# Chapter 3 Physical Environment

This chapter provides the results of the assessment of potential effects on physical resources. Each resource area addressed includes a discussion of existing conditions, assessment methods, environmental consequences, and applicable mitigation measures. This chapter is organized as follows:

- Section 3.1, *Water Supply and Delta Water Management*;
- Section 3.2, *Delta Tidal Hydraulics*;
- Section 3.3, *Delta Water Quality*;
- Section 3.4, *Geology and Soils*;
- Section 3.5, *Transportation*;
- Section 3.6, *Air Quality*;
- Section 3.7, *Noise*; and
- Section 3.8, *Climate Change*.

# 3.1 Water Supply and Delta Water Management

## 3.1.1 Introduction

This section describes Delta conditions related to water supply (the amount of water available for beneficial uses) and the possible effects of the Intertie on water supply conditions. Beneficial uses of Delta water include in-Delta use (e.g., agricultural, municipal) by other water-right holders, maintenance of fish and wildlife habitat, and export to CVP and SWP contractors. Water supply changes for the CVP are small but are one of the project purposes. Water supply impacts on SWP or other water users are not anticipated. The water supply changes likely to result from the project alternatives are fully disclosed in this section.

The water supply evaluation of the Intertie relies on the DWR and Reclamation joint planning model—CALSIM II, which is a general-purpose reservoir simulation model of the combined CVP/SWP systems, as well as a host of smaller water supply entities with which the CVP/SWP systems interact. CALSIM II includes the Sacramento River basin, the San Joaquin River basin, and the Delta. All water supply evaluations of the Intertie used the CALSIM II model. Additional material summarized and used in this section can be found in Appendix B, "CALSIM II Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie."

The CALSIM II model recently has been modified for the simulations for the 2008 OCAP conditions, as described in the August 2008 version of the CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). The modeling for the Intertie project uses this most recent version of the model and is fully compatible with the OCAP assumptions and results for the CVP and SWP system operations under D-1641, the Central Valley Project Improvement Act (CVPIA), and the existing BOs for CVP and SWP facilities and operations. This section describes the CVP and SWP water supply changes resulting from the Intertie alternatives.

## 3.1.2 CALSIM Model Limitations

The CALSIM model is the primary tool used to simulate and evaluate changes in the CVP and SWP operations. As such, it has been used for this analysis. Although it comprises the best available information, it does not represent a fault-proof tool. DWR, Reclamation, and others continue to modify and improve the CALSIM model to more accurately reflect actual conditions. In general, the CALSIM model does provide a basis for comparison of alternatives to guide decision-makers regarding implementation of Proposed Actions. For simulating current conditions and evaluating potential future changes, it provides only monthly outputs (because it uses a monthly timestep), limiting its ability to identify day to day or other instantaneous changes in the system. For evaluations related to water supply or other resources which are generally managed and discussed over a span of time, CALSIM can provide all the information needed. But for resources such as fish, some short-term (i.e., daily or weekly) effects are not detectable by CALSIM.

CALSIM relies on measured historical hydrology conditions (i.e., runoff). With the changes expected over the next century related to climate change, it is speculative to assume that the 1922–2003 hydrological conditions are representative of future hydrological conditions. However, because the CALSIM model uses so many different years, it is assumed that most potential future runoff conditions are captured in the model simulation of the CVP and SWP operations.

### 3.1.3 Water Supply Regulatory Framework

#### *1978 Water Quality Control Plan and D-1485*

In 1978, the State Water Board adopted water right D-1485 and the Water Quality Control Plan (WQCP) for the Sacramento–San Joaquin Delta and Suisun Marsh (1978 Delta WQCP). D-1485 modified the Reclamation and DWR water right permits to require the CVP and the SWP to meet water quality standards specified in the 1978 Delta WQCP. The general goal of D-1485 standards was to protect Delta resources by maintaining them under conditions that would have occurred in the absence of CVP and SWP operations. D-1485 also required extensive monitoring and special studies of Delta aquatic resources. The D-1485 objectives included reduced pumping in May and June for fish protection. The CVP and SWP pumping were each limited to 3,000 cfs in May and June. The SWP pumping was limited to 4,600 cfs in July (which was the CVP design average monthly capacity). The D-1485 objectives are still relevant because the CVP and SWP operations under D-1485 are used as the baseline for evaluation and allocation of the CVPIA(b)(2) water dedicated to fish and wildlife enhancement.

#### *Water Quality Control Plan and D-1641*

Numerous parties hold rights to divert water from the Delta and upstream Delta tributaries. Various water quality and flow objectives have been established by the State Water Board to ensure that the quality of Delta water is sufficient to satisfy all designated uses; implementation of these objectives requires that limitations be placed on Delta water supply operations, particularly operations of the SWP and CVP, affecting amounts of fresh water and salinity levels in the Delta. The Proposed Action is modifying none of these protective measures.

The State Water Board's 1995 WQCP (adopted May 1995; State Water Resources Control Board 1995) incorporated several elements of the U.S. Environmental

Protection Agency (EPA), NMFS, and USFWS regulatory objectives for salinity and endangered species protection. The changes from D-1485 regulatory limits for CVP and SWP Delta operations are substantial. The State Water Board implemented the 1995 WQCP with D-1641 in 2000. The new provisions for X2 (i.e., the position of the 2 parts per thousand [ppt] salinity gradient), export/inflow (E/I) ratio, and the Vernalis Adaptive Management Program (VAMP) that are implemented in D-1641 are described in some detail because these are the basis for the baseline CVP and SWP operations assumed in CALSIM II. The WQCP was amended by the State Water Board in 2006, but the major Delta objectives were unchanged.

The limits on Banks and Jones Pumping Plant pumping are important to understanding Delta water management because these regulatory limits collectively restrict supply of full CVP and SWP demands for Delta exports. These regulatory limits may result from Delta outflow requirements, E/I limits, and permitted or physical export pumping capacity. The Intertie would not change any of these regulatory limits and therefore would not change the protections provided for water quality and fish in the Delta.

#### *Delta Outflow Requirements*

The minimum monthly Delta outflow objectives protect the salinity range for the estuarine aquatic habitat and are included in D-1641. The monthly minimum depends on the water-year type, which is calculated as the Sacramento Four-River Index from the unimpaired runoff of the Sacramento, Feather, Yuba, and American Rivers. The monthly outflows from February to June are calculated on a daily basis to satisfy the X2 objective. Minimum monthly flows for July range from 4,000 cfs in critical years to 8,000 cfs in wet years. The August outflows range from 3,000 cfs in dry years to 4,000 cfs in below normal years and wetter year types. The September minimum outflow is 3,000 cfs in all year types. The October minimum outflows are 3,000 in critical and 4,000 cfs in all other year types. The November and December required outflows are 3,500 cfs in critical and 4,500 cfs in all other year types.

Although these D-1641 outflow objectives specify the minimum outflows during these months, a water supply and water quality tradeoff is involved in the actual operation of the Delta. A slightly higher outflow will reduce the salinity intrusion of Suisun Bay water into the central Delta and reduce the salinity (i.e., electrical conductivity [EC], chloride, bromide) of the CVP and SWP exports. The CVP and SWP operations sometimes may reduce pumping during these fall months to reduce the salinity of the exports, even though this will also reduce the water supply volume pumped during these months.

### *X2 Objective*

The location of the estuarine salinity gradient is regulated during the months of February–June by the X2 objective in the 1995 WQCP (D-1641). The X2 position must remain downstream of Collinsville (kilometer 91 upstream from the Golden Gate Bridge) for the entire 5-month period. This requires a minimum outflow of about 7,100 cfs. The X2 objective specifies the number of days each month when the location of X2 must be downstream of Chipps Island (kilometer 75) or downstream of the Port Chicago EC monitoring station (kilometer 64). The number of days depends on the previous month's runoff index value. Maintaining X2 at Chipps Island requires a Delta outflow of about 11,400 cfs, and maintaining X2 at Port Chicago requires a Delta outflow of about 29,200 cfs. Meeting the X2 objectives can require a relatively large volume of water for outflow during dry months that follow months with large storms.

### *Maximum Export/Inflow Ratios*

D-1641 includes a maximum E/I ratio objective to limit the fraction of Delta inflows that is exported. This objective was developed to protect fish species and to reduce entrainment losses. Delta exports used to compute the E/I ratio are the amounts diverted at the Jones and Banks Pumping Plants. Delta inflows are the gaged river inflows (does not include rainfall runoff in the Delta). The maximum E/I ratio is 0.35 for February through June and 0.65 for the remainder of the year. If the January runoff index is relatively low, the February E/I ratio is increased to 0.45. CVP and SWP have agreed to share the allowable exports if the E/I ratio is limiting at less than twice the Jones Pumping Plant capacity.

### *Delta Cross Channel Operations*

Reclamation operates the Delta Cross Channel (DCC) to improve the transfer of water from the Sacramento River to the export facilities at the Jones Pumping Plant and to improve water quality in the south Delta by reducing saltwater intrusion from Antioch. The gates, however, are closed whenever flows in the Sacramento River at Freeport reach about 25,000 cfs to reduce scour on the downstream side of the gates and to reduce potential flooding on the Mokelumne River channels.

State Water Board D-1641 provides for closure of the DCC gates from February 1 through May 20 for fish protection. From November through January, the DCC may be closed up to an additional 45 days. The gates also may be closed for 14 days during the period of May 21 through June 15. Reclamation determines the timing and duration of the closures after consultation with USFWS, DFG, and NMFS. Monitoring for fish presence and movement in the Sacramento River and Delta, the salvage of salmon at the Tracy and Skinner facilities, and hydrologic "cues" (e.g., storm events) are used to determine the timing of DCC closures, subject to water quality conditions.

### *Central Valley Project Improvement Act Water Management in the Delta*

The USFWS manages 800 thousand acre-feet per year (taf/yr) of CVP water supply that is dedicated for anadromous fish enhancement and wildlife purposes. A portion of this water is designated to reduce Jones Pumping Plant pumping during periods of high risk to the protected species. The VAMP period of April 15–May 15 is one of the designated periods of protection. Because the D-1485 conditions are considered the baseline for the (b)(2) water accounting, the 3,000 cfs Jones Pumping Plant pumping limit (that originally was replaced with wheeling by SWP pumping) often is maintained as part of the (b)(2) allocation in May and June. Additional reduction of CVP pumping to 800 cfs usually is requested during the VAMP period and sometimes extending into May and June if fish densities at the salvage facilities remain high and water remains in the CVPIA(b)(2) water account. The Intertie action would allow some additional portion of the CVP demands to be pumped at the Jones Pumping Plant facility without relying on SWP wheeling at the Banks Pumping Plant.

### *Environmental Water Account Operations*

The EWA is a cooperative management program with the purpose of providing protection to at-risk fish species of the Bay-Delta estuary through environmentally beneficial changes in SWP and CVP operations at no uncompensated water cost to the projects' users. This approach to fish protection involves changing project operations to benefit fish and the acquisition of alternative sources of project water supply, called the *EWA assets*, which the EWA agencies use to replace the regular project water supply lost by pumping reductions (U.S. Department of the Interior, Bureau of Reclamation 2003).

The EWA program consists of two primary elements: implementing fish actions that protect species of concern and increasing water supply reliability by acquiring and managing assets to compensate for the effects of these actions. Actions that protect fish species include reduction of pumping at the Banks and Jones Pumping Plants in the Delta. Pumping reductions can reduce water supply reliability for the SWP and CVP export service area, causing conflicts between fishery and water supply interests. A key feature of the EWA is use of water assets to replace supplies that are interrupted during pumping reductions. The EWA assets also can provide benefits such as augmenting instream flows and Delta outflows (U.S. Department of the Interior, Bureau of Reclamation 2003).

The EWA implementation is assumed in the CALSIM II modeling of the Intertie project. The EWA actions generally have been used to reduce SWP pumping at Banks Pumping Plant because the CVPIA(b)(2) water management actions have been used to restrict Jones Pumping Plant pumping in the April–June period of highest fish density.

## 3.1.4 Affected Environment

### *Sources of Information*

The following key sources of information were used in the preparation of this section.

- The most recent and complete description of the existing CVP and SWP facilities and operations is included in the August 2008 CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). These materials, which provide extensive information on the facilities, the operating criteria, and the CALSIM modeling assumption and results, are available from: <http://www.usbr.gov/mp/cvo/ocap_page.html>.
- The 2008 OCAP evaluation and modeling studies included the Intertie project as part of the assumed future facilities, but because the OCAP evaluations cover the entire CVP and SWP system and operations effects on the ESA species (i.e., take assessment), the incremental effects of individual facilities and operations are not identified. Therefore, Reclamation has used the CALSIM II model to separate the relatively small effects of the Intertie. These modeling studies are described fully in Appendix B.

The SWP and the CVP store and release water upstream of the Delta and export water from the Delta to areas generally south and west of the Delta. Reclamation diverts water from the Delta through its Jones Pumping Plant to the DMC. DWR pumps for export through the California Aqueduct and South Bay Aqueduct at its Banks Pumping Plant in CCF, and also diverts water at the Barker Slough Pumping Plant for export through the North Bay Aqueduct. The State Water Board first issued water right permits to Reclamation for operation of the CVP in 1958 (water right Decision 893) and to DWR for operation of the SWP in 1967 (water right Decision 1275 and Decision 1291).

A third substantial diverter of Delta water is the Contra Costa Water District (CCWD), which currently diverts water from Rock Slough under Reclamation's CVP water rights and from a second intake constructed on Old River near the State Route (SR) 4 Bridge that serves as the pumping plant for Los Vaqueros Reservoir. Several municipal users and many agricultural users also divert water from the Delta under riparian and appropriative rights. The upstream CVP and SWP facilities and operations are described briefly below because they are operated in conjunction with the Delta facilities. Much more information is available in the 2008 CVP/SWP Longterm Operations Plan.

### *Central Valley Project and State Water Project Facilities and Operations*

The following description of CVP and SWP facilities and operational constraints in the Delta and upstream tributaries (i.e., reservoirs) is provided to establish current operational conditions needed to evaluate Intertie project alternatives for water supply conditions. These constraints have been incorporated into the CALSIM II simulations that are used to evaluate monthly changes in water supply conditions attributable to the Intertie. The CALSIM II results from the upstream reservoirs are shown here, although the Intertie alternatives generally would not change Future No Action upstream reservoir operations in any systematic or substantial way.

#### *Trinity River Division*

The CVP Trinity River Division, completed in 1964, has facilities to store and regulate water in the Trinity River and facilities to transfer water to the Sacramento River basin. Trinity Reservoir (formerly called Clair Engle Lake) has a maximum storage capacity of approximately 2.4 maf. All releases from Trinity Dam are re-regulated downstream at Lewiston Lake to meet downstream flow requirements, and supply exports through Clear Creek tunnel and the Carr power plant to Whiskeytown Lake. Spring Creek tunnel and power plant convey water from Whiskeytown Lake to Keswick Lake, located on the Sacramento River below Shasta Dam. The mean annual flow into Trinity Reservoir is approximately 1.2 maf, and the instream flow requirements range from about 370 thousand acre-feet (taf) to about 815 taf, depending on the Trinity runoff volume. There is some flood storage space reserved in the winter months, and the minimum storage in Trinity Reservoir generally is maintained above 1,000 taf for recreation and water temperature considerations. The reservoir normally is filled to the highest storage level in April–June and then is drawn down slightly by the end of September. Only in the drought year sequences was the simulated carryover storage less than 1,000 taf.

Figure 3.1-1 shows the annual sequence of carryover (end of September) storage in Trinity Reservoir for the Future No Action and Intertie conditions. The maximum storage for each year also is shown. The absolute minimum storage simulated was about 500 taf in a few years. Several other years have carryover storage of between 500 taf and 1,000 taf. The normal seasonal drawdown of Trinity Reservoir is moderate, with carryover storage usually between 1,000 taf and 2,000 taf. The change between the previous carryover storage and the maximum storage shows the seasonal filling in the winter and spring months. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for exports and Trinity River flows. The Intertie would cause only minor changes in the carryover storage or the maximum storage in a few years, because the Trinity reservoir operations are determined primarily by the runoff to the reservoir, with almost all of the runoff not required for Trinity River flows exported to the Sacramento River through the Clear Creek tunnel.

The Trinity River flow requirements for the Trinity River Restoration Program (ranging from 370 taf/yr to 815 taf/yr) are included accurately in the simulation. The Future No Action Trinity exports (Clear Creek Tunnel) average about 535 taf/yr, with a range of about 100 taf/yr to about 1,200 taf/yr.

Table 3.1-1 shows a summary of the simulated monthly distribution of Clear Creek Tunnel flows. The simulated flows are sorted for each month, and the cumulative distribution values are shown in the summary. The annual volumes (taf) are also sorted separately and the cumulative distribution is given. The average values, given at the bottom of the table, are often higher than the median (50%) values because there are a few very high flows. The months of highest export are June–October, corresponding to the highest demands (and prices) for the hydroelectric energy produced by these exports through Carr and Spring Creek power plants. Most of the runoff is released for required Trinity River flows or exported through the Clear Creek tunnel. Trinity Reservoir flood control releases are infrequent. The Intertie would not substantially change the monthly pattern or the annual total of Trinity exports because most of the runoff not required for Trinity River flows is exported.

#### *Lake Shasta*

Runoff from the upper Sacramento River and tributaries is regulated by the CVP Shasta Dam and re-regulated approximately 10 miles downstream at Keswick Dam. The watershed above Shasta Dam drains approximately 6,650 square miles and produces an average annual inflow of about 6 maf. Inflows generally increase from November through March, with peak flows generally occurring in March. As snowmelt is not the dominant component of Shasta inflows, runoff generally decreases in April and May, and inflow is less than 5,000 cfs from June through October.

Maximum Lake Shasta storage occurs in April–June. A considerable portion of the maximum storage of about 4.5 maf is reserved for flood control space between November and March. Storage usually increases from January through April and decreases from June through October. Figure 3.1-2 shows the Shasta Reservoir carryover storage simulated by CALSIM II for the 1922–2003 hydrology. The maximum storage for each year also is shown. The normal seasonal drawdown of Shasta Reservoir is moderate, with carryover storage usually between 2,500 taf and 3,500 taf. Shasta carryover storage generally is held above 2.0 maf for water temperature–control purposes but is simulated to be less than 2.0 maf in about 10% of the years. The change between the previous carryover storage and the maximum storage shows the seasonal filling in the winter and spring months. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for Sacramento River diversions, minimum Keswick flows, and Delta exports. The Intertie would cause only minor changes in the carryover storage or the maximum storage in a few years, because the reservoir operations are determined primarily by the runoff to the reservoir, with almost all of the seasonal storage released during the summer and fall.

Table 3.1-2 shows the monthly Keswick Dam release flows simulated by CALSIM II for the Future No Action and Intertie conditions. The Keswick flows generally are regulated by the minimum fish flows and the downstream water supply demands of CVP contractors along the Sacramento River and south of the Delta. Summer flows also are sometimes regulated for river temperature control. The Keswick flows represent the full regulated CVP water supply from Shasta and Trinity, as well as some flood control spills from Shasta. The annual Keswick releases average about 6.25 maf and range from less than 4.0 maf in the lowest 10% of the years to more than 9 maf in the highest 10% of the years.

The median (50% distribution) flows can be used to indicate the seasonal flow pattern at Keswick. The median flows are about 5,000 cfs from September through April, and about 7,500 in May, 10,000 cfs in June and August, with a peak of 14,000 cfs in July. The Keswick powerhouse has a maximum capacity of about 15,000 cfs.

The Intertie did change the simulated monthly sequence of flows but did not change the seasonal pattern of Keswick flows. Because the monthly changes in Keswick flows do not correspond to the monthly increased pumping at the Jones Pumping Plant, the simulated changes are indirect consequences of slightly changed CVP San Luis Reservoir storage effects on Shasta and Trinity Reservoir releases. The Intertie has the general effect of allowing more of the regulated CVP releases from Keswick to be pumped at the Jones Pumping Plant, rather than causing any direct changes in the Trinity and Shasta releases.

#### *Lake Oroville*

Lake Oroville was completed in 1968 and is the major SWP storage reservoir, with a maximum capacity of about 3.5 maf. However, the Hyatt Power Plant inlets (which can be selected to regulate the release temperature) are located at elevations that provide a minimum storage volume of about 1.0 maf. The effective seasonal and year-to-year drawdown therefore is limited to 2.5 maf. The average annual inflow to Lake Oroville is about 4.0 maf and is a combination of rainfall runoff and snowmelt. Releases from Oroville flow into the Thermalito Reservoir complex, which provides a storage facility (i.e., afterbay) to allow pumped-storage operations at the Hyatt Power Plant and deliveries of up to 900 taf to SWP Settlement contractors. A release of 600 cfs is made to the river to provide spawning and attracting flows for the Feather River hatchery.

Maximum Lake Oroville storage occurs in April–June. About 700 taf of the maximum storage is reserved for flood control space between December and March. Storage usually increases from January through April and decreases from June through October. Figure 3.1-3 shows the Oroville Lake carryover storage simulated by CALSIM II for the Future No Action and Intertie conditions for the 1922–2003 hydrology. The maximum storage for each year also is shown. The carryover storage is highly variable, from about 750 taf in a few dry years to more than 3.0 maf in about 20% of the years. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for Thermalito diversions, minimum Feather River flows, and Delta exports.

As simulated, the Intertie has minor effects on the Oroville carryover storage and maximum storage in a few years. The simulated effects of the Intertie on Lake Oroville storage are indirect consequences of the simulated changes in SWP San Luis Reservoir storage, caused by the additional Jones Pumping Plant pumping allowed by the Intertie.

