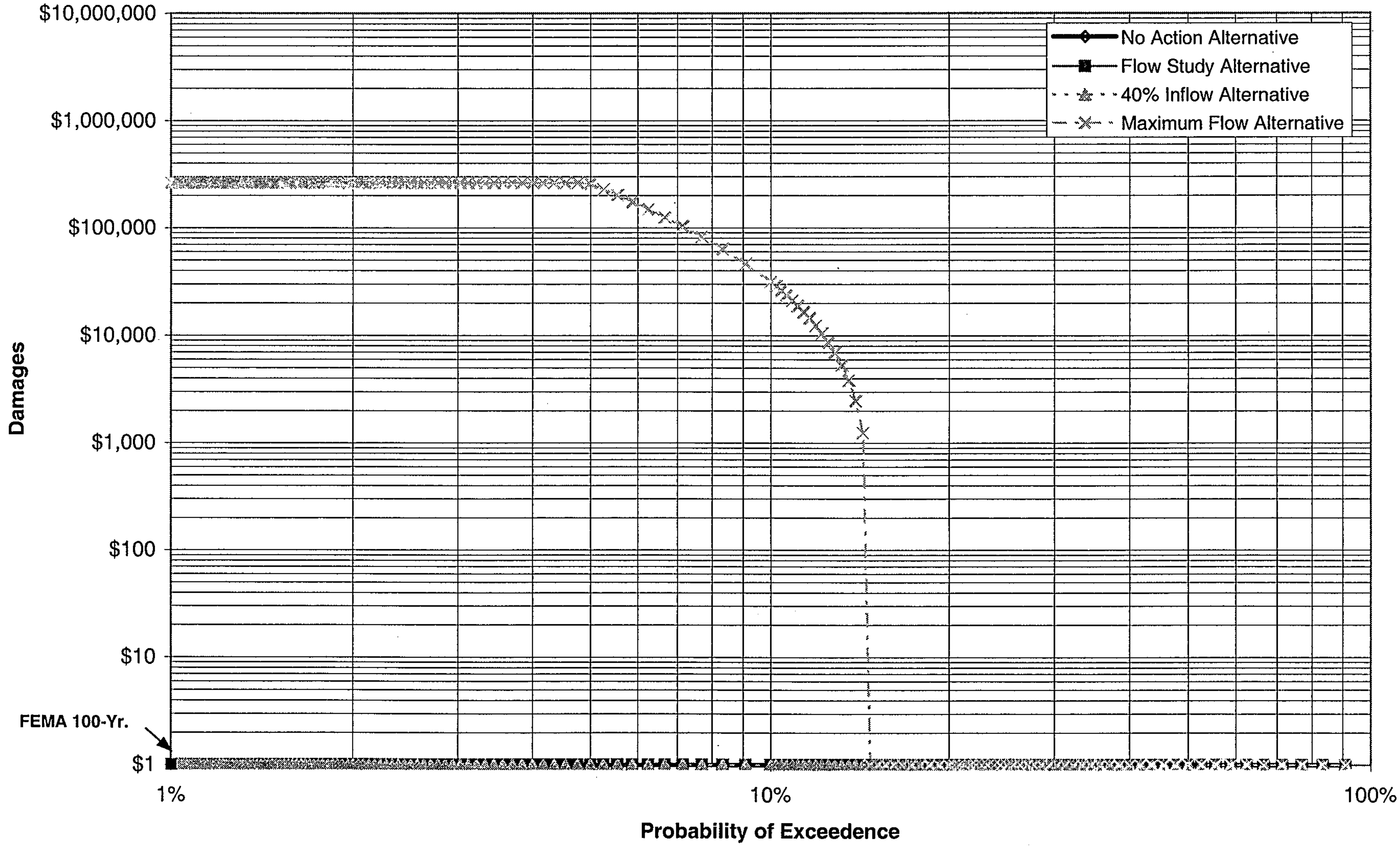


Fig 1.xls:@L

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C-093058

**FIGURE 2** ***DRAFT***

## Flood Damage Probability Curves at Salt Flat (for Proposed Trinity River Flow