Table 3.1-3 shows the monthly Feather River flow releases below Thermalito Afterbay Reservoir for the Future No Action simulation. The Feather River flows below Thermalito are regulated by the minimum fish flows (of 900 cfs, 1,200 cfs or 1,700 cfs depending on runoff conditions) in a few months, and the downstream water supply demands of SWP for Delta export pumping. Highest release flows are made in the months of July, August, and September, corresponding to the higher Delta E/I ratio of 65% in these summer months, which allows a greater fraction of the reservoir releases to be exported. Annual flows vary with runoff conditions, and the average annual release flow volume is about 3.2 maf, with a flow volume of 1.6 maf in the lowest 10% of the years and a flow volume of about 5.3 maf in the highest 10% of the years. As simulated, the Intertie does not change the pattern of monthly Oroville release flows, but the CALSIM model simulates very large changes (of more than 1,000 cfs) in some monthly flows in a few years. The maximum simulated changes in the monthly Oroville releases (i.e., 4,000 cfs) are much larger than the maximum simulated changes in Jones Pumping Plant pumping (i.e., 400 cfs) caused by the Intertie. These are simulated indirect changes in Lake Oroville releases caused by small changes in SWP San Luis Reservoir storage, and the subsequent changes in the simulated seasonal allocation of SWP deliveries.

### *Folsom Lake*

Folsom Lake was constructed by the U.S. Army Corps of Engineers (Corps) for Reclamation between 1948 and 1956 as part of the CVP. Folsom Dam impounds a maximum of about 1 maf and is a multipurpose reservoir that provides flood control and seasonal water storage for recreation, power, water supply, and minimum fish protection flows in the American River and to the Delta. Other agencies have constructed several major reservoirs upstream in the Sierra Nevada (with a total storage of another 1 maf) that provide additional flood control and seasonal storage and power benefits. The average runoff of about 2.6 maf is considerably larger than the Folsom Reservoir storage. Nimbus Dam, located 7 miles downstream, provides re-regulation of the Folsom releases and diversion to the Folsom South Canal. Total diversions from the American River are estimated in the CALSIM II model to be about 400 taf.

About 400 taf of storage is reserved for flood control space between December and March. Maximum Folsom Lake storage of 975 taf usually occurs in May–June. Figure 3.1-4 shows the Folsom Lake carryover storage at the end of September simulated by CALSIM II for the Future No Action and Intertie conditions for 1922–2003 hydrology. The maximum storage for each year also is shown. The reservoir storage is always less than 650 taf, in preparation for rainfall flood control storage in November–March. Storage is less than 300 taf in the driest 10% of the years. The carryover storage is generally between 400 taf and 650 taf. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for water supply diversions, minimum American River flows, and Delta exports. As simulated, the Intertie had only minor effects on the Folsom carryover storage.

Table 3.1-4 shows the monthly Nimbus Dam releases. The average Nimbus annual release volume was about 2,500 taf/yr, with a range of annual flow volumes from less than 1 maf in the lowest 10% of the years, more than 2 maf in 50% of the years, to more than 4 maf in the highest 10% of the years. The combination of upstream storage and Folsom Reservoir storage provides a very uniform seasonal release pattern. The lowest 10% of the simulated monthly flows are between 800 cfs and 1,800 cfs in all. The median Nimbus flows are about 2,000 cfs from August through January, about 3,500 in February, about 2,500 cfs in March–May, about 3,000 cfs in June, and 4,000 cfs in July. The highest 10% of the monthly flows are greater than 5,000 cfs only in December through June.

As simulated, the Intertie has no effects on the monthly pattern of Nimbus release flows, but the CALSIM model simulates very large changes (of more than 1,000 cfs) in some monthly flows in a few years. The maximum simulated changes in the monthly Nimbus releases (i.e., 2,000 cfs) are much larger than the maximum simulated changes in Jones Pumping Plant pumping (i.e., 400 cfs) caused by the Intertie. These are simulated indirect changes caused by small changes in CVP San Luis Reservoir storage, and the subsequent changes in the simulated seasonal allocation of CVP deliveries.

### *New Melones Reservoir*

Operation of New Melones Reservoir is governed by the interim operations plan and includes higher releases for anadromous fish in April and May as part of the CVPIA(b)(2) water management program. Maximum storage of about 2,500 taf is achieved in only a few sequences of relatively wet years. New Melones Reservoir supplies irrigation diversions of about 600 taf/yr and provides considerable year-to-year storage protection. New Melones usually reaches seasonal maximum storage in June or July from snowmelt.

Figure 3.1-5 shows the New Melones Reservoir carryover storage for the Future No Action and Intertie conditions simulated by CALSIM II for the 1922–2003 hydrology. The carryover storage is strongly dependent on the sequence of hydrology because the storage is a relatively large fraction of average runoff. Storage is above 2 maf in about 10% of the years. Storage normally declines in subsequent years and may fall below 1 maf in drought sequences. The storage was simulated at about 500 taf in the 1931–1934 drought sequence and the 1990–1992 sequence.

The CVP release flows downstream of the irrigation diversions for South San Joaquin and Oakdale Irrigation Districts provide required minimum fisheries flows, provide additional flushing flows during the spring period of Chinook salmon outmigration (during April and May as part of the [b][2] water allocation), and help control salinity on the San Joaquin River at Vernalis. The average release is about 625 taf/yr, but ranges from about 300 taf/yr in dry years to more than 1 million acre-feet per year (maf/yr) in a few wet years (as a result of reservoir flood control spills). The Intertie does not change the simulated New Melones Reservoir operations.

The Tuolumne and Merced Rivers both have major storage reservoirs and large irrigation diversions and minimum river flows. These are not CVP or SWP reservoirs, so their operations are dependent only on hydrology and irrigation demands and instream flow requirements. Therefore, the Intertie project does not modify the CALSIM II model simulations of these reservoirs.

### *Delta Inflows*

On average, about 21 maf of water reaches the Delta annually, but monthly average inflows vary widely from year to year and within each year. Delta inflow in water year 1977 totaled only 6 maf, and inflow for water year 1983 was about 70 maf. The average monthly natural runoff to the Delta is lowest in the summer and fall months. The operation of the upstream water supply reservoirs has increased summer and fall flows into the Delta.

Table 3.1-5 shows the CALSIM II simulated monthly Sacramento River flows at Freeport for the Future No Action and Intertie conditions for the 1922–2003 hydrology. The annual inflow at Freeport ranges from less than 7 maf to more than 35 maf. The lowest 10% of the years have an inflow of less than 8 maf, while the highest 10% of the years have an inflow of more than 26 maf. Very high flows bypass the Sacramento River channel at Freeport and enter the Delta through the Yolo Bypass.

The monthly flows are highly regulated by the upstream reservoirs. The minimum monthly flows are between 5,000 cfs and 10,000 cfs in all months. The 10% flow distribution in all months is between 8,000 cfs and 12,000 cfs. The median flows are between 10,000 cfs and15,000 cfs from August to November, and greater than 20,000 cfs only in January–March. The 90% flow distribution is greater than 50,000 cfs in December–April. The Intertie does not change the monthly distribution of flows. The CALSIM model does simulate a few months with large changes, which are the result of changes in releases subsequent to changes in CVP and SWP exports and San Luis Reservoir storage, rather than of direct changes in releases to support additional Intertie pumping.

Table 3.1-6 shows the monthly San Joaquin River flows at Vernalis, which include the releases from New Melones Reservoir and the flows from the Tuolumne and Merced Rivers, as well as floodflows from the San Joaquin River upstream of the Merced River (Friant Dam). The annual inflow at Vernalis is about 3 maf, and ranges from less than 1 maf in the lowest 10% of the years to more than 6 maf in the highest 10% of the years.

The monthly flows are highly regulated by the upstream reservoirs. The minimum monthly flows are between 500 cfs and 1,500 cfs in all months. The 10% flow distribution in all months is between 1,000 cfs and 2,000 cfs. The median flows are between 1,500 cfs and 2,000 cfs from June through January, about 3,000 cfs in February and March, and about 5,000 cfs in April and May (as regulated by VAMP flows). The Intertie has no effect on these simulated San Joaquin River inflows.

### *San Luis Reservoir*

San Luis Dam and Reservoir are located near Los Banos. The reservoir, with a capacity of about 2.0 maf, is a pumped-storage reservoir used primarily to provide seasonal storage for both CVP and SWP water exported from the Delta. The CVP share of the San Luis Reservoir storage is 972 taf. The SWP share of the San Luis Reservoir storage is 1,067 taf.

O'Neill Dam and Forebay are located downstream of San Luis Dam along the California Aqueduct. The forebay is used as a hydraulic junction point for state and federal waters. The O’Neill pumping-generating plant lifts CVP water from the DMC to the O’Neill Forebay. The joint CVP/SWP William R. Gianelli pumping-generating plant lifts CVP/SWP water from O’Neill Forebay to San Luis Reservoir. The forebay provides re-regulation storage necessary to permit off-peak pumping and on-peak power generation by the Gianelli plant. When CVP water is released from O’Neill Forebay to the DMC, the units at the O’Neill pumping-generating plant operate as hydroelectric generators. The O’Neill Pumping Plant has a capacity of 4,200 cfs, which is not enough to pump the full DMC capacity of 4,600 cfs into O’Neill Forebay and subsequently into San Luis Reservoir. The Intertie is intended to eliminate this bottleneck in the CVP conveyance along the DMC to San Luis Reservoir storage in the fall and winter months.

The San Luis Canal, the joint federal and state (CVP/SWP) portion of the California Aqueduct, conveys water southeasterly from O'Neill Forebay along the west side of the San Joaquin Valley for delivery to CVP and SWP contractors. The Coalinga Canal conveys water from the San Luis Canal to the Coalinga area, where it serves the southern San Joaquin Valley region. The California Aqueduct continues south to the Edmonston Pumping Plant and over the Tehachapi Mountains to The Metropolitan Water District of Southern California (Metropolitan) and other SWP contractors.

Figure 3.1-6 shows the simulated CVP San Luis Reservoir winter maximum (January–March) and summer minimum (July–September) storage for the Future No Action and Intertie conditions for 1922–2003. Maximum CVP storage of 972 taf is simulated in the majority of years. The minimum CVP storage is more variable, with some years near the absolute minimum of 50 taf, and other years with 200 taf to 400 taf remaining in storage. Although the Intertie will allow CVP San Luis Reservoir to fill more rapidly, and maximum storage was achieved in a few more years, there were some years when filling of CVP San Luis Reservoir was not possible because of limited water supply. The minimum CVP storage was also shifted slightly in some years as a result of small changes in Jones Pumping Plant pumping and CVP water delivery.

Table 3.1-7 shows the CALSIM II simulated monthly distribution (range) of CVP San Luis storage for 1922–2003 under the Future No Action and Intertie conditions. The major water supply change allowed by the Intertie is this increase in CVP San Luis storage. Maximum CVP San Luis storage usually occurs in January to March. The Future No Action maximum CVP San Luis storage is more than 900 taf in about half of the years. Storage usually reaches a minimum in August or September. The assumed minimum CVP San Luis storage is 45 taf. The average simulated carryover storage was about 200 taf. The Intertie slightly increased the carryover storage to an average of 210 taf. The Intertie increased the maximum CVP San Luis storage in several years and allowed the CVP San Luis storage to reach capacity 1 month earlier in several years. The CVP San Luis Reservoir storage was full at the end of February in about 10% of the years for the Future No Action, and in about 30% of the years with the Intertie. The CVP San Luis Reservoir storage was full at the end of March in about 40% of the years for the Future No Action, and in about 60% of the years with the Intertie. The simulated average CVP San Luis Reservoir storage was higher in all months with the Intertie, and was about 50 taf higher than the Future No Action in December, January, and February.

Figure 3.1-7 shows the simulated SWP San Luis Reservoir winter maximum (January–March) and summer minimum (July–September) storage for the Future No Action and Intertie conditions for 1922–2003. Maximum SWP storage of 1,067 taf is simulated in the majority of years. The minimum SWP storage is more variable, with about 20% of the years below 200 taf, and about 20% of the years above 600 taf. The use of SWP San Luis Reservoir storage is dependent on the summer Banks Pumping Plant pumping and the water delivery allocation. Although the Intertie will delay the filling of SWP San Luis Reservoir in some years, maximum SWP San Luis Reservoir storage is still achieved in most years, although there are some years when filling SWP San Luis Reservoir was not be possible because of limited water supply. The minimum SWP storage also was shifted slightly in some years as a result of small changes in Banks Pumping Plant pumping and SWP water delivery.

Table 3.1-8 shows the CALSIM II simulated monthly range (distribution) of SWP San Luis storage for 1922–2003 under the Future No Action and Intertie conditions. Maximum SWP San Luis storage usually occurs in January to March. The maximum SWP San Luis storage is more than 1,000 taf in March of most (80%) of the years. Storage usually reaches a minimum in August or September. The average simulated carryover storage was about 420 taf for both the No Action and the Intertie. The minimum storage is assumed to be 55 taf. The Intertie generally delays the maximum SWP storage by a month, but does not usually change the maximum SWP San Luis storage. The average SWP San Luis Reservoir storage was reduced by about 10 taf in the months of November to February, but was the about the same in March. The simulated SWP San Luis storage for both the Future No Action and the Intertie reaches capacity of 1,067 taf in about 60% of the years.

### *Central Valley Project Delta Facilities*

The Jones Pumping Plant, about 5 miles north of Tracy, consists of six pumps with a maximum rated capacity of about 5,100 cfs. The original motor-pumps had a maximum capacity of 4,600 cfs (about 767 cfs each). Bronze impellers were replaced with stainless steel impellers in three units which increased the capacity of each of these units to about 935 cfs. The Jones Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles long. At the head of the intake channel, “louver” screens that are part of the Tracy Fish Collection Facility intercept fish, which are then collected and transported by tanker truck to release sites away from the pumps. The water is pumped about 200 feet into the DMC, which has a maximum design capacity of about 4,600 cfs.

The Jones Pumping Plant has a maximum average monthly capacity of about 4,600 cfs. Table 3.1-9 compares the CVP monthly demands, based on full contract amounts, to the maximum Jones Pumping Plant monthly pumping volume (taf). The demand for water pumped at the Jones Pumping Plant is estimated by CALSIM II to be about 3,330 taf/yr. The CVP monthly demands exceed the CVP monthly pumping capacity in the May–August period. This 783 taf of summer demands must be pumped during the winter and early spring and stored in San Luis Reservoir to supply the full annual allocations of water. This imbalance is increased by the frequent allocation of CVPIA(b)(2) water to reduce CVP pumping to 3,000 cfs in May and June, which was the allowed pumping under the previous Delta water right decision, D-1485. This unused CVP pumping in May and June is almost 200 taf.

If the Jones Pumping Plant pumps were at maximum capacity of 4,600 cfs for the entire year, they could deliver about 3,330 taf/yr from the Delta (about 275 taf each month). This is unlikely to occur, however, because there are required periods for maintenance of the pump units and DMC facilities and because the hydrology and other regulatory restrictions in the Delta do not allow full pumping every day of the year. CVP water for the Cross Valley Canal is usually pumped by Banks Pumping Plant. Generally, however, the CVP demands exceed the available Jones Pumping Plant pumping capacity.

The DMC capacity north of Santa Nella and the O'Neill Pumping Plant capacity of 4,200 cfs creates a DMC capacity limit during the fall and winter period of September–April, when diversions from the upper DMC (between Jones and O'Neill Pumping Plants) are less than 400 cfs. This DMC limitation reduces the maximum Jones Pumping Plant pumping by about 200–400 cfs, or about 140 taf for the year. These constraints make it impossible for the Jones Pumping Plant to supply the full CVP demands. The Intertie project would allow some additional pumping in this October–March period to fill CVP San Luis Reservoir.

The CVPIA introduced additional constraints on the Jones Pumping Plant pumping capacity. A portion of the Section (b)(2) water (maximum of 800 taf/yr) that is dedicated to anadromous fish restoration (protection) purposes normally is allocated by USFWS to reduce pumping during the VAMP period (April 15–May 15), and additional CVP pumping reductions are often applied during the remainder of May and June. The CALSIM II modeling assumes a 3,000 cfs limit for Jones Pumping Plant pumping in May and June. The E/I ratio of 35% during the February–June period further limits pumping. Therefore, under current regulations, it is impossible for the Jones Pumping Plant to supply the full CVP demands. The Intertie would allow more of the CVP demands to be satisfied with the Jones Pumping Plant.

Table 3.1-10 shows the CALSIM II assumed maximum Jones Pumping Plant capacity for the Future No Action and the Intertie alternatives. The differences in maximum pumping volumes also are shown. For the August–April period with some assumed upper DMC delivery limitations, the difference is a total of 136 taf. The April and May pumping is limited for the Future No Action and the Intertie by the assumed (b)(2) reductions in export pumping for the VAMP period. The May and June pumping is limited for the Future No Action and the Intertie by the assumed (b)(2) reductions in export pumping for fish protection, corresponding to the previous D-1485 pumping limits. The current CVP contracts and refuge deliveries are more than the allowable pumping at the Jones Pumping Plant. The Intertie would allow more of the CVP demands to be satisfied with the Jones Pumping Plant.

### *State Water Project Delta Facilities*

The Banks Pumping Plant has an installed capacity of about 10,668 cfs (two units of 375 cfs, five units of 1,130 cfs, and four units of 1,067 cfs). With full pumping capacity, the Banks Pumping Plant theoretically is capable of pumping 7,725 taf each year. However, the current permitted diversion rate into Clifton Court Forebay is 6,680 cfs as a 3-day average, and the pumping rate cannot be much higher than the diversion rate because the water elevation in CCF cannot be drawn down below –2.0 feet above mean sea level (msl) without introducing cavitation (i.e., air entrainment) problems at the pumps. This maximum permitted pumping would provide a maximum of about 4,836 taf/yr if full permitted pumping could be maintained every day of the year. Additional permitted diversions of one-third of the San Joaquin River at Vernalis, if the Vernalis flow is above 1,000 cfs, are allowed under the current permit rule for a 90-day period from December 15 to March 15. This additional increment of permitted pumping could yield a maximum of 710 taf/yr (for a total of 5,546 taf) if the San Joaquin River flow at Vernalis was higher than 13,000 cfs for the entire 90-day period (a very unlikely hydrologic condition).

The monthly pumping capacity of Banks Pumping Plant for the basic 6,680-cfs pumping limits is given in Table 3.1-11. The seasonal SWP demands, based on Table A contract amounts, are highest in the summer months, requiring a portion of the demands to be supplied from San Luis Reservoir storage. San Luis Reservoir releases often are needed during these months because the Banks Pumping Plant pumping is limited during April–June by a combination of assumed export reductions during the VAMP period and the 35% E/I ratio that applies from February–June.

Only in a few years will there be sufficient Delta inflow each month to satisfy the in-Delta water diversions, meet the required Delta outflow for water quality and fish protection, supply the full Jones Pumping Plant pumping, and also allow Banks Pumping Plant pumping of 4,300 taf to supply the entire SWP demand plus aqueduct and reservoir losses that are assumed to be 100 taf/yr. The current CVP and SWP pumping capacity, under the existing Delta objectives (D-1641), can rarely meet the full CVP and SWP water demands. The Intertie project will allow a small increase in the allowable CVP pumping (about 135 taf) and reduce the pumping limitation that currently restricts CVP water supply reliability in many years.

### *Central Valley Project South-of-Delta Deliveries*

The recent historical monthly deliveries to Central Valley Project south-of-Delta locations (contractors and refuges) are described here to introduce the CALSIM modeling results and to illustrate the current limits on the Jones Pumping Plant and upper DMC capacity limitations. The Intertie would improve the water supply reliability for these CVP contractors while meeting all regulatory requirements for

Delta operations. The monthly pumping and delivery data for calendar years 2005, 2006, and 2007, as reported on the Central Valley Operations (CVO) website (www.usbr.gov/mp/cvo/deliv.html), are described to illustrate typical recent CVP delivery patterns (U.S. Department of the Interior, Bureau of Reclamation 2009). Total annual calendar year deliveries in these three recent years were very similar, with 2,705 taf delivered in 2005; 2,598 taf delivered in 2006; and 2,586 taf delivered in 2007.

Figure 3.1-8 shows a simplified diagram with the major categories of CVP south-of-Delta deliveries. The upper DMC, between Jones and O'Neill Pumping Plants at DMC mile 70, has several water districts, exchange contractors, and wildlife refuges. The upper DMC ends at the O'Neill Pumping Plant, located near DMC Check 13, at DMC mile 70. The lower DMC extends from Check 13 to the Mendota Pool at DMC mile 116. This section of the DMC also delivers water to water districts, exchange contractors, and wildlife refuges. The San Luis Canal (joint CVP/SWP facility) extends from O'Neill Forebay to deliver water to several water districts and the Cross Valley Canal. The CVP San Luis Reservoir stores water for summer deliveries to the lower DMC and San Luis Canal, and the Pacheco Pumping Plant delivers water from San Luis Reservoir to the San Felipe division.

### Calendar Year 2005 Deliveries

Table 3.1-12 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2005. The monthly and annual delivery values are given in acre-feet. The first section shows the CCWD and Jones Pumping Plant values. The pumping for CCWD is the only in-Delta CVP contractor. This water is pumped at the Rock Slough or Old River intakes. The CCWD pumping ranged from less than 1 taf in December to about 20 taf in June, with a total pumping of 123 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 65 taf in May to more than 250 taf in several months (January, and June–December). The pumping was more than 4,000 cfs in eight months, and greater than 3,000 in two more months. Reduced pumping in April and May was for the VAMP fish protection period. The total annual pumping was about 2,705 taf in 2005.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-12. The total annual deliveries in 2005 to the upper DMC water districts, exchange contractors, and refuges were about 396 taf, with 157 taf to water districts, 90 taf to exchange contractors, and 149 taf to refuges. The water district and exchange contractors are agricultural deliveries that are strongly seasonal, with peak deliveries in May–September. The wildlife refuges' delivery is more distributed throughout the year with peak deliveries in September and October. O'Neill pumping supplies the San Luis Canal deliveries, and some is pumped into San Luis Reservoir for seasonal storage.

The CVP San Luis Reservoir end-of-month storage values (taf) are given to indicate the seasonal storage and drawdown of water for CVP contractors. The CVP San Luis storage was about 610 taf at the beginning of 2005, increased by almost 190 taf to 797 taf at the end of January, increased by almost 70 taf to 868 taf at the end of February, and increased by almost 100 taf to 966 taf at the end of March. CVP San Luis Reservoir released about 65 taf in May, about 100 taf in June, 230 taf in July, and another 200 taf in August, with a minimum storage of about 375 taf. The CVP San Luis Reservoir storage increased in October, November, and December to about 725 taf at the end of 2005. The Jones Pumping Plant pumping was reduced in March because San Luis storage was filled, and was reduced in April and May for fish protection.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-12. The total annual deliveries in 2005 to the lower DMC water districts, exchange contractors, and refuges were about 911 taf, with 79 taf to water districts, 647 taf to exchange contractors, and 185 taf to refuges. The water district and exchange contractor peak deliveries are in June–August, and the wildlife refuge deliveries are highest in September and October.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-12. The total annual deliveries in 2005 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,320 taf. The majority of this water went to Panoche Water District (53 taf), San Luis Water District (67 taf) and Westlands Water District (1,051 taf), with 111 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were highest in June–August, but were more than 40 taf/month in all months except January. The total DMC deliveries for 2005 were about 2,627 taf which is about 75 taf lower than the total Jones Pumping Plant pumping of about 2,705 taf. The San Luis storage increased by about 125 taf, and there were normal DMC losses to evaporation and seepage. Overall, this monthly accounting of DMC water pumped at Jones Pumping Plant, stored in CVP San Luis, and delivered to CVP contractors is very accurate.

All of the seasonal storage pumping into San Luis Reservoir, and the deliveries to the San Luis Canal, must be pumped from the DMC at the O’Neill Forebay, with a capacity of 4,200 cfs. This limit was approached in January and December of 2005. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the O’Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

### Calendar Year 2006 Deliveries

Table 3.1-13 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2006. The CCWD pumping ranged from less than 1 taf in April (fish protection period) to 18 taf in June, with a total annual pumping of 120 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 50 taf in April to about 250 taf in several months. The pumping was more than 4,000 cfs in seven months, and more than 3,000 cfs in three more months. The total annual pumping was about 2,598 taf in 2006.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-13. The total annual deliveries in 2006 to the upper DMC water districts, exchange contractors, and refuges were about 368 taf, with 160 taf to water districts, 83 taf to exchange contractors, and 125 taf to refuges. The water district peak deliveries were in May–August, and the exchange contractor deliveries were greatest in June–August. The wildlife refuge peak deliveries were in August–October. O'Neill pumping supplies the San Luis Canal, and some is pumped into San Luis Reservoir for seasonal storage.

The CVP San Luis storage was 726 taf at the beginning of 2006, increased to 877 taf at the end of January, and was nearly full at the end of March. CVP San Luis released about 75 taf in May, 100 taf in June, 270 taf in July, and 130 taf in August of 2006. CVP San Luis storage was about 400 taf in August, September, and October and refilled by about 125 taf each month in November and December to about 680 taf at the end of the year.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-13. The total annual deliveries in 2006 to the lower DMC water districts, exchange contractors, and refuges were about 993 taf, with 108 taf to water districts, 677 taf to exchange contractors, and 208 taf to refuges. The water district and exchange contractor peak deliveries were in May–August, and the wildlife refuge deliveries were highest in February, and September–November.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-12. The total annual deliveries in 2006 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,356 taf. The majority of this water went to the Panoche Water District (50 taf), San Luis Water District (65 taf), and Westlands Water District (1,116 taf), with about 90 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were highest (more than 100 taf/month) in May–August, but the deliveries in other months were more than 40 taf/month. All of the seasonal storage in San Luis Reservoir and the deliveries to the San Luis Canal must be pumped from the DMC at the O'Neill Forebay, with a capacity of 4,200 cfs. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the O'Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

### Calendar Year 2007 Deliveries

Table 3.1-14 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2007. The first section shows the CCWD and Jones Pumping Plant values. CCWD is the only in-Delta CVP contractor. The

CCWD pumping ranged from less than 1 taf in April (fish protection period) to 24 taf in June, with a total pumping of 111 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 50 taf in May to about 250 taf in several months (January–March, and July–October). The pumping was more than 4,000 cfs in seven months, and more than 3,000 in two more months. The total annual pumping was about 2,586 taf in 2007.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-14. The total annual deliveries in 2007 to the upper DMC water districts, exchange contractors, and refuges were about 432 taf, with 154 taf to water districts, 152 taf to exchange contractors, and 126 taf to refuges. The water district and exchange contractors are agricultural deliveries that are strongly seasonal, with peak deliveries in May–August. The wildlife refuge deliveries are more distributed throughout the year with peak deliveries in September and October. O’Neill pumping supplies the San Luis Canal, and some is pumped into San Luis Reservoir for seasonal storage. The CVP San Luis Reservoir end-of-month storage values (taf) are shown to indicate the seasonal storage and drawdown of water for CVP contractors. For 2007, the CVP San Luis storage was 680 taf at the beginning of 2007 and increased to 778 taf at the end of January but never filled to capacity of 972 taf. CVP San Luis released about 80 taf in April, about 260 taf in May, and another 250 taf in June of 2007. The Jones Pumping Plant pumping was very low in these three months, requiring these large storage releases for seasonal deliveries. CVP San Luis storage was less than 100 taf in July and August and refilled by about 125 taf each month beginning in September to reach about 650 taf at the end of the year.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-14. The total annual deliveries in 2007 to the lower DMC water districts, exchange contractors, and refuges were about 844 taf, with 82 taf to water districts, 596 taf to exchange contractors, and 166 taf to refuges. The water district and exchange contractor peak deliveries are in May–August, and the wildlife refuge deliveries are highest in January, September, and October.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-14. The total annual deliveries in 2007 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,318 taf. The majority of this water went to San Luis Water District (70 taf) and Westlands Water District (928 taf), with 154 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were more constant, with more than 80 taf delivered from January to August, and less than 30 taf delivered in September to December. All of the seasonal storage in San Luis Reservoir, and the deliveries to the San Luis Canal, must be pumped from the DMC at the O’Neill Forebay, with a capacity of 4,200 cfs. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the

O'Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

## 3.1.5 Environmental Consequences

### *Approach*

Evaluation of the CVP and SWP water supply conditions that may be affected by the Intertie alternatives uses the CALSIM II model, which simulates monthly CVP and SWP reservoir operations and Delta export pumping patterns for the 1922–2003 historical period of hydrology (runoff and estimated local water uses). The water supply evaluation using the CALSIM II model allows a quantitative approach for comparing the water supply reliability (i.e., ability to consistently meet the water supply demands) of the Proposed Action and alternatives. Although the Intertie will allow full CVP pumping capacity of 4,600 cfs in July–March (Table 3.1-10) of all years, the hydrology and reservoir storage conditions will vary, so the water supply effects of the Intertie will be slightly different in each year. Simulating the effects for the 82-year sequence of historical hydrology is the best available method for evaluating the range of potential water supply changes caused by the Intertie. The incremental effects of the Intertie are consistent with the August 2008 CVP/SWP Longterm Operations Plan Future conditions. The Intertie was assumed to be operational in this OCAP evaluation. The CALSIM II results described here resulted from removing the Intertie from the OCAP Future condition simulation (Run 8.0).

Additional Delta pumping restrictions have been included in the USFWS Operations BO for delta smelt that was released in December 2008. Additional upstream reservoir and/or Delta operational changes are required in the NMFS Operations BO released in June 2009. The Jones Pumping Plant will be operated in compliance with the USFWS Operations BO and NMFS Operations BO provisions. These Delta pumping restrictions may limit the use of the Intertie in some fish protection periods, but will increase the value of the Intertie water when it can be operated. The water supply operations described in this CALSIM-model evaluation of the Future No action and the Intertie represent the greatest likely use of the Intertie facility, with the greatest likely impacts on water quality and fish.

#### *Water Supply Impacts*

Changes in water supply may result in impacts to water rights, or be the causative agents that may result in impacts on resources such as water quality, fish habitat or fish populations, recreation, groundwater, and agricultural production. The magnitude of the simulated changes will be judged relative to the Future No Action conditions to allow the effects (i.e., monthly differences) of the Proposed Action on water supply conditions to be evaluated. No mitigation of any identified CVP or SWP water supply changes is required because these changes are not considered to be environmental impacts. The magnitude and pattern of the simulated changes in CVP and SWP pumping and south of Delta deliveries are described in the following section.

### 3.1.6 Environmental Effects

The results presented in this section are used to provide information for subsequent analysis of the environmental consequences of the Proposed Action and No Action Alternative for each resource area. Because the only likely water supply changes would be a slight increase in CVP pumping and a possible shifting of water deliveries between CVP and SWP, in accord with the Coordinated Operations Agreement, D-1641 Delta objectives and fish protection programs, no substantial environmental impacts are expected from these water supply changes.

#### *Alternative 1 (No Action)*

*Construction Effects*

The No Action Alternative will not require any construction activities.

*Operation Effects*

There are no operational changes of the No Action Alternative. This is the assumed Future No Action conditions that are simulated in CALSIM II as the baseline conditions, assuming all other existing CVP and SWP facilities, reservoir operating criteria, D-1641 Delta objectives, and full south-of-Delta CVP and SWP demands. These Future No Action conditions are described in comparison to the Proposed Action (Alternative 2).

#### *Alternative 2 (Proposed Action)*

*Construction Effects*

There are no expected changes in water supply during the construction period. The Jones Pumping Plant and the DMC will remain fully operational during construction of the Intertie project. The Banks Pumping Plant and the California Aqueduct also will remain fully operational during construction.

*Operation Effects*

The Intertie is expected to make some improvements in CVP water supply reliability without having any major impacts on the SWP or on local water supplies, including the water diversions that supply agricultural water needs in the south Delta. The Intertie would reduce the reliance of CVP deliveries on wheeling at Banks Pumping Plant, but may reduce the SWP supply because the SWP sometimes captures CVP water from upstream reservoir releases that cannot be physically pumped at the Jones Pumping Plant with the current DMC limitations. Slightly earlier filling of San Luis Reservoir may allow pumping surplus water (Section 215) to CVP contractors in some years. However, CVP Section 215 water is not included in the CALSIM II model.

**Impact WS-1: Changes in Central Valley Project Delta Pumping**

Table 3.1-15 shows the monthly distribution of simulated Jones Pumping Plant pumping for the simulated Existing Condition and the Proposed Action. The Jones Pumping Plant monthly pumping is given in units of flow (cfs). The annual pumping volumes are given in taf. The simulated Future No Action annual (water year) Jones Pumping Plant pumping ranged from a minimum of 1.1 maf (in 1934) to a maximum of 2.9 maf (in 1952), with an average annual total pumping of 2,355 taf/yr. The Proposed Action provides an average increase of 35 taf/yr (about 1.5% of the average Future No Action CVP pumping). Although this change is a relatively small fraction of the total CVP pumping, it is considered a substantial change in CVP pumping capability because it provides increased operational flexibility and increased emergency response capability.

The simulated Future No Action monthly distribution results indicate the percentage of years when pumping will be close to full Jones Pumping Plant capacity (greater than 4,000 cfs). The simulated Jones Pumping Plant pumping was greater than 4,000 cfs in more than 50% of the years for each month from July through February. Pumping was reduced in March because CVP San Luis Reservoir was often filled, was reduced in April and May because of VAMP pumping limits, and was reduced in May and June because of simulated CVPIA(b)(2) pumping reductions. The only month with a simulated monthly pumping of 4,600 cfs for the No Action was July, and only about 10% of the years would be pumping at capacity.

The simulated results for the Intertie indicate that the maximum assumed CVP pumping capacity of 4,600 cfs would be used in many months of most years. The percentage of monthly pumping at 4,600 cfs would be increased to about 30% in July, 50% in August, 50% in September, 30% in October, 60% in November, 70% in December, 60% in January and 30% in February. The March pumping would be reduced considerably in most years compared to the Future No Action because CVP San Luis would be filled more often. Simulated pumping at the Jones Pumping Plant with the Intertie was almost the same as the Future No Action in April and May because of VAMP pumping limits, and was the same as the Future No Action in May and June of most years because of simulated CVPIA(b)(2) pumping reductions.

The bottom panel of Table 3.1-15 shows the monthly distribution of monthly flows in the Intertie connecting the DMC with the California Aqueduct. The months of greatest use are the months with the increased Jones Pumping Plant Pumping. However, the average use of the Intertie Facility would be about 76 taf/yr. The increase Jones Pumping Plant pumping was only about 35 taf/yr, because the Intertie allowed the CVP San Luis Reservoir to be filled earlier, and the pumping in February or March was consequently reduced.

Although the monthly CALSIM II model cannot indicate the benefits of the Proposed Action during periods of routine maintenance or during emergency operations in the DMC or California Aqueduct that would be temporarily assisted with the Intertie connection between the two conveyance facilities, it is assumed that with a permanent structure, Reclamation can more easily and quickly respond to maintenance needs and emergencies, and the potential for water supply interruptions would be reduced compared to the No Action. As such, this would be a benefit.

**Impact WS-2: Changes in Central Valley Project South-of-Delta Deliveries**

Table 3.1-16 shows the simulated distribution of monthly and annual (water year) CVP south-of-Delta deliveries for the Future No Action simulation and the Intertie Proposed Action. The monthly and annual changes in the CVP deliveries also are shown. The average annual total CVP delivery was 2,536 taf/yr for the simulated Future No Action Condition. The simulated annual CVP south-of - Delta deliveries ranged from a minimum of 1,325 taf/yr to a maximum of 3,283 taf/yr. The lowest 10% of the years had a delivery of less than 1.5 maf/yr, and the highest 10% of the years had a delivery of more than 3.1 maf/yr. The average annual total CVP delivery with the Proposed Action was increased by 35 taf/yr to 2,571 taf/yr. As described for the Jones Pumping Plant pumping, the Intertie facility was simulated to be used for an average of about 76 taf/yr, but pumping was subsequently reduced in many years when CVP San Luis Reservoir was filled earlier.

Figure 3.1-9 shows the 1922–2003 water-year sequence of simulated CVP south-of-Delta deliveries for the Future No Action conditions. The simulated annual change in CVP south-of-Delta deliveries for the Existing Condition with the Proposed Action is relatively small. The CVP water supply was more than 3.0 maf (i.e., 90% of CVP demand of 3,332 taf) in about 20% of the years. The CVP delivery dropped below 2.0 maf (60% of CVP demand) in about 20% of the years. The CVP delivery was less than 1,500 taf (45% of CVP demand) in about 10% of the years. There are four drought sequences in the historical record, 1924–1926, 1929–1935, 1976–1977, and 1988–1992. All of these years have CVP south-of-Delta deliveries of less than 2,000 taf/yr.

Also shown in Figure 3.1-9 are the Jones Pumping Plant pumping for October–March, which is the period when the Intertie allows slightly more CVP pumping. The years with slightly higher pumping usually are years in which slightly higher CVP deliveries result. The Jones Pumping Plant pumping from October to March is generally about 1,500 taf. The years with reduced pumping in these months lead to reduced CVP San Luis storage, and usually correspond to greatly reduced CVP deliveries in the April–October period. This is because reduced Delta inflows in the fall and winter period correspond to reduced inflows to the upstream CVP reservoirs. This emphasizes the value of the Intertie facility, which will allow CVP to capture slightly more water during the winter in most years.

The average change in CVP deliveries with the Proposed Action was an increase of 35 taf/yr. The minimum annual change was –110 taf (in 1949), and the maximum annual change was 157 taf (in 1975). The changes in CVP deliveries were more than 25 taf in about 50% of the years, and more than 75 taf in about 20% of the years. This simulated increase in CVP deliveries is an average of about 1.5% of the average CVP deliveries. This is considered a beneficial effect for CVP water supply deliveries.

### Impact WS-3: Changes in State Water Project Delta Pumping

Table 3.1-17 shows the monthly cumulative distribution of simulated Banks Pumping Plant pumping for the Future No Action and for the Proposed Action. The simulated Future No Action annual (water year) Banks Pumping Plant pumping ranged from a minimum of 1,055 taf (in 1991) to a maximum of 4,281 taf (in 1982), with an average annual pumping of 3,241 taf/yr. Banks Pumping Plant pumping was generally simulated to be the same with the Intertie Proposed Action and the Future No Action conditions in all months, although there was a slight decrease under the Proposed Action of 3 taf/yr in the average SWP pumping. The reduction in Banks Pumping Plant pumping generally occurred in the same months when the Intertie was operating, allowing slightly more CVP pumping. SWP pumping was simulated to increase slightly in the summer months.

The CALSIM model accounts for three categories of Banks Pumping Plant pumping. Most Banks Pumping Plant pumping is for SWP Table A contract demands (allocations). Some Banks Pumping Plant pumping is wheeling for CVP to deliver Cross Valley Canal water during the summer when there is excess CVP share (under the COA) and Banks Pumping Plant capacity. SWP Article 21 (surplus) water often is pumped in the winter months when SWP San Luis Reservoir is full.

Because the Jones Pumping Plant pumping was increased by about 35 taf/yr and the Banks Pumping Plant pumping was reduced by about 3 taf/yr, the overall change in total pumping was a slight increase of about 32 taf/yr. This is a small change relative to the combined average CVP and SWP pumping, and there would be no adverse effect.

### Impact WS-4: Changes in State Water Project South-of-Delta Deliveries

Table 3.1-18 shows the simulated distribution of monthly and annual (water year) SWP south-of-Delta total deliveries for the simulated Future No Action and the

Intertie Proposed Action. The CALSIM model tracks three categories of SWP deliveries—Table A contract allocation (i.e., firm), Article 21 (i.e., surplus or interruptible), and Article 56 (i.e., held in San Luis Reservoir and delivered in January–March of following year). Article 21 water is available to SWP contractors when SWP San Luis reservoir is full and there is excess water in the Delta. Pumping Article 21 water must not interfere with delivery of allocated Table A water and contractors must use the water directly or store it in local storage facilities. Article 56 water, referred to as carryover water, is Table A water allocated to a contractor in one year but delivered in the following calendar year, provided storage is available in SWP storage facilities." Article 56 water, therefore, was pumped from the Delta in the previous (relatively wet year) and remained in San Luis Reservoir until delivered in the subsequent calendar year. The average simulated total SWP delivery for the Future No Action conditions was 3,407 taf/yr and was 3,406 taf/yr with the Intertie Proposed Action. The average simulated Table A contract allocation delivery was 3,007 taf/yr for the Future No Action and was 3,008 taf/yr for the Intertie Proposed Action. The average simulated Article 21 (surplus) delivery was 286 taf/yr for the Future No Action and was 283 taf/yr for the Intertie Proposed Action. The average simulated Article 56 (carryover) delivery was 113 taf/yr for the Future No Action and was 114 taf/yr for the Intertie Proposed Action.

Figure 3.1-10 shows the 1922–2003 sequence of simulated SWP south-of-Delta total deliveries for the Future No Action and the Intertie Proposed Project. Total simulated Future No Action SWP deliveries ranged from a minimum of 925 taf (in 1977) to a maximum of 5,350 taf (in 1983). The simulated SWP deliveries were very reliable in most years. The deliveries were greater than 3.7 maf (90% of Table A contracts) in 50% of the years. The deliveries were less than 2.0 maf (50% of Table A contracts) in only about 10% of the years. Also shown in Figure 3.1-10 are the simulated Table A deliveries. The simulated maximum Table A delivery was about 4.0 maf, and Table A deliveries were greater than 3.7 maf (90% of Table A contracts) in about 20% of the years for the Future No Action conditions.

The SWP deliveries were not changed by the Intertie because most of the reduced SWP pumping in the winter when additional Jones Pumping Plant pumping was simulated with the Intertie was balanced by additional SWP pumping in March once CVP San Luis was filled, or in the summer months. Therefore, there were no changes in water supply for SWP deliveries from the Intertie Proposed Project and there would be no effect.

### *Alternative 3 (TANC Intertie Site)*

*Construction Effects*

There are no expected changes in water supply during the construction period. The Jones Pumping Plant and the DMC would remain fully operational during construction of the Intertie project.

*Operation Effects*

The operational effects of Alternative 3 are identical to the simulated changes shown for the Proposed Action (Alternative 2) because the operations of the Intertie would be identical.

### *Alternative 4 (Virtual Intertie)*

Under the Virtual Intertie (Alternative 4), the CVP would use the Banks Pumping Plant to convey CVP water to San Luis Reservoir. The permitted pumping capacity at Banks Pumping Plant would not change from the No Action Alternative. Under the No Action Alternative, available CVP water for export that cannot be pumped at Jones Pumping Plant because of the conveyance limitations at Jones Pumping Plant is treated as unused federal share under the COA and can be exported by the SWP at Banks Pumping Plant. This water, often stemming from upstream CVP instream flow or temperature releases, cannot be recovered by the CVP with current pumping restrictions.