Alternatives)

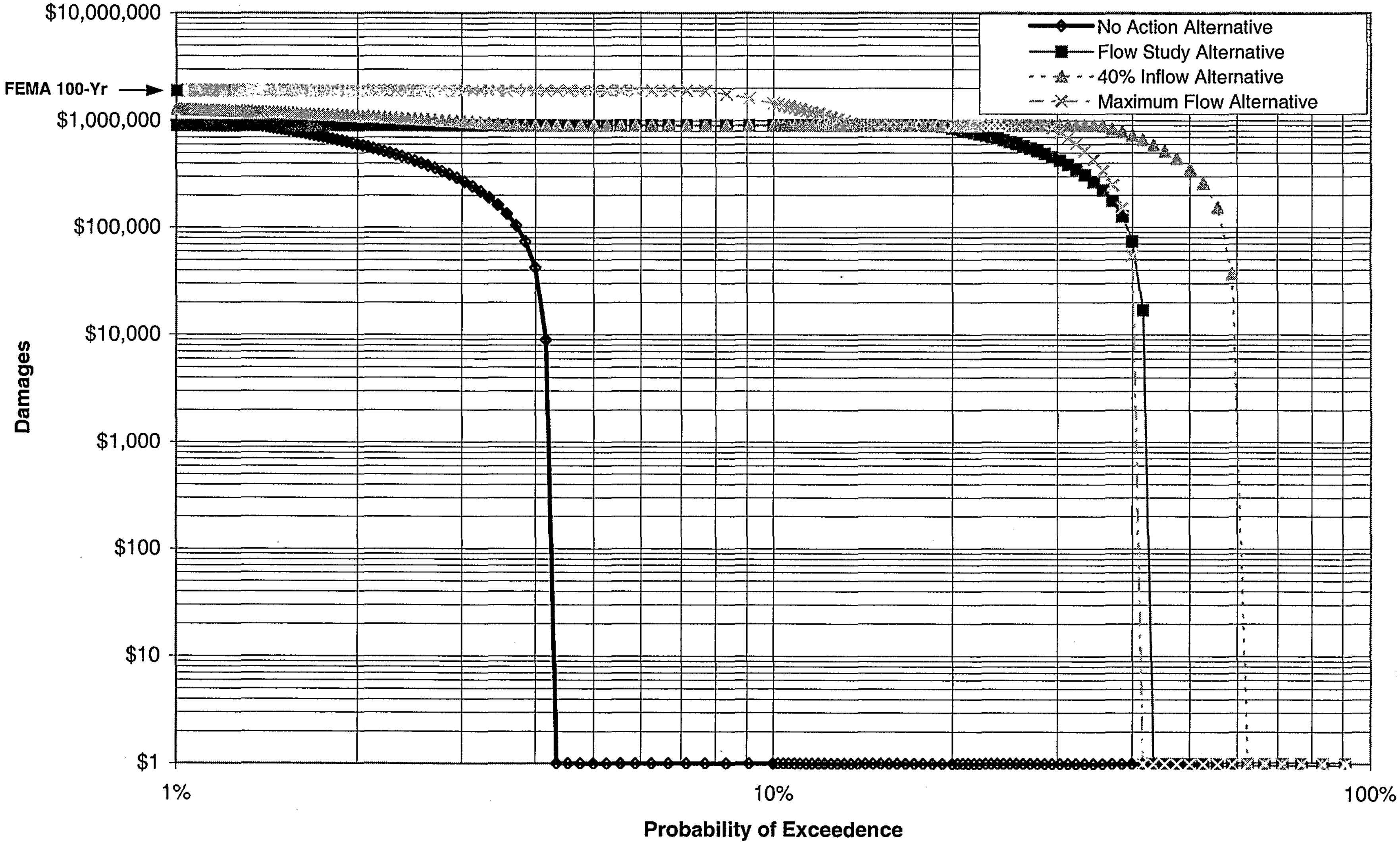


Fig 2.xls

Kamman Hydrology 09/24/1999

C — 0 9 3 0 5 9

**FIGURE 3** ***DRAFT***

## Flood Damage Probability Curves at Buck Tail (for Proposed Trinity River Flow Alternatives)

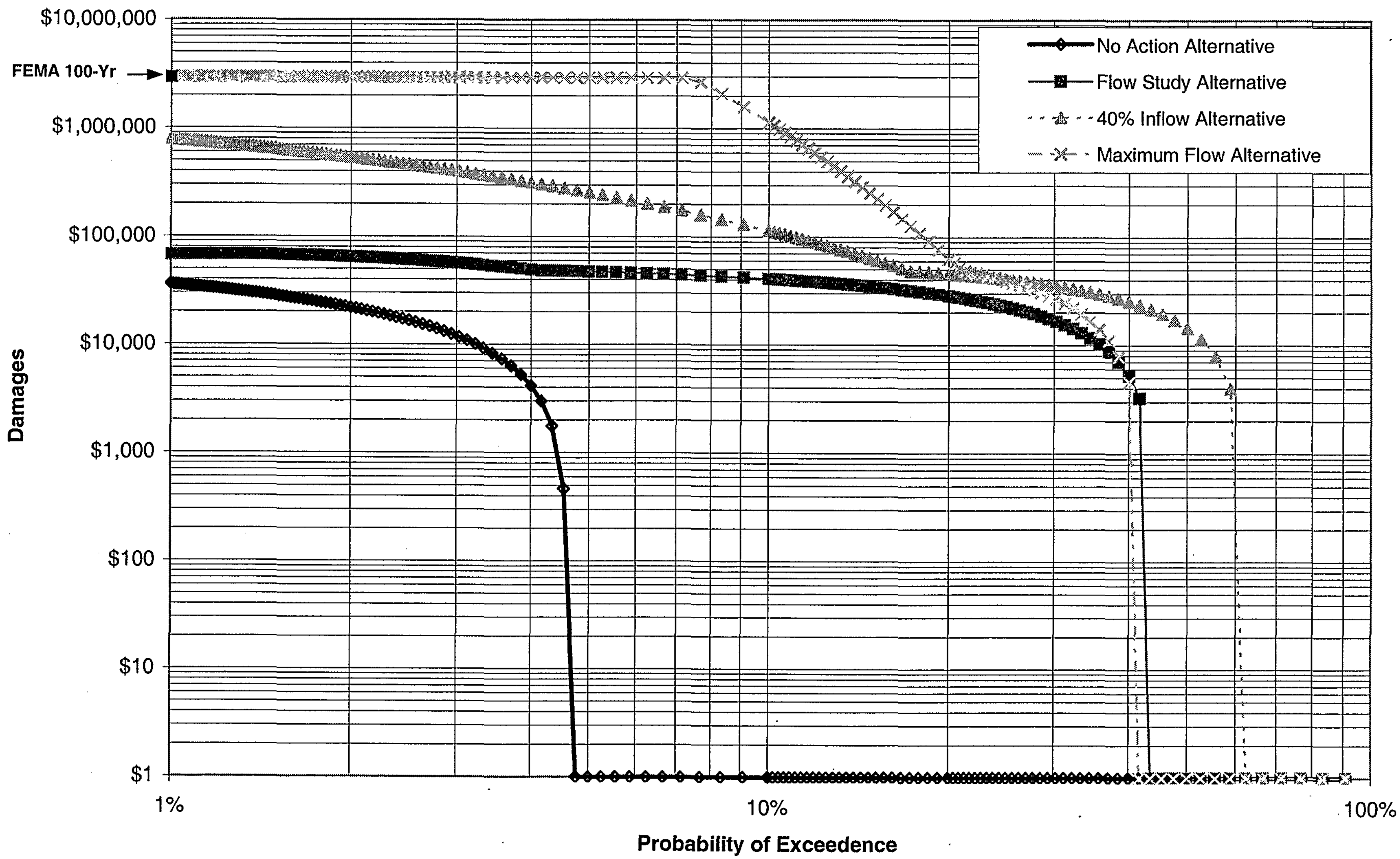


Fig 3.xls

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C—093060

**DRAFT**

# FIGURE 4

## Flood Damage Probability Curves at Poker Bar (for Proposed Trinity River Flow