Under the Virtual Intertie Alternative, the CVP was assumed to be given up to 400 cfs of priority capacity in Banks Pumping Plant to pump water that is released from CVP reservoirs. Additional CVP pumping during the fall and winter months, when Jones Pumping Plant cannot pump at full capacity of 4,600 cfs, was assumed to be wheeled at the Banks Pumping Plant. The State Water Board would be petitioned to appropriately change the D-1641 JPOD requirements for this wheeling of the CVP share of Delta pumping under the COA. This likely would allow this wheeling under JPOD stage 1, which requires minimum conditions to protect south Delta water users (agricultural diversions).

CVP water recovered by Banks Pumping Plant pumping JPOD may reduce the total water available for SWP export. Through reoperation, the SWP may be able to recover the loss of supply later in the year or may need to reduce deliveries or San Luis storage. Reduced available capacity for the SWP at Banks Pumping Plant may affect the timing of SWP San Luis filling and SWP Article 21 deliveries. More coordination between CVP and SWP operations, and notification and reporting of this JPOD to the Water Board would be required to implement this Virtual Intertie Alternative. However, the physical Intertie facility would not be constructed.

*Construction Effects*

During emergency operations (Jones Pumping Plant or DMC shutoff period), a temporary pumping plant (or siphon) would be installed between the DMC and the California Aqueduct. This would not result in any changes in water supply.

*Operation Effects*

The operational effects of the Virtual Intertie (Alternative 4) would be similar to the Proposed Action (Alternative 2). The water supply effects on CVP and SWP were evaluated based on the CALSIM results from the Proposed Intertie (Alternative 2). This was evaluated by changing the priority for JPOD stage 2 (terms in D-1641) to allow this additional Intertie pumping of any unused federal COA share of upstream CVP storage releases at the Banks Pumping Plant.

The Virtual Intertie would provide the almost the same CVP pumping benefits as the Proposed Action, but in a few years the SWP pumping and Article 21 deliveries would be slightly reduced, unless the Banks Pumping Plant pumping limits were increased.

**Impact WS-1: Changes in Central Valley Project Delta Pumping**

Table 3.1-19 shows the monthly distribution of estimated Jones Pumping Plant pumping for the simulated Existing Condition and the Virtual Intertie. The Virtual Intertie would reduce the Jones Pumping Plant pumping by an average of about 33 taf/yr, because all of the Virtual Intertie pumping would be shifted to the Banks Pumping Plant, and reductions at Jones Pumping Plant would occur in February and March when CVP San Luis Reservoir was filled with the Virtual Intertie pumping.

The bottom panel of Table 3.1-19 shows the distribution of monthly pumping for the Virtual Intertie compared to the Intertie pumping. The reduction in pumping corresponds to the winter months when the Banks Pumping Plant pumping would wheel the Intertie pumping. The Virtual Intertie would allow the CVP pumping to be reduced by about 68 taf/yr compared with the simulated Intertie Alternative.

The monthly CALSIM II model was not used to simulate the Virtual Intertie. Therefore, the CVP deliveries can only be estimated from the change in CVP pumping, with Jones Pumping Plant and CVP wheeling at Banks Pumping Plant combined. This combined pumping was increased by 27 taf/yr, which is similar to the Intertie CVP pumping increment of 35 taf/yr. Therefore the increase in CVP deliveries for the Virtual Intertie was assumed to be nearly identical to the simulated increase in CVP deliveries for the Intertie Alternative and this would be beneficial.

### Impact WS-3: Changes in State Water Project Delta Pumping

Table 3.1-20 shows the monthly cumulative distribution of simulated Banks Pumping Plant pumping for the No Action and for the Virtual Intertie Alternative. Banks Pumping Plant pumping (including the wheeling of CVP Intertie pumping) was estimated to increase by about 48 taf/yr compared to the No Action SWP pumping. The calculated changes in SWP pumping (not including CVP wheeling) was a decrease of about 13 taf/yr for SWP Article 21 pumping and an increase of 3 taf/yr for SWP Table A pumping. Therefore, without an allowed increase in SWP pumping limits during some of the Intertie pumping wheeling periods, a slight reduction in deliveries of SWP Article 21 water would result from the Virtual Intertie. This is a minor change and there would be no adverse effect.

**Table 3.1-1.** Comparison of Clear Creek Tunnel (Trinity Exports) Monthly Flow Distribution (cfs) for Future No Action and Intertie Conditions

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 152 | 6 | 89 |
| **0.1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,250 | 1,275 | 516 | 283 |
| **0.2** | 250 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 18 | 1,500 | 1,500 | 1,000 | 342 |
| **0.3** | 250 | 88 | 2 | 79 | 0 | 100 | 136 | 0 | 112 | 1,500 | 1,500 | 1,438 | 399 |
| **0.4** | 750 | 100 | 100 | 100 | 24 | 100 | 201 | 0 | 189 | 1,500 | 1,622 | 1,500 | 468 |
| **0.5** | 750 | 100 | 104 | 100 | 100 | 100 | 277 | 0 | 250 | 1,500 | 1,750 | 1,500 | 536 |
| **0.6** | 750 | 307 | 154 | 124 | 100 | 112 | 321 | 0 | 687 | 1,888 | 2,000 | 2,000 | 571 |
| **0.7** | 750 | 500 | 250 | 250 | 100 | 192 | 398 | 100 | 750 | 2,000 | 2,029 | 2,000 | 611 |
| **0.8** | 1,653 | 500 | 353 | 755 | 100 | 453 | 447 | 250 | 750 | 2,655 | 2,500 | 2,500 | 703 |
| **0.9** | 1,858 | 522 | 832 | 1,740 | 250 | 1,034 | 907 | 250 | 1,374 | 3,300 | 2,750 | 2,541 | 789 |
| **Max** | 3,300 | 2,161 | 1,645 | 2,651 | 2,745 | 3,300 | 2,603 | 2,914 | 3,300 | 3,300 | 3,300 | 2,909 | 1,205 |
| **Avg** | 816 | 303 | 256 | 451 | 137 | 316 | 379 | 185 | 557 | 1,887 | 1,917 | 1,639 | 533 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 182 | 6 | 107 |
| **0.1** | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,234 | 1,286 | 324 | 278 |
| **0.2** | 250 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 22 | 1,500 | 1,500 | 1,000 | 341 |
| **0.3** | 250 | 100 | 4 | 100 | 0 | 100 | 136 | 0 | 131 | 1,500 | 1,500 | 1,322 | 401 |
| **0.4** | 714 | 100 | 100 | 100 | 4 | 100 | 215 | 0 | 195 | 1,500 | 1,622 | 1,500 | 464 |
| **0.5** | 750 | 175 | 104 | 100 | 100 | 100 | 277 | 0 | 250 | 1,500 | 1,750 | 1,500 | 531 |
| **0.6** | 750 | 369 | 154 | 250 | 100 | 112 | 321 | 0 | 636 | 1,898 | 2,000 | 2,000 | 578 |
| **0.7** | 750 | 500 | 250 | 479 | 100 | 190 | 398 | 100 | 750 | 2,068 | 2,047 | 2,000 | 621 |
| **0.8** | 1,653 | 500 | 353 | 796 | 100 | 387 | 447 | 250 | 750 | 2,678 | 2,500 | 2,500 | 705 |
| **0.9** | 1,858 | 606 | 711 | 1,740 | 250 | 1,034 | 907 | 250 | 1,374 | 3,300 | 2,775 | 2,541 | 805 |
| **Max** | 3,300 | 2,161 | 1,645 | 2,651 | 2,778 | 3,300 | 2,359 | 2,914 | 3,300 | 3,300 | 3,300 | 2,909 | 1,206 |
| **Avg** | 817 | 320 | 255 | 478 | 136 | 310 | 373 | 183 | 565 | 1,881 | 1,926 | 1,630 | 535 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 18 |
| **0.1** | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -16 | 11 | -192 | -5 |
| **0.2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | -1 |
| **0.3** | 0 | 12 | 2 | 21 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | -117 | 2 |
| **0.4** | -36 | 0 | 0 | 0 | -21 | 0 | 14 | 0 | 6 | 0 | 0 | 0 | -4 |
| **0.5** | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -5 |
| **0.6** | 0 | 62 | 0 | 126 | 0 | 0 | 0 | 0 | -51 | 10 | 0 | 0 | 6 |
| **0.7** | 0 | 0 | 0 | 229 | 0 | -3 | 0 | 0 | 0 | 68 | 18 | 0 | 10 |
| **0.8** | 0 | 0 | 0 | 41 | 0 | -66 | 0 | 0 | 0 | 22 | 0 | 0 | 2 |
| **0.9** | 0 | 84 | -121 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 17 |
| **Max** | 0 | 0 | 0 | 0 | 33 | 0 | -244 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Avg** | 0 | 17 | -1 | 27 | 0 | -6 | -5 | -1 | 8 | -6 | 9 | -9 | 2 |

**Table 3.1-2.** Comparison of Monthly Keswick Flow Distribution (cfs) for Future No Action and Intertie Conditions (1922–2003)

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 3,323 | 3,250 | 3,240 | 3,226 | 3,081 | 3,230 | 3,185 | 3,250 | 7,159 | 8,598 | 6,710 | 3,253 | 3,427 |
| **10%** | 4,219 | 3,783 | 3,250 | 3,250 | 3,250 | 3,250 | 3,516 | 4,965 | 8,813 | 10,419 | 8,091 | 4,020 | 4,139 |
| **20%** | 4,500 | 4,354 | 3,408 | 3,253 | 3,250 | 3,250 | 4,459 | 5,988 | 9,323 | 11,869 | 8,674 | 4,433 | 4,536 |
| **30%** | 4,961 | 4,500 | 3,617 | 3,622 | 3,250 | 3,256 | 4,500 | 6,445 | 9,529 | 12,571 | 9,122 | 4,739 | 4,786 |
| **40%** | 5,228 | 4,500 | 4,437 | 4,250 | 4,151 | 4,150 | 5,019 | 7,009 | 9,943 | 12,965 | 9,647 | 5,353 | 5,251 |
| **50%** | 5,680 | 4,678 | 4,500 | 4,500 | 4,500 | 4,500 | 5,447 | 7,388 | 10,630 | 13,853 | 10,094 | 5,780 | 5,721 |
| **60%** | 6,066 | 4,962 | 4,500 | 6,697 | 6,681 | 4,500 | 6,287 | 7,934 | 11,058 | 14,255 | 10,663 | 6,436 | 6,435 |
| **70%** | 6,692 | 5,409 | 5,694 | 8,037 | 11,850 | 7,905 | 6,896 | 9,013 | 11,655 | 14,851 | 10,976 | 6,887 | 6,992 |
| **80%** | 8,201 | 6,469 | 9,332 | 13,041 | 18,699 | 12,965 | 8,030 | 9,412 | 12,709 | 15,000 | 11,777 | 9,027 | 7,644 |
| **90%** | 8,725 | 7,996 | 16,691 | 19,756 | 29,296 | 18,417 | 10,081 | 10,611 | 14,993 | 15,000 | 13,029 | 11,181 | 8,785 |
| **Max** | 9,870 | 29,089 | 30,282 | 52,774 | 53,770 | 46,109 | 29,893 | 16,007 | 19,324 | 15,772 | 14,306 | 12,544 | 12,587 |
| **Avg** | 6,077 | 5,686 | 7,183 | 8,908 | 10,874 | 8,579 | 6,701 | 7,766 | 11,001 | 13,240 | 10,221 | 6,576 | 6,203 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 3,323 | 3,250 | 3,250 | 3,250 | 3,150 | 3,231 | 3,222 | 3,250 | 7,135 | 8,596 | 6,297 | 3,250 | 3,412 |
| **10%** | 4,405 | 3,783 | 3,250 | 3,250 | 3,250 | 3,250 | 3,516 | 4,987 | 8,796 | 10,841 | 7,919 | 4,031 | 4,143 |
| **20%** | 4,500 | 4,262 | 3,408 | 3,252 | 3,250 | 3,250 | 4,460 | 5,973 | 9,314 | 12,065 | 8,732 | 4,456 | 4,560 |
| **30%** | 4,883 | 4,486 | 3,696 | 3,605 | 3,253 | 3,256 | 4,500 | 6,499 | 9,506 | 12,674 | 9,121 | 4,886 | 4,810 |
| **40%** | 5,203 | 4,500 | 4,363 | 4,136 | 4,277 | 4,134 | 4,978 | 7,057 | 9,934 | 13,190 | 9,657 | 5,356 | 5,293 |
| **50%** | 5,589 | 4,698 | 4,500 | 4,500 | 4,500 | 4,500 | 5,338 | 7,352 | 10,660 | 13,910 | 10,059 | 5,894 | 5,733 |
| **60%** | 6,040 | 4,999 | 4,500 | 6,521 | 5,950 | 4,656 | 6,285 | 7,960 | 11,056 | 14,293 | 10,552 | 6,325 | 6,458 |
| **70%** | 6,482 | 5,571 | 5,478 | 7,872 | 10,978 | 7,926 | 6,906 | 9,026 | 11,836 | 14,948 | 10,855 | 6,775 | 6,990 |
| **80%** | 8,197 | 6,600 | 8,937 | 13,041 | 18,699 | 12,965 | 8,039 | 9,494 | 12,915 | 15,000 | 11,878 | 9,086 | 7,667 |
| **90%** | 8,725 | 8,105 | 16,622 | 20,661 | 28,933 | 18,417 | 10,081 | 10,611 | 14,905 | 15,000 | 13,101 | 11,183 | 8,760 |
| **Max** | 9,870 | 29,089 | 30,282 | 52,774 | 53,770 | 46,109 | 29,893 | 16,007 | 19,324 | 15,772 | 14,306 | 12,544 | 12,589 |
| **Avg** | 6,049 | 5,681 | 7,172 | 8,852 | 10,822 | 8,584 | 6,692 | 7,770 | 11,034 | 13,374 | 10,206 | 6,611 | 6,205 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 10 | 24 | 69 | 1 | 37 | 0 | -24 | -2 | -413 | -3 | -15 |
| **10%** | 186 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | -17 | 422 | -172 | 12 | 4 |
| **20%** | 0 | -92 | 0 | -1 | 0 | 0 | 1 | -15 | -10 | 196 | 58 | 23 | 25 |
| **30%** | -78 | -14 | 79 | -17 | 3 | 0 | 0 | 54 | -23 | 102 | -1 | 147 | 24 |
| **40%** | -25 | 0 | -74 | -114 | 126 | -16 | -41 | 48 | -8 | 224 | 10 | 3 | 42 |
| **50%** | -91 | 20 | 0 | 0 | 0 | 0 | -109 | -36 | 29 | 57 | -35 | 114 | 12 |
| **60%** | -26 | 36 | 0 | -176 | -732 | 156 | -3 | 26 | -1 | 39 | -111 | -111 | 23 |
| **70%** | -210 | 162 | -216 | -165 | -872 | 21 | 10 | 13 | 180 | 97 | -121 | -112 | -2 |
| **80%** | -4 | 131 | -395 | 0 | 0 | 0 | 10 | 82 | 205 | 0 | 101 | 59 | 24 |
| **90%** | 0 | 109 | -69 | 905 | -363 | 0 | 0 | 0 | -88 | 0 | 72 | 2 | -25 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Avg** | -27 | -6 | -11 | -55 | -52 | 5 | -9 | 4 | 33 | 134 | -15 | 34 | 2 |

**Table 3.1-3.** Comparison of Monthly Feather River Flow Releases below Thermalito Afterbay Reservoir (cfs) for Future No Action and Intertie Conditions

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 902 | 900 | 900 | 900 | 900 | 800 | 682 | 536 | 1,000 | 1,417 | 674 | 995 | 821 |
| **10%** | 1,581 | 930 | 900 | 900 | 900 | 800 | 858 | 985 | 1,732 | 2,377 | 1,497 | 1,072 | 1,631 |
| **20%** | 2,047 | 1,700 | 1,200 | 1,200 | 1,200 | 1,134 | 1,000 | 1,000 | 2,301 | 3,189 | 2,316 | 1,226 | 1,895 |
| **30%** | 2,867 | 1,700 | 1,700 | 1,700 | 1,700 | 1,700 | 1,000 | 1,024 | 2,956 | 4,623 | 2,853 | 1,316 | 2,151 |
| **40%** | 3,107 | 1,835 | 1,700 | 1,700 | 1,700 | 2,281 | 1,000 | 1,415 | 3,581 | 5,802 | 3,659 | 1,493 | 2,412 |
| **50%** | 3,373 | 2,474 | 1,700 | 1,700 | 2,747 | 4,342 | 1,232 | 1,755 | 4,814 | 6,942 | 4,472 | 1,831 | 2,725 |
| **60%** | 3,799 | 2,500 | 1,854 | 3,017 | 5,594 | 5,331 | 1,901 | 2,121 | 5,611 | 7,885 | 5,234 | 2,208 | 3,326 |
| **70%** | 3,951 | 2,500 | 3,010 | 5,093 | 8,590 | 6,893 | 2,803 | 3,071 | 6,434 | 8,737 | 5,840 | 2,773 | 3,778 |
| **80%** | 3,996 | 2,500 | 4,152 | 8,293 | 11,366 | 10,134 | 4,147 | 5,816 | 6,986 | 9,160 | 7,229 | 3,229 | 4,476 |
| **90%** | 4,000 | 3,439 | 9,053 | 14,317 | 16,507 | 14,383 | 7,791 | 10,314 | 8,182 | 9,715 | 7,619 | 3,623 | 5,304 |
| **Max** | 6,826 | 14,550 | 27,802 | 40,940 | 23,672 | 34,018 | 18,991 | 20,391 | 11,681 | 10,000 | 8,631 | 5,310 | 8,091 |
| **Avg** | 3,232 | 2,481 | 3,789 | 5,540 | 6,261 | 6,353 | 3,090 | 3,761 | 4,849 | 6,414 | 4,530 | 2,163 | 3,165 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 902 | 900 | 823 | 806 | 900 | 799 | 682 | 536 | 1,000 | 1,417 | 674 | 995 | 841 |
| **10%** | 1,700 | 1,170 | 900 | 900 | 900 | 800 | 858 | 983 | 1,790 | 2,387 | 1,500 | 1,028 | 1,667 |
| **20%** | 2,096 | 1,417 | 1,200 | 1,200 | 1,200 | 1,219 | 1,000 | 1,000 | 2,303 | 2,998 | 2,499 | 1,156 | 1,864 |
| **30%** | 2,947 | 1,700 | 1,700 | 1,700 | 1,700 | 1,700 | 1,000 | 1,025 | 2,973 | 4,591 | 3,132 | 1,327 | 2,157 |
| **40%** | 3,223 | 1,715 | 1,700 | 1,700 | 1,700 | 1,946 | 1,000 | 1,426 | 3,779 | 5,650 | 4,013 | 1,477 | 2,405 |
| **50%** | 3,492 | 2,487 | 1,700 | 1,700 | 2,790 | 4,198 | 1,231 | 1,759 | 4,540 | 6,892 | 4,597 | 1,951 | 2,678 |
| **60%** | 3,764 | 2,500 | 2,119 | 2,953 | 5,004 | 5,280 | 1,901 | 2,218 | 5,569 | 8,040 | 5,225 | 2,348 | 3,378 |
| **70%** | 3,957 | 2,500 | 2,917 | 4,559 | 8,590 | 6,944 | 2,801 | 3,178 | 6,500 | 8,759 | 6,179 | 2,765 | 3,778 |
| **80%** | 4,000 | 2,500 | 4,357 | 8,293 | 11,691 | 10,134 | 4,147 | 5,816 | 6,972 | 9,029 | 7,248 | 3,174 | 4,476 |
| **90%** | 4,000 | 2,896 | 9,053 | 14,324 | 16,373 | 14,383 | 7,792 | 10,295 | 8,175 | 9,757 | 7,664 | 3,741 | 5,300 |
| **Max** | 6,826 | 14,550 | 27,802 | 40,940 | 23,672 | 34,018 | 18,991 | 20,391 | 11,681 | 10,000 | 8,601 | 5,082 | 8,090 |
| **Avg** | 3,273 | 2,454 | 3,807 | 5,481 | 6,195 | 6,292 | 3,090 | 3,781 | 4,870 | 6,369 | 4,667 | 2,186 | 3,166 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | -77 | -94 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| **10%** | 119 | 240 | 0 | 0 | 0 | 0 | 0 | -1 | 58 | 10 | 2 | -44 | 36 |
| **20%** | 49 | -283 | 0 | 0 | 0 | 84 | 0 | 0 | 3 | -191 | 183 | -70 | -31 |
| **30%** | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | -32 | 280 | 12 | 6 |
| **40%** | 116 | -119 | 0 | 0 | 0 | -334 | 0 | 11 | 198 | -152 | 354 | -16 | -7 |
| **50%** | 120 | 13 | 0 | 0 | 43 | -145 | -1 | 4 | -274 | -49 | 125 | 120 | -47 |
| **60%** | -35 | 0 | 266 | -64 | -590 | -51 | -1 | 98 | -42 | 155 | -9 | 140 | 52 |
| **70%** | 6 | 0 | -94 | -534 | 0 | 51 | -2 | 107 | 66 | 22 | 339 | -7 | 0 |
| **80%** | 4 | 0 | 205 | 0 | 325 | 0 | 0 | 0 | -13 | -131 | 19 | -55 | 0 |
| **90%** | 0 | -542 | 0 | 7 | -134 | 0 | 0 | -19 | -8 | 43 | 45 | 118 | -4 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -31 | -228 | -1 |
| **Avg** | 41 | -27 | 18 | -59 | -66 | -60 | 1 | 20 | 21 | -44 | 137 | 23 | 0 |

**Table 3.1-4.** Comparison of Simulated Monthly Distribution of Nimbus Dam Releases (cfs) for Future No Action and Intertie Conditions (1922–2003)

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 500 | 500 | 517 | 800 | 800 | 427 | 363 | 305 | 357 | 362 | 346 | 333 | 403 |
| **10%** | 866 | 806 | 850 | 987 | 1,270 | 901 | 985 | 958 | 1,482 | 1,811 | 807 | 801 | 1,066 |
| **20%** | 1,361 | 1,397 | 1,428 | 1,700 | 1,445 | 1,132 | 1,445 | 1,240 | 1,845 | 2,707 | 1,342 | 1,139 | 1,296 |
| **30%** | 1,500 | 1,696 | 1,836 | 1,700 | 1,750 | 1,554 | 1,560 | 1,500 | 2,333 | 2,996 | 1,750 | 1,533 | 1,490 |
| **40%** | 1,500 | 1,925 | 2,000 | 1,750 | 2,607 | 1,759 | 1,885 | 1,789 | 2,597 | 3,520 | 1,758 | 1,535 | 1,812 |
| **50%** | 1,500 | 1,925 | 2,000 | 1,986 | 3,463 | 2,372 | 2,356 | 2,678 | 2,950 | 3,870 | 2,031 | 2,079 | 2,071 |
| **60%** | 1,500 | 2,229 | 2,000 | 2,799 | 4,663 | 3,461 | 3,101 | 3,387 | 3,538 | 4,200 | 2,411 | 2,939 | 2,463 |
| **70%** | 1,500 | 2,612 | 2,316 | 4,632 | 6,379 | 4,162 | 4,179 | 4,021 | 4,137 | 4,702 | 2,712 | 3,721 | 3,058 |
| **80%** | 1,500 | 2,934 | 4,202 | 6,624 | 8,964 | 5,412 | 5,007 | 4,857 | 4,829 | 5,000 | 3,487 | 4,006 | 3,658 |
| **90%** | 1,855 | 3,943 | 7,221 | 10,267 | 11,399 | 7,597 | 6,572 | 8,147 | 6,979 | 5,000 | 4,056 | 4,071 | 4,174 |
| **Max** | 2,931 | 17,288 | 20,136 | 31,359 | 32,179 | 16,588 | 14,433 | 11,301 | 14,191 | 5,701 | 4,736 | 4,949 | 6,132 |
| **Avg** | 1,484 | 2,619 | 3,456 | 4,451 | 5,224 | 3,709 | 3,303 | 3,468 | 3,733 | 3,655 | 2,302 | 2,446 | 2,404 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 618 | 500 | 517 | 800 | 800 | 427 | 363 | 305 | 357 | 362 | 346 | 395 | 403 |
| **10%** | 885 | 861 | 850 | 1,072 | 1,270 | 867 | 985 | 971 | 1,724 | 1,807 | 807 | 801 | 1,071 |
| **20%** | 1,388 | 1,428 | 1,416 | 1,700 | 1,445 | 1,128 | 1,445 | 1,292 | 1,980 | 2,696 | 1,303 | 1,132 | 1,315 |
| **30%** | 1,500 | 1,733 | 1,836 | 1,700 | 1,788 | 1,518 | 1,699 | 1,497 | 2,280 | 2,972 | 1,750 | 1,533 | 1,494 |
| **40%** | 1,500 | 1,925 | 2,000 | 1,761 | 2,471 | 1,750 | 1,997 | 1,774 | 2,607 | 3,454 | 1,760 | 1,572 | 1,823 |
| **50%** | 1,500 | 1,925 | 2,000 | 2,027 | 3,366 | 2,316 | 2,523 | 2,678 | 3,021 | 3,804 | 1,960 | 2,279 | 2,039 |
| **60%** | 1,500 | 2,282 | 2,000 | 2,845 | 4,727 | 3,403 | 3,119 | 3,377 | 3,497 | 4,125 | 2,361 | 2,702 | 2,482 |
| **70%** | 1,500 | 2,543 | 2,300 | 4,632 | 6,252 | 4,282 | 4,207 | 4,025 | 4,114 | 4,730 | 2,798 | 3,672 | 3,055 |
| **80%** | 1,500 | 2,911 | 3,924 | 6,658 | 8,893 | 5,394 | 5,007 | 4,862 | 4,828 | 5,000 | 3,568 | 3,989 | 3,659 |
| **90%** | 1,770 | 3,943 | 7,204 | 10,259 | 11,378 | 7,575 | 6,572 | 8,147 | 6,979 | 5,000 | 4,056 | 4,066 | 4,180 |
| **Max** | 2,884 | 17,233 | 20,206 | 31,318 | 32,178 | 16,671 | 14,432 | 11,301 | 14,191 | 5,701 | 4,736 | 4,949 | 6,133 |
| **Avg** | 1,477 | 2,619 | 3,444 | 4,464 | 5,195 | 3,697 | 3,317 | 3,475 | 3,763 | 3,640 | 2,292 | 2,447 | 2,403 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 0 |
| **10%** | 19 | 54 | 0 | 84 | 0 | -34 | 0 | 13 | 241 | -4 | 0 | 0 | 5 |
| **20%** | 27 | 31 | -11 | 0 | 0 | -4 | 0 | 51 | 135 | -11 | -39 | -7 | 18 |
| **30%** | 0 | 38 | 0 | 0 | 38 | -36 | 139 | -3 | -53 | -24 | 0 | 0 | 4 |
| **40%** | 0 | 0 | 0 | 11 | -137 | -9 | 112 | -14 | 9 | -66 | 2 | 38 | 11 |
| **50%** | 0 | 0 | 0 | 41 | -96 | -56 | 167 | 0 | 71 | -66 | -71 | 201 | -32 |
| **60%** | 0 | 53 | 0 | 46 | 64 | -58 | 18 | -11 | -41 | -75 | -50 | -237 | 18 |
| **70%** | 0 | -69 | -16 | 0 | -127 | 121 | 28 | 3 | -23 | 28 | 86 | -49 | -3 |
| **80%** | 0 | -23 | -277 | 34 | -72 | -18 | 0 | 5 | -1 | 0 | 82 | -17 | 1 |
| **90%** | -85 | 0 | -17 | -8 | -21 | -21 | 0 | 0 | 0 | 0 | 0 | -5 | 6 |
| **Max** | -46 | -55 | 70 | -41 | 0 | 83 | -1 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Avg** | -8 | 0 | -12 | 13 | -29 | -12 | 15 | 7 | 30 | -14 | -10 | 0 | -1 |

**Table 3.1-5.** Comparison of Monthly Sacramento River Flows at Freeport (cfs) for Future No Action and Intertie Conditions

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 4,826 | 7,134 | 7,289 | 10,076 | 8,225 | 8,094 | 8,055 | 5,327 | 8,281 | 8,727 | 7,710 | 6,414 | 6,519 |
| **10%** | 7,727 | 8,579 | 11,132 | 13,062 | 13,516 | 12,205 | 9,752 | 8,519 | 11,146 | 11,139 | 9,442 | 8,169 | 8,398 |
| **20%** | 9,131 | 9,837 | 12,495 | 14,311 | 16,397 | 15,219 | 10,818 | 9,944 | 12,968 | 14,129 | 10,988 | 9,854 | 10,285 |
| **30%** | 9,834 | 10,811 | 14,149 | 15,924 | 21,052 | 19,215 | 11,686 | 11,188 | 14,073 | 16,479 | 13,602 | 11,155 | 11,725 |
| **40%** | 10,756 | 11,680 | 15,767 | 19,260 | 24,129 | 22,146 | 12,658 | 11,970 | 14,987 | 17,803 | 14,332 | 12,038 | 12,589 |
| **50%** | 11,271 | 12,174 | 16,951 | 23,710 | 33,989 | 28,088 | 15,903 | 13,240 | 15,842 | 19,115 | 15,016 | 12,664 | 13,726 |
| **60%** | 11,495 | 12,975 | 20,650 | 31,550 | 47,626 | 33,783 | 21,017 | 14,802 | 16,907 | 20,183 | 15,358 | 13,478 | 18,274 |
| **70%** | 11,996 | 14,898 | 25,051 | 44,578 | 57,721 | 43,858 | 24,465 | 18,335 | 19,042 | 21,631 | 15,910 | 14,491 | 20,083 |
| **80%** | 13,375 | 16,096 | 37,351 | 58,885 | 69,432 | 58,584 | 38,312 | 28,596 | 20,199 | 22,358 | 16,714 | 17,282 | 21,918 |
| **90%** | 15,632 | 25,518 | 63,363 | 73,144 | 74,453 | 70,464 | 53,205 | 42,311 | 25,376 | 23,254 | 17,261 | 19,495 | 26,309 |
| **Max** | 33,592 | 65,134 | 75,563 | 78,593 | 79,108 | 77,741 | 74,939 | 66,672 | 64,168 | 24,427 | 20,837 | 26,245 | 34,745 |
| **Avg** | 11,560 | 15,285 | 26,235 | 33,778 | 39,808 | 34,389 | 23,749 | 19,323 | 18,184 | 18,355 | 14,297 | 13,336 | 16,187 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 5,249 | 7,130 | 7,300 | 9,388 | 8,223 | 8,121 | 8,053 | 4,941 | 8,295 | 9,085 | 7,890 | 6,409 | 6,692 |
| **10%** | 7,716 | 8,478 | 11,023 | 12,676 | 13,478 | 12,224 | 9,752 | 8,534 | 11,149 | 11,168 | 9,938 | 8,028 | 8,467 |
| **20%** | 9,175 | 9,724 | 12,699 | 14,274 | 16,170 | 15,222 | 10,781 | 10,385 | 12,905 | 14,624 | 11,075 | 10,155 | 10,319 |
| **30%** | 9,772 | 10,731 | 14,566 | 15,412 | 20,869 | 19,090 | 11,674 | 11,221 | 14,070 | 16,560 | 13,428 | 11,152 | 11,767 |
| **40%** | 10,669 | 11,738 | 15,763 | 19,571 | 24,169 | 22,082 | 12,657 | 11,970 | 15,149 | 17,932 | 14,295 | 12,110 | 12,521 |
| **50%** | 11,280 | 12,624 | 16,930 | 23,556 | 33,789 | 28,071 | 15,903 | 13,216 | 15,995 | 18,880 | 15,064 | 12,700 | 13,782 |
| **60%** | 11,610 | 13,157 | 20,678 | 31,594 | 46,600 | 33,525 | 21,019 | 14,762 | 17,444 | 20,272 | 15,506 | 13,508 | 18,269 |
| **70%** | 11,953 | 14,747 | 25,047 | 44,398 | 57,971 | 43,848 | 24,550 | 18,338 | 18,938 | 21,662 | 16,096 | 14,574 | 20,054 |
| **80%** | 13,549 | 15,821 | 36,980 | 58,765 | 69,079 | 58,473 | 38,317 | 28,595 | 20,088 | 22,367 | 16,785 | 17,221 | 21,926 |
| **90%** | 15,636 | 25,506 | 63,364 | 72,857 | 74,457 | 70,568 | 53,207 | 42,313 | 25,382 | 23,414 | 17,339 | 19,498 | 26,293 |
| **Max** | 32,979 | 65,135 | 75,563 | 78,588 | 79,089 | 77,740 | 74,939 | 66,673 | 64,169 | 24,483 | 20,838 | 26,247 | 34,740 |
| **Avg** | 11,576 | 15,260 | 26,237 | 33,659 | 39,637 | 34,320 | 23,754 | 19,347 | 18,254 | 18,422 | 14,391 | 13,393 | 16,184 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 423 | -4 | 12 | -688 | -3 | 26 | -2 | -386 | 15 | 358 | 179 | -5 | 172 |
| **10%** | -10 | -102 | -108 | -385 | -38 | 19 | 0 | 15 | 3 | 28 | 496 | -141 | 68 |
| **20%** | 44 | -113 | 204 | -37 | -227 | 3 | -37 | 441 | -63 | 495 | 87 | 301 | 33 |
| **30%** | -62 | -80 | 418 | -512 | -183 | -125 | -12 | 33 | -3 | 81 | -174 | -3 | 42 |
| **40%** | -88 | 58 | -4 | 311 | 41 | -64 | 0 | 0 | 163 | 129 | -37 | 72 | -68 |
| **50%** | 9 | 450 | -22 | -154 | -200 | -18 | 0 | -24 | 153 | -235 | 48 | 35 | 55 |
| **60%** | 115 | 181 | 27 | 44 | -1,026 | -258 | 2 | -39 | 537 | 89 | 149 | 30 | -4 |
| **70%** | -42 | -152 | -3 | -180 | 250 | -10 | 84 | 4 | -104 | 30 | 187 | 84 | -29 |
| **80%** | 174 | -275 | -371 | -120 | -354 | -111 | 5 | -1 | -111 | 9 | 71 | -61 | 9 |
| **90%** | 4 | -12 | 1 | -287 | 4 | 103 | 1 | 2 | 5 | 160 | 78 | 3 | -15 |
| **Max** | -613 | 1 | 0 | -5 | -20 | 0 | 0 | 1 | 1 | 56 | 1 | 2 | -5 |
| **Avg** | 16 | -25 | 1 | -119 | -171 | -69 | 4 | 24 | 71 | 68 | 94 | 56 | -3 |

**Table 3.1-6.** Comparison of Monthly San Joaquin River flows at Vernalis (cfs) for Future No Action and Intertie Conditions

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 1,134 | 1,373 | 1,379 | 1,108 | 1,606 | 1,183 | 1,174 | 1,152 | 574 | 549 | 666 | 930 | 879 |
| **10%** | 1,506 | 1,659 | 1,667 | 1,469 | 1,867 | 1,670 | 1,706 | 2,061 | 1,071 | 918 | 1,032 | 1,428 | 1,128 |
| **20%** | 1,772 | 1,796 | 1,802 | 1,653 | 1,987 | 1,826 | 2,457 | 2,712 | 1,253 | 1,122 | 1,180 | 1,612 | 1,330 |
| **30%** | 1,878 | 1,896 | 1,916 | 1,939 | 2,198 | 2,035 | 2,576 | 2,987 | 1,393 | 1,188 | 1,255 | 1,700 | 1,538 |
| **40%** | 2,025 | 1,992 | 1,972 | 2,111 | 2,505 | 2,553 | 3,296 | 3,584 | 1,691 | 1,337 | 1,335 | 1,776 | 1,737 |
| **50%** | 2,194 | 2,121 | 2,126 | 2,331 | 3,185 | 2,929 | 4,456 | 4,279 | 1,931 | 1,509 | 1,426 | 1,884 | 1,884 |
| **60%** | 2,498 | 2,290 | 2,219 | 2,497 | 4,562 | 4,857 | 5,210 | 5,073 | 2,486 | 1,762 | 1,729 | 2,212 | 2,606 |
| **70%** | 2,702 | 2,457 | 2,436 | 3,490 | 6,491 | 6,705 | 6,181 | 5,728 | 3,090 | 2,153 | 2,359 | 2,517 | 3,299 |
| **80%** | 2,937 | 2,713 | 2,879 | 4,932 | 9,515 | 8,477 | 7,480 | 7,655 | 7,220 | 3,557 | 2,719 | 2,771 | 4,471 |
| **90%** | 3,623 | 2,996 | 4,660 | 9,690 | 15,465 | 14,429 | 11,803 | 14,264 | 13,613 | 7,256 | 4,224 | 4,089 | 5,957 |
| **Max** | 7,489 | 16,671 | 24,085 | 60,018 | 34,345 | 48,461 | 27,377 | 26,252 | 28,119 | 23,849 | 9,141 | 7,882 | 15,956 |
| **Avg** | 2,435 | 2,511 | 3,326 | 4,783 | 6,505 | 6,257 | 5,805 | 6,123 | 4,579 | 3,220 | 2,046 | 2,341 | 3,012 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 1,135 | 1,373 | 1,379 | 1,108 | 1,606 | 1,183 | 1,175 | 1,153 | 575 | 550 | 668 | 930 | 879 |
| **10%** | 1,506 | 1,659 | 1,667 | 1,469 | 1,867 | 1,670 | 1,706 | 2,061 | 1,074 | 918 | 1,032 | 1,428 | 1,128 |
| **20%** | 1,772 | 1,796 | 1,802 | 1,653 | 1,987 | 1,826 | 2,457 | 2,712 | 1,253 | 1,123 | 1,181 | 1,612 | 1,330 |
| **30%** | 1,878 | 1,896 | 1,916 | 1,939 | 2,198 | 2,035 | 2,577 | 2,988 | 1,394 | 1,191 | 1,256 | 1,701 | 1,538 |
| **40%** | 2,025 | 1,992 | 1,972 | 2,111 | 2,505 | 2,554 | 3,296 | 3,585 | 1,692 | 1,338 | 1,336 | 1,777 | 1,737 |
| **50%** | 2,195 | 2,121 | 2,126 | 2,331 | 3,186 | 2,929 | 4,457 | 4,279 | 1,931 | 1,512 | 1,427 | 1,884 | 1,884 |
| **60%** | 2,498 | 2,290 | 2,219 | 2,497 | 4,562 | 4,855 | 5,210 | 5,074 | 2,487 | 1,763 | 1,732 | 2,212 | 2,607 |
| **70%** | 2,702 | 2,457 | 2,436 | 3,490 | 6,490 | 6,705 | 6,181 | 5,728 | 3,090 | 2,154 | 2,359 | 2,518 | 3,299 |
| **80%** | 2,937 | 2,713 | 2,879 | 4,932 | 9,516 | 8,477 | 7,480 | 7,655 | 7,223 | 3,560 | 2,719 | 2,771 | 4,471 |
| **90%** | 3,624 | 2,996 | 4,660 | 9,690 | 15,462 | 14,428 | 11,803 | 14,264 | 13,613 | 7,256 | 4,224 | 4,089 | 5,957 |
| **Max** | 7,489 | 16,671 | 24,085 | 60,018 | 34,345 | 48,461 | 27,377 | 26,252 | 28,119 | 23,849 | 9,141 | 7,882 | 15,956 |
| **Avg** | 2,435 | 2,511 | 3,326 | 4,783 | 6,504 | 6,257 | 5,805 | 6,123 | 4,580 | 3,221 | 2,047 | 2,341 | 3,013 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | -1 | 0 | 0 | -2 | -5 | -4 | -3 | -2 | -2 | -4 | -2 | -1 | -1 |
| **10%** | 0 | 0 | 0 | 0 | -1 | -2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **20%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **40%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **50%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **60%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **70%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| **80%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 1 | 0 |
| **90%** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 | 1 | 1 |
| **Max** | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 3 | 3 | 5 | 3 | 3 | 1 |
| **Avg** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

**Table 3.1-7.** Comparison of Monthly CVP San Luis Reservoir Storage (taf) for No Action and Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No-Action** | | | | | | | | | | | | |
| **Min** | 45 | 46 | 257 | 418 | 552 | 561 | 535 | 417 | 309 | 45 | 45 | 45 |
| **10%** | 152 | 258 | 411 | 574 | 669 | 766 | 713 | 582 | 376 | 127 | 45 | 78 |
| **20%** | 171 | 321 | 489 | 648 | 759 | 816 | 792 | 625 | 385 | 170 | 74 | 99 |
| **30%** | 185 | 326 | 504 | 664 | 790 | 876 | 841 | 639 | 415 | 212 | 94 | 117 |
| **40%** | 208 | 338 | 525 | 698 | 809 | 915 | 867 | 658 | 449 | 255 | 124 | 149 |
| **50%** | 240 | 369 | 542 | 725 | 840 | 947 | 882 | 704 | 484 | 294 | 161 | 167 |
| **60%** | 268 | 401 | 576 | 744 | 862 | 972 | 897 | 745 | 526 | 371 | 194 | 202 |
| **70%** | 317 | 436 | 605 | 765 | 892 | 972 | 927 | 772 | 578 | 415 | 234 | 241 |
| **80%** | 341 | 468 | 639 | 785 | 927 | 972 | 972 | 839 | 636 | 448 | 274 | 282 |
| **90%** | 401 | 559 | 742 | 891 | 972 | 972 | 972 | 914 | 726 | 522 | 375 | 352 |
| **Max** | 771 | 920 | 972 | 972 | 972 | 972 | 972 | 972 | 881 | 746 | 646 | 685 |
| **Avg** | 263 | 392 | 564 | 722 | 832 | 904 | 865 | 721 | 514 | 315 | 183 | 200 |
| **B. Intertie** | | | | | | | | | | | | |
| **Min** | 45 | 55 | 283 | 369 | 580 | 595 | 568 | 448 | 230 | 45 | 45 | 50 |
| **10%** | 144 | 283 | 442 | 592 | 712 | 830 | 764 | 605 | 387 | 125 | 45 | 90 |
| **20%** | 176 | 333 | 528 | 714 | 808 | 882 | 825 | 646 | 406 | 167 | 56 | 104 |
| **30%** | 191 | 349 | 545 | 734 | 861 | 921 | 866 | 669 | 441 | 213 | 95 | 123 |
| **40%** | 210 | 368 | 569 | 753 | 885 | 967 | 885 | 703 | 468 | 271 | 124 | 151 |
| **50%** | 238 | 383 | 582 | 781 | 917 | 972 | 903 | 726 | 496 | 312 | 166 | 176 |
| **60%** | 287 | 425 | 615 | 809 | 951 | 972 | 923 | 749 | 560 | 388 | 208 | 207 |
| **70%** | 340 | 471 | 666 | 836 | 972 | 972 | 941 | 799 | 601 | 432 | 251 | 265 |
| **80%** | 371 | 526 | 704 | 879 | 972 | 972 | 972 | 840 | 659 | 469 | 307 | 297 |
| **90%** | 450 | 590 | 785 | 956 | 972 | 972 | 972 | 914 | 726 | 528 | 379 | 391 |
| **Max** | 801 | 970 | 972 | 972 | 972 | 972 | 972 | 972 | 881 | 746 | 653 | 701 |
| **Avg** | 276 | 417 | 605 | 779 | 883 | 927 | 885 | 738 | 528 | 324 | 191 | 211 |
| **C. Intertie minus No Action** | | | | | | | | | | | | |
| **Min** | 0 | 9 | 25 | -49 | 28 | 35 | 33 | 31 | -79 | 0 | 0 | 5 |
| **10%** | -8 | 25 | 31 | 17 | 43 | 64 | 51 | 23 | 11 | -2 | 0 | 11 |
| **20%** | 5 | 12 | 38 | 66 | 48 | 66 | 33 | 21 | 21 | -3 | -18 | 4 |
| **30%** | 6 | 24 | 40 | 70 | 71 | 45 | 25 | 29 | 26 | 2 | 1 | 6 |
| **40%** | 3 | 31 | 44 | 55 | 75 | 51 | 18 | 45 | 19 | 16 | 1 | 2 |
| **50%** | -2 | 14 | 40 | 56 | 77 | 25 | 20 | 22 | 12 | 18 | 4 | 9 |
| **60%** | 18 | 24 | 40 | 65 | 89 | 0 | 26 | 4 | 34 | 17 | 14 | 5 |
| **70%** | 23 | 34 | 61 | 72 | 80 | 0 | 14 | 27 | 23 | 16 | 17 | 24 |
| **80%** | 30 | 58 | 65 | 94 | 45 | 0 | 0 | 1 | 23 | 21 | 33 | 14 |
| **90%** | 49 | 31 | 43 | 65 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 39 |
| **Max** | 31 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 15 |
| **Avg** | 13 | 25 | 41 | 57 | 51 | 23 | 20 | 16 | 14 | 9 | 8 | 11 |