Alternatives)

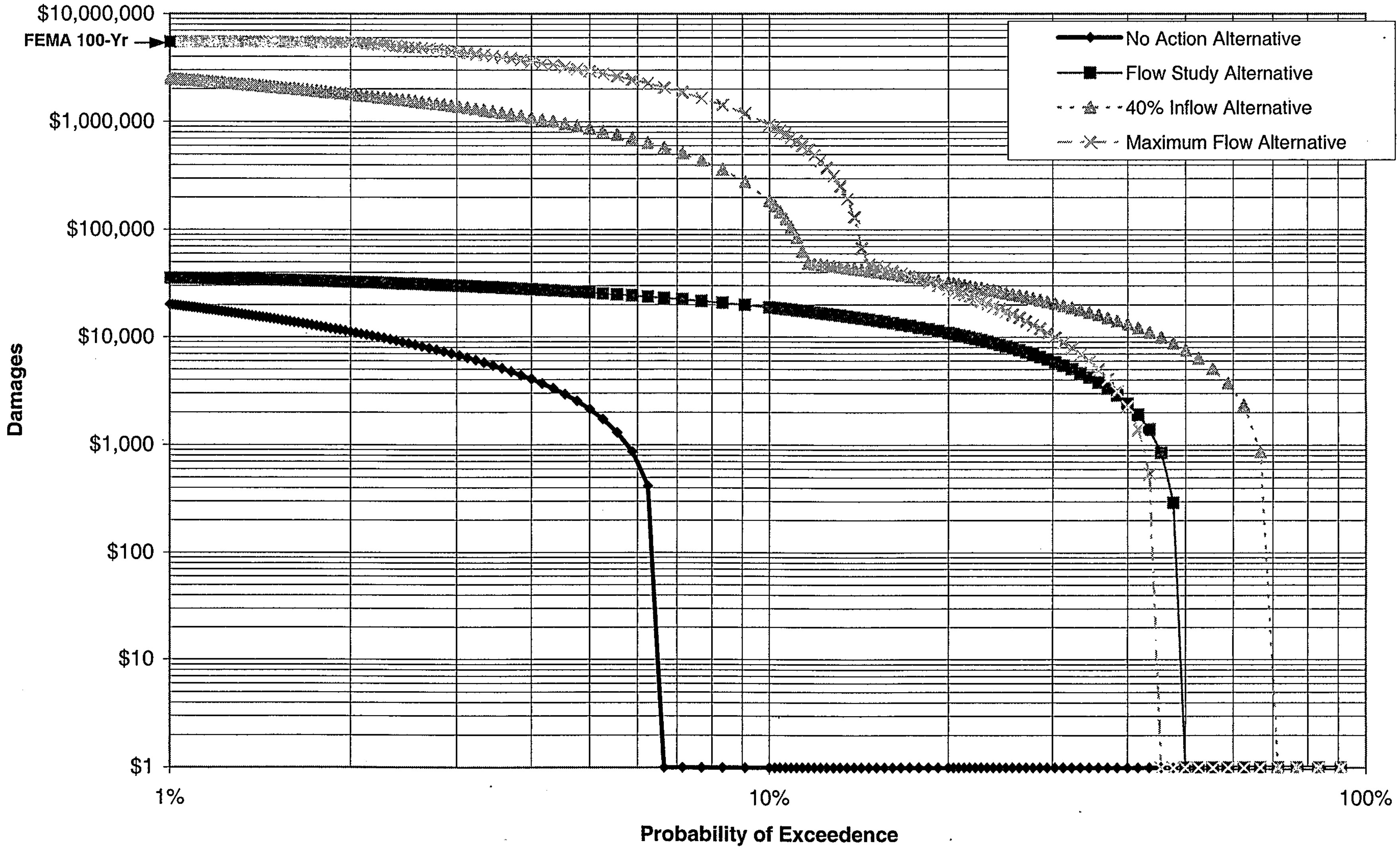


fig 4.xls

Kamman Hydrology 09/24/1999

C — 0 9 3 0 6 1

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FIGURE 5 **DRAFT**

## Flood Damage Probability Curves at Steel Bridge (for Proposed Trinity River Flow Alternatives)

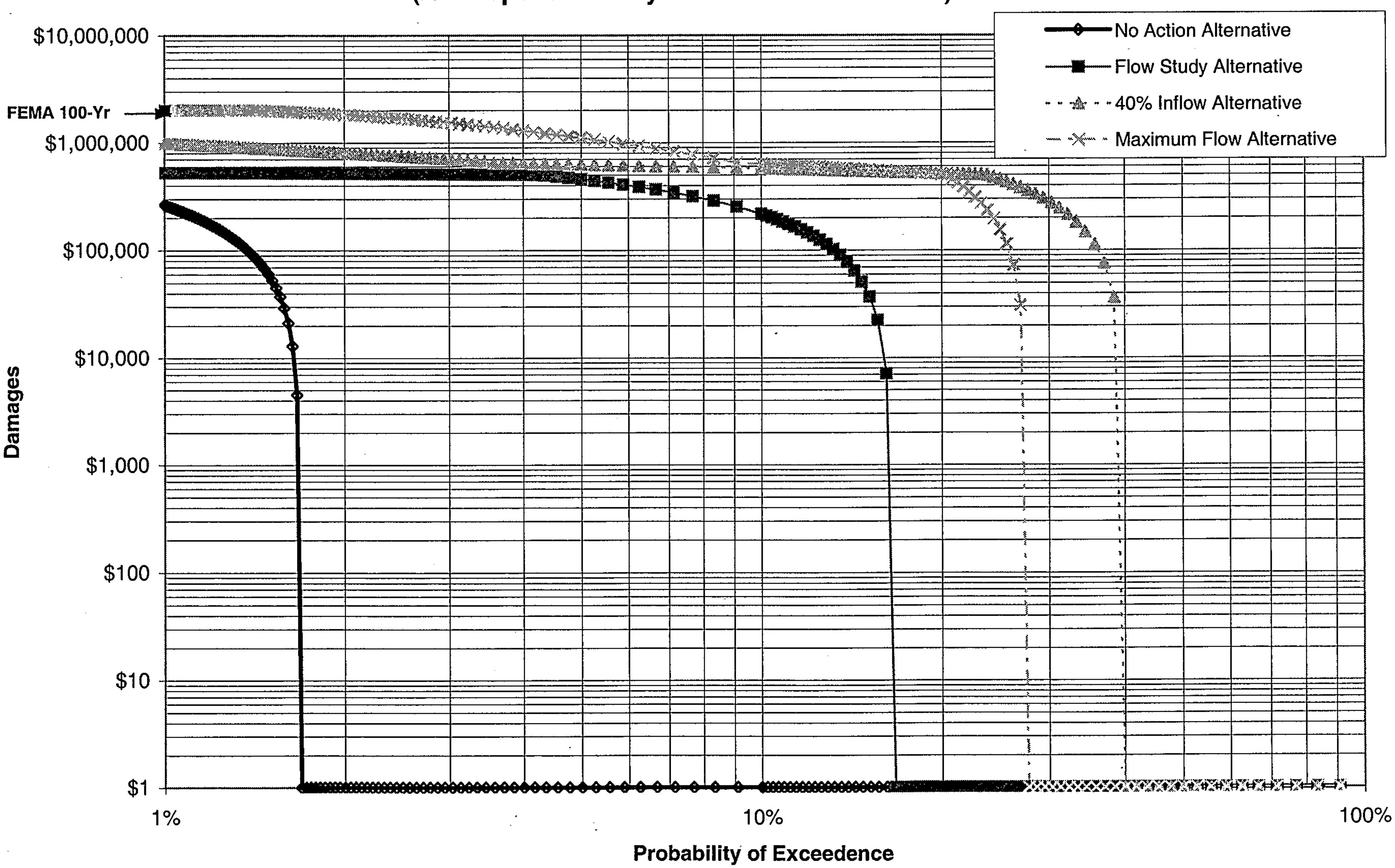


Fig 5.xls

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**FIGURE 6** ***DRAFT***

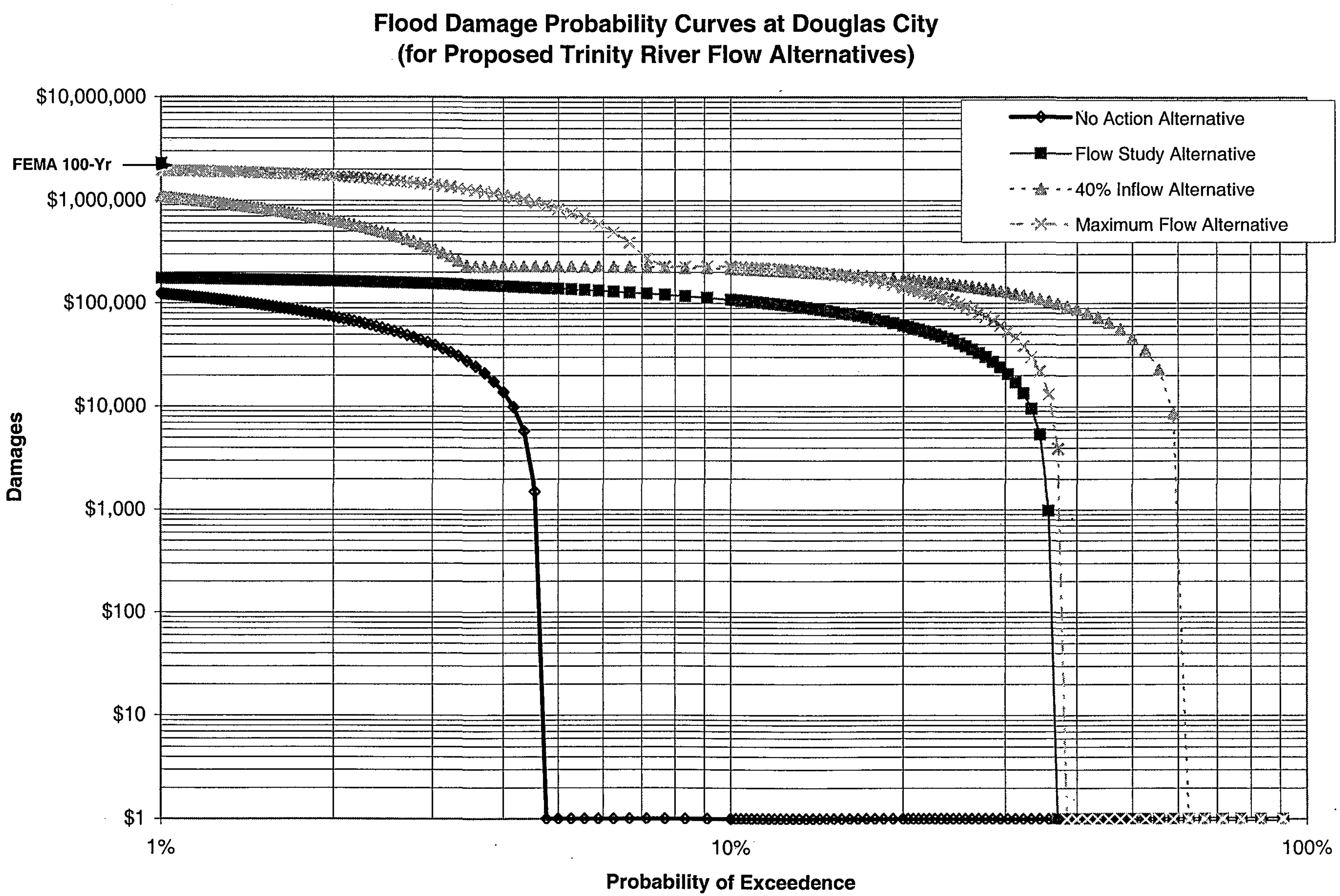


Fig 6.xls

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C —0 9 3 0 6 3

# FIGURE 7

***DRAFT***



## Cumulative Flood-Damage Probability Curves from Lewiston to Douglas City
## (for Proposed Trinity River Flow Alternatives)