**Table 3.1-8.** Comparison of Monthly SWP San Luis Reservoir Storage (taf) for No Action and Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No-Action** | | | | | | | | | | | | |
| **Min** | 55 | 55 | 55 | 203 | 308 | 425 | 352 | 275 | 55 | 64 | 70 | 67 |
| **10%** | 140 | 184 | 304 | 545 | 704 | 749 | 612 | 458 | 272 | 226 | 171 | 140 |
| **20%** | 206 | 246 | 454 | 686 | 876 | 926 | 823 | 574 | 381 | 305 | 224 | 185 |
| **30%** | 251 | 365 | 532 | 784 | 961 | 1,006 | 882 | 661 | 449 | 342 | 271 | 251 |
| **40%** | 321 | 419 | 624 | 885 | 1,026 | 1,048 | 913 | 698 | 517 | 383 | 298 | 308 |
| **50%** | 400 | 486 | 707 | 973 | 1,067 | 1,064 | 932 | 733 | 554 | 421 | 338 | 337 |
| **60%** | 443 | 553 | 783 | 1,026 | 1,067 | 1,067 | 962 | 777 | 609 | 483 | 391 | 380 |
| **70%** | 596 | 679 | 869 | 1,067 | 1,067 | 1,067 | 986 | 841 | 680 | 549 | 495 | 550 |
| **80%** | 704 | 796 | 1,029 | 1,067 | 1,067 | 1,067 | 1,024 | 916 | 763 | 629 | 587 | 634 |
| **90%** | 1,018 | 1,066 | 1,067 | 1,067 | 1,067 | 1,067 | 1,030 | 988 | 902 | 865 | 829 | 889 |
| **Max** | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 | 1,057 | 1,030 | 1,030 | 1,061 | 1,021 | 1,063 |
| **Avg** | 463 | 537 | 690 | 877 | 960 | 982 | 889 | 728 | 566 | 473 | 404 | 417 |
| **B. Intertie** | | | | | | | | | | | | |
| **Min** | 67 | 55 | 55 | 201 | 318 | 418 | 349 | 256 | 55 | 64 | 55 | 89 |
| **10%** | 163 | 151 | 287 | 504 | 745 | 742 | 598 | 403 | 272 | 234 | 191 | 159 |
| **20%** | 199 | 232 | 412 | 668 | 809 | 887 | 831 | 585 | 385 | 279 | 234 | 195 |
| **30%** | 243 | 378 | 522 | 762 | 942 | 997 | 879 | 656 | 448 | 342 | 274 | 239 |
| **40%** | 317 | 420 | 612 | 892 | 1,016 | 1,052 | 902 | 690 | 508 | 381 | 301 | 289 |
| **50%** | 365 | 476 | 669 | 966 | 1,051 | 1,067 | 923 | 735 | 545 | 423 | 335 | 342 |
| **60%** | 451 | 529 | 785 | 1,026 | 1,067 | 1,067 | 959 | 772 | 587 | 475 | 390 | 385 |
| **70%** | 595 | 668 | 851 | 1,067 | 1,067 | 1,067 | 977 | 822 | 685 | 536 | 500 | 565 |
| **80%** | 686 | 791 | 1,016 | 1,067 | 1,067 | 1,067 | 1,020 | 924 | 766 | 630 | 558 | 625 |
| **90%** | 1,005 | 1,065 | 1,067 | 1,067 | 1,067 | 1,067 | 1,035 | 989 | 906 | 875 | 828 | 893 |
| **Max** | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 | 1,067 | 1,062 | 1,030 | 1,030 | 1,061 | 1,021 | 1,063 |
| **Avg** | 461 | 528 | 680 | 870 | 952 | 979 | 885 | 725 | 561 | 469 | 407 | 418 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | |
| **Min** | 12 | 0 | 0 | -1 | 9 | -7 | -2 | -19 | 0 | 0 | -15 | 22 |
| **10%** | 23 | -34 | -17 | -41 | 41 | -7 | -14 | -55 | 0 | 8 | 20 | 19 |
| **20%** | -7 | -15 | -42 | -18 | -67 | -39 | 8 | 11 | 4 | -26 | 10 | 10 |
| **30%** | -8 | 13 | -10 | -22 | -19 | -9 | -3 | -5 | -1 | 0 | 3 | -11 |
| **40%** | -3 | 1 | -12 | 7 | -10 | 4 | -11 | -9 | -9 | -2 | 2 | -20 |
| **50%** | -35 | -10 | -38 | -7 | -16 | 3 | -9 | 2 | -9 | 2 | -3 | 5 |
| **60%** | 9 | -24 | 2 | 0 | 0 | 0 | -3 | -5 | -22 | -8 | -1 | 5 |
| **70%** | -1 | -11 | -18 | 0 | 0 | 0 | -8 | -19 | 5 | -12 | 5 | 16 |
| **80%** | -18 | -5 | -13 | 0 | 0 | 0 | -4 | 9 | 3 | 2 | -29 | -8 |
| **90%** | -13 | -1 | 0 | 0 | 0 | 0 | 5 | 1 | 5 | 10 | -2 | 4 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| **Avg** | -1 | -9 | -10 | -7 | -8 | -3 | -5 | -3 | -4 | -4 | 3 | 2 |

**Table 3.1-9.** CVP DMC Demands (Full Contract Amounts) and Jones Pumping Plant Pumping Capacity

| Month | CVP Delta-Mendota Canal Demands (taf) | Maximum Volume at 4,600 cfs Jones Pumping Plant Capacity (taf) | Additional Needed from San Luis Reservoir (taf) |
|---|---|---|---|
| October | 204 | 283 | – |
| November | 123 | 274 | – |
| December | 107 | 283 | – |
| January | 137 | 283 | – |
| February | 166 | 255 | – |
| March | 192 | 283 | – |
| April | 236 | 274 | – |
| May | 344 | 283 | 61 |
| June | 502 | 274 | 228 |
| July | 583 | 283 | 300 |
| August | 476 | 283 | 193 |
| September | 262 | 274 | – |
| Total | 3,332 | 3,332 | 782 |

CVP = Central Valley Project.

taf = thousand acre-feet.

**Table 3.1-10.** Assumed Monthly Maximum Jones Pumping Plant Pumping

| Month | Future No Action Maximum Jones Pumping Plant Pumping Capacity (cfs) | Intertie Maximum Jones Pumping Plant Pumping Capacity (cfs) | Difference in Jones Pumping Plant Pumping Capacity (cfs) |
|---|---|---|---|
| October | 4,387 | 4,600 | 213 |
| November | 4,264 | 4,600 | 336 |
| December | 4,226 | 4,600 | 374 |
| January | 4,231 | 4,600 | 369 |
| February | 4,253 | 4,600 | 347 |
| March | 4,300 | 4,600 | 300 |
| April | 3,518 | 3,745 | 227 |
| May | 3,000 | 3,000 | 0 |
| June | 3,000 | 3,000 | 0 |
| July | 4,600 | 4,600 | 0 |
| August | 4,600 | 4,600 | 0 |
| September | 4,490 | 4,600 | 110 |
| Total (taf) | 2,951 | 3,087 | 136 |

cfs = cubic feet per second.

taf = thousand acre-feet.

**Table 3.1-11.** Banks Pumping Plant Demands (Table A Contract Amounts) and Maximum Pumping Capacity

| Month | Banks Pumping Plant Demand (taf) | Maximum Volume at 6,680 cfs Banks Pumping Plant Capacity (taf) | Additional Needed from San Luis Reservoir (taf) |
|---|---|---|---|
| **October** | 295 | 411 | – |
| **November** | 261 | 397 | – |
| **December** | 245 | 411 | – |
| **January** | 173 | 411 | – |
| **February** | 203 | 371 | – |
| **March** | 235 | 411 | – |
| **April** | 302 | 397 | – |
| **May** | 407 | 411 | – |
| **June** | 520 | 397 | 123 |
| **July** | 541 | 411 | 130 |
| **August** | 532 | 411 | 121 |
| **September** | 404 | 397 | 7 |
| **Total** | 4,118 | 4,836 | 381 |

taf = thousand acre-feet.

**Table 3.1-12.** Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2005

| Canals (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Delta Pumping** | | | | | | | | | | | | | |
| Contra Costa | 6,503 | 10,143 | 2,444 | 7,761 | 16,498 | 19,980 | 17,289 | 15,234 | 10,660 | 11,462 | 4,809 | 740 | 123,523 |
| Delta-Mendota | 259,293 | 215,968 | 207,613 | 125,999 | 65,875 | 247,959 | 268,964 | 271,049 | 259,526 | 266,552 | 254,621 | 262,410 | 2,705,829 |
| Jones Pumping Plant (cfs) | 4,215 | 3,887 | 3,375 | 2,116 | 1,071 | 4,165 | 4,372 | 4,406 | 4,359 | 4,333 | 4,277 | 4,265 | 3,736 |
| **B. Upper Delta-Mendota Canal (af)** | | | | | | | | | | | | | |
| Banta Carbona ID | 0 | 0 | 0 | 0 | 13 | 164 | 987 | 177 | 0 | 0 | 274 | 0 | 1,615 |
| Broadview WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Byron Bethany ID | 16 | 15 | 24 | 203 | 407 | 512 | 668 | 575 | 425 | 207 | 49 | 21 | 3,122 |
| Centinella WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Del Puerto WD | 10 | 56 | 1,044 | 6,561 | 10,396 | 12,850 | 19,127 | 14,724 | 8,656 | 4,986 | 1,951 | 567 | 80,928 |
| DWR Intertie at MP7.70-R | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eagle Field WD | 0 | 103 | 1 | 184 | 98 | 541 | 659 | 650 | 7 | 163 | 125 | 13 | 2,544 |
| Mercy Springs WD | 0 | 0 | 0 | 43 | 12 | 75 | 142 | 12 | 250 | 31 | 0 | 0 | 565 |
| Newman Wasteway | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oro Loma WD | 0 | 37 | 0 | 0 | 0 | 36 | 67 | 41 | 0 | 0 | 0 | 0 | 181 |
| Panoche WD—Ag | 102 | 289 | 148 | 429 | 670 | 1,181 | 1,460 | 811 | 105 | 2 | 8 | 143 | 5,348 |
| Panoche WD—M&I | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 24 |
| Patterson WD | 0 | 123 | 33 | 245 | 485 | 596 | 1,448 | 962 | 1,666 | 422 | 168 | 73 | 6,221 |
| San Luis WD—Ag | 175 | 646 | 769 | 678 | 645 | 2,171 | 2,902 | 2,014 | 631 | 148 | 117 | 7 | 10,903 |
| San Luis WS—M&I | 1 | 1 | 1 | 1 | 20 | 34 | 32 | 33 | 27 | 21 | 10 | 1 | 182 |
| Tracy, City of | 29 | 249 | 681 | 898 | 1,152 | 1,245 | 1,159 | 1,217 | 1,103 | 804 | 404 | 0 | 8,941 |
| West Side ID | 0 | 0 | 0 | 0 | 107 | 37 | 298 | 402 | 21 | 0 | 0 | 0 | 865 |
| Widren | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W. Stanislaus ID | 0 | 1 | 279 | 2,630 | 3,271 | 2,686 | 6,266 | 8,497 | 5,598 | 3,617 | 1,789 | 590 | 35,224 |
| **Subtotal** | **335** | **1,522** | **2,982** | **11,874** | **17,278** | **22,130** | **35,217** | **30,117** | **18,491** | **10,403** | **4,897** | **1,417** | **156,663** |
| **Exchange Contractors** | | | | | | | | | | | | | |
| Central California ID—above | 452 | 0 | 189 | 926 | 1,583 | 1,670 | 2,144 | 2,886 | 1,952 | 626 | 498 | 746 | 13,672 |

| Canals (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central California ID—below | 0 | 414 | 946 | 291 | 736 | 9,015 | 21,629 | 16,279 | 191 | 147 | 1,372 | 2,646 | 53,666 |
| Firebaugh Canal Co | 0 | 1,291 | 0 | 264 | 137 | 4,560 | 7,233 | 7,164 | 268 | 577 | 339 | 785 | 22,618 |
| **Subtotal** | **452** | **1,705** | **1,135** | **1,481** | **2,456** | **15,245** | **31,006** | **26,329** | **2,411** | **1,350** | **2,209** | **4,177** | **89,956** |
| **Refuges** | | | | | | | | | | | | | |
| China Island—76.05 | 0 | 0 | 369 | 368 | 0 | 351 | 608 | 490 | 0 | 0 | 491 | 1,133 | 3,810 |
| Freitas Unit—76.05L | 0 | 0 | 335 | 507 | 0 | 458 | 473 | 236 | 0 | 0 | 845 | 1,023 | 3,877 |
| Salt Slough Unit—76.05L | 0 | 0 | 899 | 488 | 0 | 1,016 | 875 | 799 | 0 | 0 | 1,061 | 1,424 | 6,562 |
| Los Banos WMA—76.05L (DF) | 0 | 0 | 542 | 524 | 0 | 668 | 584 | 874 | 0 | 0 | 1,141 | 1,263 | 5,596 |
| Volta Wildlife Mgmt Area | 22 | 89 | 0 | 0 | 0 | 0 | 0 | 505 | 2,677 | 2,548 | 1,834 | 1,130 | 8,805 |
| Grasslands WD—76.05L | 2,043 | 2,460 | 3,373 | 2,870 | 6,883 | 4,926 | 1,520 | 5,468 | 16,334 | 14,370 | 4,752 | 4,892 | 69,891 |
| Grasslands WD—Volta | 69 | 151 | 0 | 205 | 3,428 | 2,668 | 1,451 | 3,031 | 11,744 | 12,672 | 5,741 | 3,343 | 44,503 |
| Kesterson Unit—Volta | 0 | 0 | 0 | 0 | 0 | 369 | 251 | 349 | 1,021 | 1,465 | 1,135 | 631 | 5,221 |
| Kesterson Unit—76.05L | 0 | 0 | 313 | 351 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 664 |
| **Subtotal** | **2,134** | **2,700** | **5,831** | **5,313** | **10,311** | **10,456** | **5,762** | **11,752** | **31,776** | **31,055** | **17,000** | **14,839** | **148,929** |
| **Total DMC Deliveries** | **2,921** | **5,927** | **9,948** | **18,668** | **30,045** | **47,831** | **71,985** | **68,198** | **52,678** | **42,808** | **24,106** | **20,433** | **395,548** |
| **O'Neill Net Pumping** | **232,200** | **153,150** | **146,447** | **86,724** | **23,481** | **116,471** | **37,532** | **40,599** | **96,272** | **125,555** | **172,764** | **231,114** | **1,462,309** |
| **CVP San Luis Reservoir (taf)** | **797,060** | **868,408** | **966,291** | **965,050** | **896,693** | **803,548** | **571,673** | **377,525** | **402,364** | **472,717** | **605,191** | **725,856** | |
| **C. Mendota Pool Deliveries (AF)** | | | | | | | | | | | | | |
| Fresno Slough WD | 0 | 29 | 201 | 107 | 367 | 546 | 892 | 576 | 73 | 109 | 0 | 0 | 2,900 |
| Tranquillity Public Utilities | 0 | 0 | 22 | 0 | 0 | 18 | 34 | 23 | 0 | 0 | 0 | 0 | 97 |
| James ID | 0 | 3,503 | 1,614 | 0 | 1,773 | 6,566 | 13,685 | 6,687 | 2,913 | 727 | 575 | 0 | 38,043 |
| Laguna WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Meyers—SLWD | 675 | 544 | 655 | 343 | 66 | 69 | 90 | 130 | 868 | 742 | 465 | 0 | 4,647 |
| Dudley & Indart—formerly C | 0 | 419 | 40 | 337 | 197 | 486 | 551 | 512 | 77 | 74 | 0 | 0 | 2,693 |
| Mid-Valley WD—no contract | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reclamation District #1606 | 0 | 0 | 0 | 0 | 0 | 122 | 171 | 142 | 6 | 0 | 0 | 0 | 441 |
| Terra Linda Farms—Coelho F | 0 | 250 | 333 | 363 | 66 | 1,396 | 2,395 | 1,149 | 432 | 291 | 204 | 0 | 6,879 |
| Tranquillity ID | 0 | 2,069 | 2,908 | 1,033 | 816 | 4,172 | 5,057 | 5,865 | 835 | 129 | 39 | 0 | 22,923 |
| Wilson, JW—no contract | 0 | 0 | 133 | 72 | 0 | 222 | 293 | 235 | 0 | 0 | 0 | 0 | 955 |

| Canals (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subtotal** | **675** | **6,814** | **5,906** | **2,255** | **3,285** | **13,597** | **23,168** | **15,319** | **5,204** | **2,072** | **1,283** | **0** | **79,578** |
| **Exchange Contractors** | | | | | | | | | | | | | |
| Central California ID | 0 | 14,278 | 25,125 | 22,405 | 40,178 | 75,162 | 93,412 | 82,911 | 37,712 | 21,071 | 20,128 | 0 | 432,382 |
| Columbia Canal Co | 0 | 1,716 | 7,992 | 4,939 | 3,755 | 7,222 | 8,601 | 9,241 | 5,575 | 3,132 | 101 | 0 | 52,274 |
| Firebaugh Canal Co | 0 | 2,281 | 1,196 | 2,307 | 3,576 | 6,030 | 5,907 | 5,127 | 2,537 | 571 | 2,440 | 0 | 31,972 |
| San Luis Canal Co | 0 | 0 | 5,318 | 7,952 | 10,805 | 24,515 | 31,000 | 27,661 | 12,543 | 2,127 | 6,457 | 1,818 | 130,196 |
| **Subtotal** | **0** | **18,275** | **39,631** | **37,603** | **58,314** | **112,929** | **138,920** | **124,940** | **58,367** | **26,901** | **29,126** | **1,818** | **646,824** |
| **Refuges** | | | | | | | | | | | | | |
| Grasslands WD—76.05L (CCI) | 6,161 | 3,105 | 1,627 | 1,391 | 3,790 | 2,526 | 865 | 2,560 | 18,722 | 22,483 | 3,665 | 250 | 67,145 |
| Kesterson—USFWS | 403 | 487 | 104 | 117 | 296 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,407 |
| Los Banos WMA—DFG | 756 | 1,410 | 514 | 175 | 1,027 | 530 | 195 | 726 | 3,721 | 4,661 | 3,341 | 735 | 17,791 |
| San Luis NWR—USFWS | 3,283 | 10,823 | 0 | 0 | 0 | 3,693 | 3,586 | 660 | 2,500 | 7,358 | 3,802 | 0 | 35,705 |
| Mendota Wildlife Area | 694 | 546 | 428 | 353 | 1,021 | 1,633 | 2,794 | 2,335 | 4,612 | 6,413 | 2,514 | 0 | 23,343 |
| China Island Unit | 375 | 609 | 123 | 122 | 339 | 117 | 203 | 163 | 1,051 | 1,022 | 164 | 0 | 4,288 |
| Salt Slough Unit | 842 | 819 | 300 | 162 | 1,097 | 338 | 292 | 266 | 1,481 | 1,217 | 354 | 0 | 7,168 |
| Freitas Unit | 619 | 628 | 112 | 169 | 555 | 152 | 158 | 79 | 867 | 1,469 | 281 | 0 | 5,089 |
| Kern National Wildlife Refuge | 411 | 0 | 620 | 849 | 506 | 0 | 0 | 1,602 | 5,130 | 5,367 | 5,222 | 3,240 | 22,947 |
| **Subtotal** | **13,544** | **18,427** | **3,828** | **3,338** | **8,631** | **8,989** | **8,093** | **8,391** | **38,084** | **49,990** | **19,343** | **4,225** | **184,883** |
| **Lower DMC Deliveries** | **14,219** | **43,516** | **49,365** | **43,196** | **70,230** | **135,515** | **170,181** | **148,650** | **101,655** | **78,963** | **49,752** | **6,043** | **911,285** |
| **D. San Luis Canal** | | | | | | | | | | | | | |
| Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| City of Avenal | 181 | 167 | 187 | 218 | 247 | 264 | 241 | 340 | 274 | 108 | 342 | 202 | 2,771 |
| Broadview WD | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 1 | 1 | 20 |
| City of Coalinga | 352 | 284 | 361 | 438 | 478 | 731 | 956 | 1,008 | 868 | 597 | 465 | 361 | 6,899 |
| City of Dos Palos | 66 | 62 | 74 | 96 | 144 | 172 | 205 | 193 | 152 | 138 | 95 | 73 | 1,470 |
| City of Huron | 49 | 44 | 65 | 98 | 86 | 113 | 139 | 132 | 115 | 87 | 89 | 64 | 1,081 |
| Pacheco WD | 1 | 1 | 1 | 1 | 1 | 818 | 2,327 | 1,654 | 255 | 157 | 8 | 444 | 5,668 |
| Pacheco CCID Non-project | 188 | 489 | 137 | 674 | 1,242 | 1,282 | 0 | 0 | 0 | 0 | 0 | 0 | 4,012 |
| Panoche WD | 1,859 | 2,546 | 2,071 | 3,029 | 4,239 | 10,753 | 14,537 | 10,168 | 1,147 | 673 | 595 | 1,328 | 52,945 |

| **Canals (af) or Water User** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| San Luis WD | 632 | 2,388 | 4,813 | 5,889 | 7,015 | 12,413 | 13,579 | 9,881 | 3,610 | 3,757 | 2,406 | 593 | 66,976 |
| Westlands WD | 23,005 | 42,250 | 58,254 | 77,959 | 91,619 | 181,375 | 212,408 | 172,050 | 56,187 | 46,208 | 39,326 | 50,878 | 1,051,519 |
| Fish & Game | 73 | 63 | 10 | 22 | 0 | 0 | 1 | 0 | 39 | 0 | 0 | 0 | 208 |
| Fish & Game | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 | 124 |
| O'Neill Forebay Wildlife | 56 | 6 | 0 | 58 | 172 | 49 | 72 | 94 | 43 | 80 | 86 | 94 | 810 |
| O'Neill Forebay Deliveries | 53 | 165 | 604 | 802 | 1,112 | 1,840 | 2,143 | 1,401 | 723 | 341 | 319 | 155 | 9,658 |
| Cross Valley Canal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,938 | 0 | 0 | 4,938 |
| Pacheco Pumping | 10,593 | 3,673 | 2,497 | 2,218 | 5,866 | 9,213 | 14,527 | 18,542 | 15,439 | 16,500 | 5,845 | 6,696 | 111,609 |
| **Subtotal** | **37,115** | **52,139** | **69,075** | **91,503** | **112,223** | **219,025** | **261,137** | **215,466** | **78,855** | **73,586** | **49,577** | **61,007** | **1,320,708** |
| **Total DMC Deliveries** | **54,255** | **101,582** | **128,388** | **153,367** | **212,498** | **402,371** | **503,303** | **432,314** | **233,188** | **195,357** | **123,435** | **87,483** | **2,627,541** |