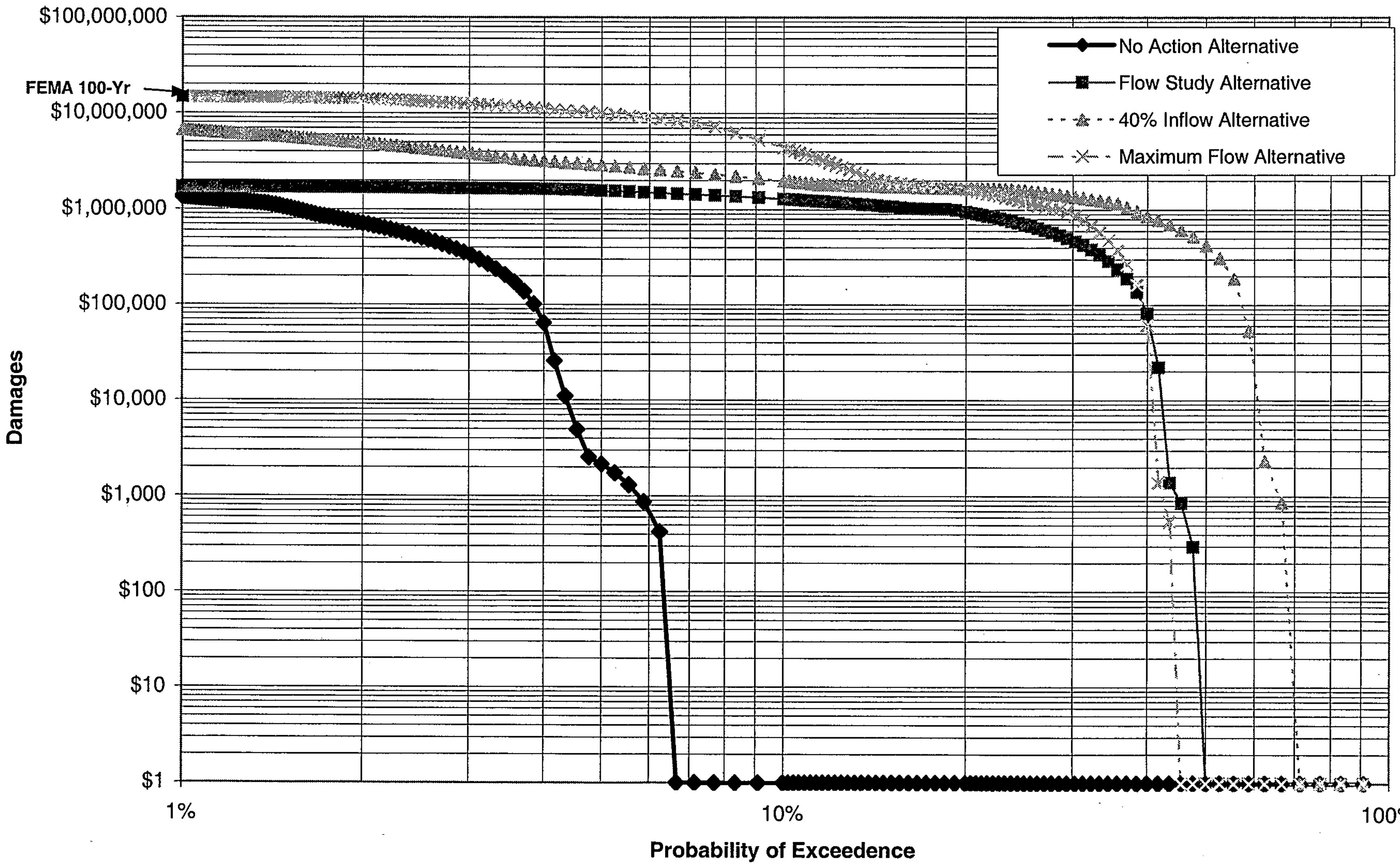




Fig 7.xls

Kamman Hydrology 09/24/1999