**Table 3.1-13.** Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2006

| Canals or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Delta Pumping** | | | | | | | | | | | | | |
| Contra Costa | 8,432 | 10,494 | 9,429 | 298 | 9,789 | 17,946 | 14,181 | 15,830 | 12,663 | 10,587 | 7,885 | 2,538 | 120,072 |
| Delta-Mendota | 240,471 | 239,578 | 200,225 | 48,483 | 110,651 | 199,739 | 270,452 | 270,127 | 260,072 | 264,891 | 239,617 | 254,129 | 2,598,435 |
| Jones Pumping Plant (cfs) | 3,909 | 4,312 | 3,255 | 814 | 1,799 | 3,355 | 4,396 | 4,391 | 4,368 | 4,306 | 4,025 | 4,131 | 3,587 |
| **B. Upper Delta Mendota Canal (AF)** | | | | | | | | | | | | | |
| Banta Carbona ID | 0 | 2 | 0 | 0 | 974 | 202 | 303 | 45 | 30 | 0 | 0 | 0 | 1,556 |
| Broadview WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Byron Bethany ID | 0 | 88 | 87 | 72 | 517 | 665 | 802 | 631 | 493 | 208 | 25 | 1 | 3,589 |
| Centinella WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Del Puerto WD | 20 | 2,038 | 928 | 995 | 12,379 | 15,778 | 18,642 | 14,494 | 8,987 | 4,004 | 1,126 | 503 | 79,894 |
| DWR Intertie at MP7.70-R | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eagle Field WD | 9 | 503 | 7 | 29 | 393 | 804 | 701 | 668 | 238 | 22 | 90 | 30 | 3,494 |
| Mercy Springs WD | 0 | 170 | 115 | 0 | 61 | 62 | 82 | 62 | 375 | 0 | 0 | 102 | 1,029 |
| Newman Wasteway | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oro Loma WD | 0 | 243 | 28 | 0 | 270 | 82 | 228 | 292 | 200 | 16 | 3 | 0 | 1,362 |
| Panoche WD—Ag | 184 | 436 | 65 | 26 | 570 | 2,569 | 2,703 | 1,725 | 369 | 2 | 107 | 105 | 8,861 |
| Panoche WD—M&I | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 173 | 2 | 2 | 195 |
| Patterson WD | 0 | 27 | 61 | 48 | 1,169 | 1,183 | 2,253 | 764 | 404 | 49 | 92 | 4 | 6,054 |
| San Luis WD—Ag | 569 | 1,999 | 825 | 169 | 848 | 2,707 | 3,232 | 1,904 | 492 | 16 | 59 | 123 | 12,943 |
| San Luis WD—M&I | 1 | 1 | 3 | 2 | 31 | 49 | 44 | 41 | 29 | 36 | 4 | 1 | 242 |
| Tracy, City of | 0 | 0 | 108 | 338 | 792 | 941 | 992 | 1,046 | 976 | 671 | 128 | 0 | 5,992 |
| West Side ID | 0 | 0 | 0 | 0 | 0 | 246 | 559 | 317 | 73 | 0 | 0 | 0 | 1,195 |
| Widren | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| West Stanislaus ID | 0 | 1,380 | 684 | 581 | 5,602 | 6,016 | 7,493 | 5,959 | 3,616 | 1,768 | 678 | 331 | 34,108 |
| **Subtotal** | **785** | **6,889** | **2,913** | **2,262** | **23,608** | **31,306** | **38,036** | **27,950** | **16,284** | **6,965** | **2,314** | **1,202** | **160,514** |
| **Exchange Contractors** | | | | | | | | | | | | | |
| Central California ID—above | 0 | 657 | 439 | 157 | 1,869 | 2,727 | 2,432 | 3,180 | 2,733 | 1,230 | 306 | 783 | 16,513 |

| Canals or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central California ID—below | 0 | 175 | 168 | 456 | 662 | 11,778 | 17,742 | 13,742 | 156 | 166 | 33 | 74 | 45,152 |
| Firebaugh Canal Co | 6 | 0 | 310 | 26 | 702 | 4,858 | 7,322 | 5,133 | 363 | 726 | 597 | 1,039 | 21,082 |
| **Subtotal** | **6** | **832** | **917** | **639** | **3,233** | **19,363** | **27,496** | **22,055** | **3,252** | **2,122** | **936** | **1,896** | **82,747** |
| **Refuges** | | | | | | | | | | | | | |
| China Island—76.05 | 506 | 599 | 0 | 0 | 0 | 128 | 416 | 537 | 0 | 0 | 0 | 0 | 2,186 |
| Freitas Unit—76.05L | 710 | 538 | 0 | 0 | 0 | 268 | 0 | 95 | 0 | 0 | 0 | 0 | 1,611 |
| Salt Slough Unit—76.05L | 887 | 763 | 0 | 0 | 0 | 672 | 1,115 | 809 | 0 | 0 | 0 | 0 | 4,246 |
| Los Banos WMA—76.05L | 890 | 585 | 0 | 0 | 0 | 189 | 369 | 628 | 0 | 0 | 0 | 0 | 2,661 |
| Volta Wildlife Mgmt Area | 505 | 1,104 | 0 | 0 | 163 | 0 | 112 | 1,101 | 2,667 | 2,568 | 1,835 | 1,139 | 11,194 |
| Grasslands WD—76.05L | 35 | 0 | 0 | 0 | 3,769 | 5,676 | 5,653 | 10,655 | 20,390 | 4,294 | 2,321 | 0 | 52,793 |
| Grasslands WD—Volta | 0 | 1,196 | 0 | 0 | 2,735 | 1,059 | 175 | 3,514 | 13,319 | 12,095 | 5,202 | 4,244 | 43,539 |
| Kesterson Unit—Volta | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 390 | 1,321 | 1,447 | 1,082 | 1,035 | 5,275 |
| Kesterson Unit—76.05L | 800 | 606 | 0 | 0 | 0 | 46 | 232 | 0 | 0 | 0 | 0 | 0 | 1,684 |
| **Subtotal** | **4,333** | **5,391** | **0** | **0** | **6,667** | **8,038** | **8,072** | **17,729** | **37,697** | **20,404** | **10,440** | **6,418** | **125,189** |
| **Total DMC Deliveries** | **5,124** | **13,112** | **3,830** | **2,901** | **33,508** | **58,707** | **73,604** | **67,734** | **57,233** | **29,491** | **13,690** | **9,516** | **368,450** |
| **O'Neill Net Pumping** | **221,499** | **116,367** | **158,861** | **37,266** | **69,948** | **124,604** | **39,385** | **46,584** | **85,919** | **142,524** | **178,067** | **199,262** | **1,420,286** |
| **CVP San Luis Reservoir (taf)** | **877,097** | **875,439** | **968,493** | **964,671** | **893,434** | **798,169** | **530,061** | **402,776** | **402,112** | **438,764** | **563,953** | **679,751** | |
| **C. Mendota Pool Deliveries (AF)** | | | | | | | | | | | | | |
| Fresno Slough WD | 0 | 608 | 28 | 0 | 89 | 496 | 716 | 552 | 76 | 21 | 0 | 0 | 2,586 |
| Tranquillity Public Utilities | 0 | 0 | 22 | 0 | 0 | 15 | 31 | 26 | 2 | 0 | 0 | 0 | 96 |
| James ID | 1,248 | 7,020 | 2,401 | 0 | 1,459 | 3,248 | 12,069 | 11,899 | 3,529 | 1,281 | 2,253 | 1,030 | 47,437 |
| Laguna WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Meyers—SLWD | 427 | 426 | 538 | 461 | 603 | 432 | 109 | 72 | 215 | 1,176 | 589 | 476 | 5,524 |
| Dudley & Indart | 36 | 258 | 138 | 21 | 79 | 298 | 769 | 469 | 183 | 0 | 0 | 24 | 2,275 |
| Mid-Valley WD—no contract | 0 | 0 | 0 | 331 | 1,438 | 1,832 | 111 | 0 | 0 | 0 | 0 | 0 | 3,712 |
| Reclamation District #1606 | 0 | 79 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 116 |
| Terra Linda Farms | 200 | 1,032 | 234 | 102 | 1,076 | 1,588 | 1,546 | 1,016 | 870 | 208 | 233 | 0 | 8,105 |
| Tranquillity ID | 0 | 4,718 | 937 | 150 | 1,286 | 4,882 | 7,116 | 5,482 | 657 | 130 | 367 | 0 | 25,725 |
| Westlands WD | 0 | 0 | 0 | 0 | 6,032 | 5,374 | 0 | 0 | 0 | 0 | 0 | 0 | 11,406 |

| Canals or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wilson, JW—no contract | 0 | 171 | 0 | 0 | 0 | 139 | 222 | 178 | 9 | 0 | 0 | 0 | 719 |
| **Subtotal** | **1,911** | **14,312** | **4,335** | **1,065** | **12,062** | **18,304** | **22,689** | **19,694** | **5,541** | **2,816** | **3,442** | **1,530** | **107,701** |
| **Exchange Contractors** | | | | | | | | | | | | | |
| Central California ID | 176 | 35,265 | 15,536 | 4,457 | 47,950 | 67,227 | 102,849 | 87,760 | 45,070 | 30,466 | 13,339 | 12,587 | 462,682 |
| Columbia Canal Co | 0 | 3,636 | 4,414 | 670 | 3,896 | 4,367 | 7,555 | 7,642 | 3,596 | 4,156 | 1,042 | 4 | 40,978 |
| Firebaugh Canal WD | 843 | 4,368 | 817 | 871 | 4,852 | 6,555 | 6,613 | 5,847 | 2,880 | 454 | 474 | 0 | 34,574 |
| San Luis Canal Co | 0 | 7,560 | 6,641 | 1,554 | 14,485 | 24,579 | 33,190 | 25,758 | 10,905 | 6,136 | 3,860 | 4,362 | 139,030 |
| **Subtotal** | **1,019** | **50,829** | **27,408** | **7,552** | **71,183** | **102,728** | **150,207** | **127,007** | **62,451** | **41,212** | **18,715** | **16,953** | **677,264** |
| **Refuges** | | | | | | | | | | | | | |
| Grasslands WD 76.05L | 3,057 | 10,556 | 1,000 | 852 | 9,415 | 3,688 | 2,182 | 4,131 | 16,596 | 26,110 | 6,171 | 2,839 | 86,597 |
| Kesterson—USFWS | 267 | 477 | 887 | 292 | 278 | 15 | 77 | 0 | 1,694 | 1,397 | 0 | 0 | 5,384 |
| Los Banos WMA—DFG | 705 | 2,322 | 872 | 154 | 216 | 63 | 123 | 793 | 2,797 | 3,961 | 3,970 | 1,850 | 17,826 |
| San Luis NWR—USFWS | 2,372 | 9,887 | 0 | 0 | 0 | 2,500 | 1,000 | 0 | 2,500 | 5,404 | 4,098 | 0 | 27,761 |
| Mendota Wildlife Area | 981 | 2,486 | 354 | 273 | 1,102 | 2,030 | 2,621 | 2,513 | 4,254 | 6,955 | 2,476 | 1,644 | 27,689 |
| China Island Unit | 168 | 470 | 627 | 169 | 188 | 43 | 139 | 179 | 902 | 1,974 | 1,557 | 686 | 7,102 |
| Salt Slough Unit | 296 | 599 | 1,137 | 621 | 900 | 224 | 371 | 270 | 1,197 | 1,173 | 1,538 | 887 | 9,213 |
| Freitas Unit | 236 | 422 | 937 | 550 | 238 | 89 | 0 | 31 | 600 | 0 | 1,171 | 922 | 5,196 |
| Kern National Wildlife Refuge | 472 | 524 | 0 | 255 | 493 | 0 | 40 | 1,561 | 4,656 | 4,698 | 5,135 | 3,448 | 21,282 |
| **Subtotal** | **8,554** | **27,743** | **5,814** | **3,166** | **12,830** | **8,652** | **6,553** | **9,478** | **35,196** | **51,672** | **26,116** | **12,276** | **208,050** |
| **Lower DMC Deliveries** | **11,484** | **92,884** | **37,557** | **11,783** | **96,075** | **129,684** | **179,449** | **156,179** | **103,188** | **95,700** | **48,273** | **30,759** | **993,015** |
| **D. San Luis Canal** | | | | | | | | | | | | | |
| City of Avenal | 182 | 176 | 198 | 201 | 255 | 269 | 323 | 324 | 285 | 240 | 231 | 224 | 2,908 |
| Broadview WD | 1 | 1 | 1 | 0 | 3 | 2 | 5 | 6 | 3 | 3 | 6 | 4 | 35 |
| City of Coalinga | 404 | 396 | 336 | 401 | 568 | 751 | 1,073 | 1,024 | 991 | 609 | 131 | 730 | 7,414 |
| City of Dos Palos | 71 | 57 | 65 | 79 | 154 | 180 | 206 | 139 | 200 | 118 | 88 | 79 | 1,436 |
| City of Huron | 57 | 60 | 63 | 108 | 146 | 113 | 136 | 131 | 118 | 106 | 87 | 66 | 1,191 |
| Pacheco WD | 19 | 1 | 1 | 1 | 1 | 1,024 | 2,546 | 1,397 | 410 | 113 | 103 | 341 | 5,957 |
| Pacheco CCID Non-project | 65 | 670 | 568 | 326 | 1,401 | 1,262 | 0 | 0 | 0 | 29 | 14 | 0 | 4,335 |
| Panoche WD | 1,701 | 2,826 | 1,265 | 943 | 5,467 | 12,017 | 14,963 | 8,279 | 1,094 | 294 | 975 | 467 | 50,291 |

| Canals or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| San Luis WD | 1,167 | 4,569 | 3,111 | 2,711 | 7,945 | 12,972 | 14,248 | 8,405 | 3,677 | 2,390 | 2,391 | 1,499 | 65,085 |
| Westlands WD | 50,509 | 77,456 | 45,092 | 39,714 | 113,392 | 202,459 | 230,170 | 155,853 | 62,723 | 48,712 | 39,745 | 50,147 | 1,115,972 |
| Fish & Game | 0 | 29 | 0 | 0 | 0 | 1 | 0 | 134 | 0 | 31 | 0 | 0 | 195 |
| Fish & Game | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 | 131 |
| O'Neill Forebay Wildlife | 60 | 118 | 81 | 18 | 3 | 28 | 143 | 160 | 64 | 182 | 56 | 24 | 937 |
| O'Neill Forebay Deliveries | 211 | 898 | 737 | 389 | 969 | 2,000 | 2,423 | 1,952 | 791 | 591 | 251 | 140 | 11,352 |
| Cross Valley Canal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pacheco Pumping | 2,828 | 6,360 | 2,453 | 2,180 | 3,242 | 7,990 | 12,486 | 12,643 | 11,827 | 10,168 | 9,719 | 7,962 | 89,858 |
| **Subtotal** | **57,337** | **93,617** | **53,971** | **47,071** | **133,546** | **241,068** | **278,722** | **190,447** | **82,183** | **63,586** | **53,797** | **61,752** | **1,357,097** |
| **Total DMC Deliveries** | **73,945** | **199,613** | **95,358** | **61,755** | **263,129** | **429,459** | **531,775** | **414,360** | **242,604** | **188,777** | **115,760** | **102,027** | **2,718,562** |

**Table 3.1-14.** Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2007

| Canal (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Delta Pumping** | | | | | | | | | | | | | |
| Contra Costa | 1,878 | 4,978 | 12,645 | 495 | 11,346 | 24,023 | 21,705 | 9,039 | 4,843 | 6,820 | 7,468 | 6,213 | 111,453 |
| Delta-Mendota | 267,158 | 242,188 | 246,918 | 162,070 | 51,730 | 147,174 | 269,482 | 271,856 | 257,465 | 261,605 | 207,504 | 201,233 | 2,586,383 |
| Jones Pumping Plant (cfs) | 4,343 | 4,359 | 4,014 | 2,722 | 841 | 2,472 | 4,380 | 4,419 | 4,325 | 4,252 | 3,485 | 3,271 | 3,571 |
| **B. Upper Delta Mendota Canal (af)** | | | | | | | | | | | | | |
| Banta Carbona ID | 0 | 0 | 0 | 215 | 60 | 369 | 473 | 71 | 0 | 1 | 0 | 0 | 1,189 |
| Broadview WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Byron Bethany ID | 31 | 33 | 224 | 523 | 586 | 529 | 523 | 384 | 342 | 84 | 91 | 17 | 3,367 |
| Centinella WD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Del Puerto WD | 1,834 | 2,039 | 8,761 | 11,388 | 12,724 | 13,590 | 14,848 | 10,322 | 5,575 | 2,079 | 1,218 | 149 | 84,527 |
| DWR Intertie at MP7.70-R | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eagle Field WD | 125 | 425 | 378 | 459 | 494 | 343 | 293 | 260 | 24 | 12 | 0 | 0 | 2,813 |
| Mercy Springs WD | 305 | 0 | 286 | 151 | 35 | 66 | 26 | 49 | 10 | 78 | 129 | 31 | 1,166 |
| Newman Wasteway | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,459 | 0 | 0 | 0 | 0 | 1,459 |
| Oro Loma WD | 27 | 61 | 38 | 1 | 44 | 19 | 33 | 35 | 0 | 0 | 0 | 0 | 258 |
| Panoche WD—Ag | 468 | 354 | 590 | 720 | 1,434 | 1,291 | 1,282 | 1,273 | 417 | 90 | 91 | 1 | 8,011 |
| Panoche WD—M&I | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 25 |
| Patterson WD | 140 | 0 | 699 | 614 | 667 | 1,157 | 1,031 | 387 | 109 | 18 | 612 | 295 | 5,729 |
| San Luis WD—Ag | 1,176 | 1,822 | 900 | 786 | 837 | 1,817 | 1,449 | 914 | 172 | 112 | 92 | 98 | 10,175 |
| San Luis WD—M&I | 1 | 2 | 14 | 15 | 22 | 25 | 28 | 31 | 19 | 12 | 12 | 2 | 183 |
| Tracy, City of | 0 | 0 | 0 | 0 | 453 | 860 | 1,085 | 1,287 | 1,050 | 721 | 528 | 443 | 6,427 |
| West Side ID | 0 | 0 | 72 | 0 | 186 | 298 | 359 | 0 | 0 | 0 | 0 | 0 | 915 |
| Widren | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| West Stanislaus ID | 1,644 | 1,064 | 4,237 | 2,938 | 2,217 | 3,075 | 6,086 | 5,815 | 745 | 0 | 0 | 0 | 27,821 |
| **Subtotal** | **5,753** | **5,802** | **16,201** | **17,812** | **19,761** | **23,442** | **27,518** | **22,289** | **8,465** | **3,209** | **2,775** | **1,038** | **154,065** |
| **Exchange Contractors (af)** | | | | | | | | | | | | | |
| Central California ID—above | 357 | 286 | 2,615 | 1,748 | 2,245 | 2,140 | 2,878 | 2,739 | 2,227 | 1,706 | 194 | 0 | 19,135 |

| Canal (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central California ID—below | 639 | 4,804 | 8,399 | 6,112 | 21,117 | 24,773 | 27,133 | 20,498 | 285 | 149 | 0 | 0 | 113,909 |
| Firebaugh Canal Co | 663 | 869 | 0 | 191 | 1,428 | 4,036 | 5,425 | 4,728 | 227 | 506 | 475 | 197 | 18,745 |
| **Subtotal** | **1,659** | **5,959** | **11,014** | **8,051** | **24,790** | **30,949** | **35,436** | **27,965** | **2,739** | **2,361** | **669** | **197** | **151,789** |
| **Refuges (af)** | | | | | | | | | | | | | |
| China Island Unit | 0 | 952 | 605 | 536 | 410 | 673 | 638 | 647 | 0 | 0 | 0 | 0 | 4,461 |
| Los Banos WMA | 0 | 1,204 | 497 | 298 | 222 | 446 | 451 | 1,322 | 0 | 0 | 0 | 0 | 4,440 |
| Salt Slough Unit | 0 | 225 | 652 | 529 | 395 | 455 | 575 | 641 | 0 | 0 | 0 | 0 | 3,472 |
| Volta WMA | 929 | 565 | 341 | 151 | 220 | 576 | 0 | 2,167 | 2,638 | 2,756 | 1,541 | 411 | 12,295 |
| Grasslands WD | 3,144 | 0 | 3,675 | 1,211 | 2,500 | 978 | 84 | 2,204 | 16,860 | 4,959 | 2,995 | 0 | 38,610 |
| Grasslands WD—Volta | 3,354 | 0 | 0 | 1,526 | 6,077 | 1,599 | 0 | 742 | 20,192 | 13,002 | 5,393 | 1,299 | 53,184 |
| Kesterson Unit—76.05 | 0 | 0 | 845 | 289 | 275 | 448 | 317 | 570 | 0 | 0 | 0 | 0 | 2,744 |
| Kesterson Unit—Volta | 61 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 932 | 1,021 | 801 | 709 | 3,624 |
| Freitas Unit—76.05 | 0 | 1,194 | 432 | 347 | 455 | 422 | 473 | 466 | 0 | 0 | 0 | 0 | 3,789 |
| **Subtotal** | **7,488** | **4,240** | **7,047** | **4,887** | **10,554** | **5,597** | **2,538** | **8,759** | **40,622** | **21,738** | **10,730** | **2,419** | **126,619** |
| **Upper DMC Total** | **14,900** | **16,001** | **34,262** | **30,750** | **55,105** | **59,988** | **65,492** | **59,013** | **51,826** | **27,308** | **14,174** | **3,654** | **432,473** |
| **O'Neill Pumping** | **190,971** | **122,096** | **140,261** | **63,180** | **-104,564** | **-45,443** | **48,651** | **91,911** | **117,176** | **148,913** | **157,240** | **168,558** | **1,098,950** |
| **CVP San Luis Reservoir (taf)** | **777,646** | **743,340** | **764,836** | **688,202** | **426,148** | **173,215** | **82,689** | **96,410** | **194,300** | **327,922** | **482,150** | **649,105** | |
| **C. Mendota Pool Deliveries (af)** | | | | | | | | | | | | | |
| Dudley & Indart | 138 | 712 | 102 | 126 | 220 | 537 | 593 | 285 | 7 | 3 | 0 | 0 | 2,723 |
| Fresno Slough WD | 0 | 613 | 187 | 221 | 470 | 525 | 727 | 647 | 123 | 62 | 0 | 0 | 3,575 |
| James ID | 3,538 | 7,983 | 4,017 | 928 | 3,271 | 5,420 | 5,734 | 2,769 | 278 | 0 | 0 | 0 | 33,938 |
| Laguna WD—via CCID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Meyers—SLWD | 643 | 441 | 542 | 382 | 122 | 91 | 103 | 140 | 80 | 0 | 282 | 30 | 2,856 |
| Mid-Valley WD—no contract | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reclamation District #1606 | 5 | 4 | 45 | 26 | 95 | 122 | 43 | 44 | 0 | 0 | 18 | 0 | 402 |
| Terra Linda Farms | 431 | 880 | 622 | 529 | 1,321 | 1,708 | 1,977 | 1,454 | 433 | 271 | 10 | 197 | 9,833 |
| Tranquillity ID | 88 | 5,053 | 1,170 | 1,149 | 4,084 | 5,220 | 5,841 | 4,144 | 689 | 384 | 329 | 0 | 28,151 |
| Tranquillity Public Utilities | 0 | 8 | 19 | 0 | 27 | 23 | 9 | 0 | 0 | 0 | 0 | 0 | 86 |
| Westlands WD—Lateral 6 & 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Canal (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wilson, JW—no contract | 0 | 153 | 59 | 0 | 104 | 93 | 114 | 83 | 0 | 0 | 0 | 0 | 606 |
| San Luis WD—via CCID | 59 | 8 | 62 | 62 | 9 | 41 | 49 | 61 | 43 | 0 | 0 | 0 | 394 |
| **Subtotal** | **4,902** | **15,855** | **6,825** | **3,423** | **9,723** | **13,780** | **15,190** | **9,627** | **1,653** | **720** | **639** | **227** | **82,564** |
| **Exchange Contractors (AF)** | | | | | | | | | | | | | |
| Central California ID—CCID | 6,331 | 34,894 | 21,197 | 21,247 | 49,924 | 60,206 | 72,431 | 49,545 | 17,095 | 26,587 | 1,197 | 1,915 | 362,569 |
| Columbia Canal Co | 71 | 3,664 | 5,565 | 4,888 | 6,972 | 8,277 | 9,717 | 6,833 | 3,945 | 5,048 | 0 | 0 | 54,980 |
| Firebaugh Canal WD | 2,640 | 6,304 | 1,392 | 4,842 | 6,387 | 7,138 | 7,804 | 5,592 | 1,400 | 1,416 | 0 | 0 | 44,915 |
| San Luis Canal Co—SLCC | 0 | 7,500 | 7,800 | 11,346 | 19,532 | 26,047 | 28,512 | 20,178 | 7,726 | 4,079 | 500 | 0 | 133,220 |
| **Subtotal** | **9,042** | **52,362** | **35,954** | **42,323** | **82,815** | **101,668** | **118,464** | **82,148** | **30,166** | **37,130** | **1,697** | **1,915** | **595,684** |
| **Refuges (AF)** | | | | | | | | | | | | | |
| Grasslands WD | 8,854 | 0 | 1,902 | 403 | 1,259 | 326 | 28 | 735 | 21,978 | 12,143 | 5,390 | 3,199 | 56,217 |
| China Island Unit | 922 | 317 | 202 | 178 | 137 | 224 | 213 | 216 | 1,240 | 801 | 460 | 936 | 5,846 |
| Los Banos WMA | 4,106 | 1,171 | 563 | 99 | 74 | 149 | 150 | 903 | 3,004 | 4,299 | 3,324 | 2,950 | 20,792 |
| Mendota Wildlife Area | 1,254 | 1,950 | 790 | 843 | 1,551 | 2,027 | 2,937 | 2,172 | 5,178 | 4,473 | 2,009 | 2,285 | 27,469 |
| Salt Slough Unit—CDFG | 945 | 75 | 217 | 176 | 132 | 151 | 192 | 214 | 1,213 | 1,400 | 1,244 | 1,081 | 7,040 |
| Freitas Unit | 1,259 | 398 | 144 | 116 | 151 | 140 | 158 | 155 | 700 | 1,892 | 1,101 | 1,023 | 7,237 |
| Kesterson | 0 | 0 | 282 | 96 | 92 | 149 | 106 | 190 | 0 | 0 | 0 | 0 | 915 |
| San Luis NWR | 9,983 | 8,865 | 632 | 0 | 0 | 2,500 | 362 | 2,242 | 2,564 | 4,378 | 5,077 | 3,727 | 40,330 |
| **Subtotal** | **27,323** | **12,776** | **4,732** | **1,911** | **3,396** | **5,666** | **4,146** | **6,827** | **35,877** | **29,386** | **18,605** | **15,201** | **165,846** |
| **Lower DMC Total** | **41,267** | **80,993** | **47,511** | **47,657** | **95,934** | **121,114** | **137,800** | **98,602** | **67,696** | **67,236** | **20,941** | **17,343** | **844,094** |
| **D. San Luis Canal** | | | | | | | | | | | | | |
| City of Avenal | 234 | 199 | 249 | 256 | 293 | 302 | 288 | 256 | 201 | 205 | 216 | 193 | 2,892 |
| Broadview WD | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| City of Coalinga | 468 | 403 | 474 | 593 | 805 | 967 | 937 | 1,016 | 728 | 584 | 490 | 342 | 7,807 |
| City of Dos Palos | 93 | 80 | 106 | 115 | 190 | 201 | 201 | 195 | 164 | 122 | 109 | 144 | 1,720 |
| City of Huron | 70 | 63 | 90 | 115 | 118 | 129 | 140 | 133 | 105 | 89 | 81 | 74 | 1,207 |
| Pacheco WD | 891 | 408 | 1,101 | 1,070 | 1 | 1,614 | 2,434 | 2,158 | 492 | 126 | 145 | 117 | 10,557 |
| Pacheco CCID Non-project | 0 | 0 | 0 | 670 | 2,107 | 868 | 0 | 0 | 0 | 0 | 0 | 0 | 3,645 |
| Panoche WD | 2,508 | 3,181 | 4,216 | 4,524 | 5,638 | 7,820 | 7,953 | 5,233 | 2,221 | 939 | 495 | 445 | 45,173 |

| Canal (af) or Water User | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| San Luis WD | 3,299 | 4,373 | 7,340 | 7,465 | 9,688 | 12,421 | 11,734 | 6,380 | 3,078 | 3,251 | 1,689 | 99 | 70,817 |
| Westlands WD | 78,995 | 82,114 | 99,694 | 109,425 | 137,133 | 145,142 | 123,579 | 79,378 | 30,628 | 21,521 | 11,257 | 9,705 | 928,571 |
| Mendota WMA—CDFG | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 4 |
| Mendota WMA—CDFG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kern National Wild | 1,020 | 806 | 0 | 305 | 500 | 200 | 0 | 2,050 | 3,470 | 4,104 | 2,974 | 2,097 | 17,526 |
| O'Neill Forebay | 447 | 610 | 1,045 | 948 | 1,136 | 1,574 | 1,698 | 1,114 | 594 | 193 | 193 | 90 | 9,642 |
| Cross Valley Canal | 0 | 0 | 0 | 0 | 0 | 0 | 18,696 | 30,219 | 15,235 | 0 | 0 | 0 | 64,150 |
| Pacheco Pumping | 8,148 | 12,120 | 14,024 | 17,641 | 18,909 | 19,898 | 18,795 | 17,378 | 14,118 | 9,577 | 3,497 | 108 | 154,213 |
| **Subtotal** | **96,184** | **104,368** | **128,339** | **143,127** | **176,518** | **191,137** | **186,456** | **145,511** | **71,035** | **40,711** | **21,146** | **13,414** | **1,317,946** |
| **Total DMC Deliveries** | **152,351** | **201,362** | **210,112** | **221,534** | **327,557** | **372,239** | **389,748** | **303,126** | **190,557** | **135,255** | **56,261** | **34,411** | **2,594,513** |

**Table 3.1-15.** Comparison of Jones Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Intertie with Intertie Pumping (cfs)

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 1,101 | 600 | 2,165 | 600 | 800 | 599 | 799 | 799 | 798 | 600 | 597 | 1,144 | 1,099 |
| **10%** | 2,639 | 2,103 | 3,320 | 3,647 | 2,127 | 1,152 | 800 | 800 | 800 | 1,195 | 800 | 2,057 | 1,639 |
| **20%** | 2,947 | 3,919 | 4,210 | 4,213 | 2,855 | 1,988 | 1,420 | 800 | 1,980 | 1,987 | 1,803 | 2,869 | 2,034 |
| **30%** | 3,523 | 4,226 | 4,214 | 4,217 | 3,744 | 2,373 | 1,600 | 800 | 2,475 | 2,984 | 3,278 | 4,054 | 2,231 |
| **40%** | 3,997 | 4,240 | 4,219 | 4,222 | 4,221 | 2,709 | 1,926 | 1,125 | 2,475 | 3,569 | 4,449 | 4,437 | 2,453 |
| **50%** | 4,263 | 4,245 | 4,220 | 4,224 | 4,237 | 3,171 | 2,097 | 1,344 | 2,650 | 4,126 | 4,506 | 4,457 | 2,518 |
| **60%** | 4,330 | 4,247 | 4,221 | 4,225 | 4,241 | 3,839 | 2,378 | 1,500 | 2,755 | 4,527 | 4,518 | 4,462 | 2,569 |
| **70%** | 4,337 | 4,248 | 4,221 | 4,226 | 4,242 | 4,155 | 2,547 | 1,762 | 2,955 | 4,553 | 4,523 | 4,465 | 2,618 |
| **80%** | 4,359 | 4,255 | 4,223 | 4,228 | 4,243 | 4,252 | 2,547 | 1,911 | 3,000 | 4,580 | 4,540 | 4,474 | 2,695 |
| **90%** | 4,387 | 4,264 | 4,226 | 4,231 | 4,247 | 4,276 | 2,747 | 3,000 | 3,000 | 4,600 | 4,571 | 4,489 | 2,754 |
| **Max** | 4,387 | 4,264 | 4,226 | 4,231 | 4,253 | 4,300 | 3,518 | 3,000 | 3,000 | 4,600 | 4,571 | 4,490 | 2,899 |
| **Avg** | 3,763 | 3,806 | 4,044 | 3,970 | 3,647 | 3,059 | 2,014 | 1,499 | 2,391 | 3,472 | 3,516 | 3,831 | 2,354 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 1,093 | 600 | 1,342 | 104 | 800 | 600 | 800 | 797 | 800 | 600 | 600 | 1,068 | 1,188 |
| **10%** | 2,478 | 2,043 | 3,358 | 3,600 | 1,932 | 1,085 | 800 | 800 | 801 | 1,049 | 800 | 2,056 | 1,685 |
| **20%** | 2,934 | 3,724 | 4,417 | 4,226 | 2,360 | 1,863 | 1,420 | 800 | 2,335 | 2,073 | 1,802 | 2,877 | 2,047 |
| **30%** | 3,298 | 4,596 | 4,600 | 4,578 | 2,751 | 2,160 | 1,603 | 800 | 2,475 | 3,040 | 2,770 | 3,898 | 2,301 |
| **40%** | 4,036 | 4,600 | 4,600 | 4,600 | 3,473 | 2,377 | 1,922 | 1,125 | 2,475 | 3,559 | 4,536 | 4,441 | 2,467 |
| **50%** | 4,313 | 4,600 | 4,600 | 4,600 | 4,241 | 2,651 | 2,082 | 1,362 | 2,650 | 4,338 | 4,600 | 4,600 | 2,549 |
| **60%** | 4,534 | 4,600 | 4,600 | 4,600 | 4,485 | 2,811 | 2,371 | 1,500 | 2,802 | 4,570 | 4,600 | 4,600 | 2,600 |
| **70%** | 4,600 | 4,600 | 4,600 | 4,600 | 4,600 | 3,129 | 2,546 | 1,736 | 2,924 | 4,600 | 4,600 | 4,600 | 2,669 |
| **80%** | 4,600 | 4,600 | 4,600 | 4,600 | 4,600 | 3,772 | 2,547 | 1,911 | 3,000 | 4,600 | 4,600 | 4,600 | 2,732 |
| **90%** | 4,600 | 4,600 | 4,600 | 4,600 | 4,600 | 4,416 | 2,734 | 3,000 | 3,000 | 4,600 | 4,600 | 4,600 | 2,814 |
| **Max** | 4,600 | 4,600 | 4,600 | 4,600 | 4,600 | 4,600 | 3,745 | 3,000 | 3,000 | 4,600 | 4,600 | 4,600 | 2,924 |
| **Avg** | 3,829 | 4,022 | 4,325 | 4,247 | 3,580 | 2,698 | 2,001 | 1,496 | 2,428 | 3,511 | 3,540 | 3,915 | 2,389 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | -9 | 0 | -822 | -496 | 0 | 1 | 1 | -1 | 2 | 0 | 3 | -76 | 89 |
| **10%** | -161 | -61 | 38 | -47 | -196 | -68 | 0 | 0 | 1 | -146 | 0 | -1 | 46 |
| **20%** | -13 | -195 | 207 | 13 | -495 | -125 | 0 | 0 | 355 | 86 | -2 | 8 | 13 |
| **30%** | -226 | 370 | 386 | 361 | -993 | -213 | 3 | 0 | 0 | 56 | -508 | -156 | 70 |
| **40%** | 39 | 360 | 381 | 378 | -749 | -332 | -4 | 0 | 0 | -11 | 88 | 4 | 14 |
| **50%** | 51 | 355 | 380 | 376 | 4 | -519 | -15 | 18 | 0 | 211 | 94 | 143 | 32 |
| **60%** | 204 | 353 | 379 | 375 | 244 | -1,028 | -7 | 0 | 47 | 43 | 82 | 138 | 31 |
| **70%** | 263 | 352 | 379 | 374 | 358 | -1,025 | -1 | -27 | -31 | 47 | 77 | 135 | 52 |
| **80%** | 241 | 345 | 377 | 372 | 357 | -480 | 0 | 0 | 0 | 20 | 60 | 126 | 36 |
| **90%** | 213 | 336 | 374 | 369 | 353 | 140 | -13 | 0 | 0 | 0 | 29 | 111 | 60 |
| **Max** | 213 | 336 | 374 | 369 | 347 | 300 | 228 | 0 | 0 | 0 | 29 | 110 | 25 |
| **Avg** | 66 | 216 | 282 | 277 | -67 | -361 | -13 | -3 | 37 | 39 | 24 | 84 | 35 |

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D. Intertie Connection from DMC to CA (cfs)** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **10%** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| **20%** | 0 | 0 | 197 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| **30%** | 0 | 336 | 374 | 347 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 |
| **40%** | 0 | 336 | 376 | 372 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 44 | 77 |
| **50%** | 0 | 345 | 378 | 373 | 4 | 0 | 0 | 0 | 0 | 0 | 29 | 110 | 83 |
| **60%** | 188 | 350 | 379 | 374 | 244 | 0 | 0 | 0 | 0 | 0 | 54 | 125 | 91 |
| **70%** | 213 | 352 | 379 | 375 | 353 | 0 | 0 | 0 | 0 | 0 | 70 | 132 | 96 |
| **80%** | 244 | 354 | 380 | 376 | 357 | 0 | 0 | 0 | 0 | 20 | 77 | 136 | 101 |
| **90%** | 259 | 357 | 386 | 383 | 359 | 126 | 0 | 0 | 0 | 43 | 82 | 140 | 105 |
| **Max** | 343 | 386 | 391 | 389 | 380 | 383 | 0 | 0 | 0 | 112 | 94 | 304 | 128 |
| **Avg** | 103 | 260 | 307 | 275 | 151 | 34 | 0 | 0 | 0 | 10 | 38 | 80 | 76 |

**Table 3.1-16.** Comparison of Simulated Monthly Distribution of CVP South-of-Delta Deliveries (taf) for Future No Action and Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 111 | 61 | 38 | 30 | 42 | 78 | 90 | 129 | 170 | 181 | 172 | 135 | 1,326 |
| **10%** | 139 | 73 | 47 | 41 | 53 | 93 | 111 | 159 | 216 | 238 | 204 | 164 | 1,584 |
| **20%** | 158 | 89 | 63 | 64 | 80 | 104 | 140 | 208 | 287 | 321 | 275 | 193 | 2,093 |
| **30%** | 169 | 96 | 74 | 83 | 101 | 124 | 154 | 242 | 342 | 384 | 324 | 214 | 2,388 |
| **40%** | 177 | 104 | 83 | 98 | 117 | 139 | 175 | 267 | 382 | 437 | 366 | 226 | 2,607 |
| **50%** | 181 | 107 | 87 | 104 | 123 | 150 | 184 | 275 | 395 | 456 | 385 | 231 | 2,697 |
| **60%** | 183 | 108 | 89 | 107 | 126 | 154 | 188 | 281 | 405 | 472 | 398 | 240 | 2,752 |
| **70%** | 190 | 110 | 91 | 110 | 129 | 158 | 192 | 287 | 413 | 494 | 441 | 253 | 2,836 |
| **80%** | 199 | 117 | 98 | 122 | 143 | 165 | 195 | 304 | 441 | 529 | 469 | 256 | 2,942 |
| **90%** | 205 | 124 | 105 | 139 | 161 | 172 | 209 | 338 | 496 | 577 | 472 | 279 | 3,130 |
| **Max** | 278 | 226 | 142 | 139 | 161 | 190 | 232 | 338 | 496 | 660 | 539 | 316 | 3,283 |
| **Avg** | 179 | 107 | 81 | 94 | 112 | 139 | 171 | 258 | 368 | 431 | 368 | 228 | 2,536 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 111 | 61 | 38 | 30 | 41 | 78 | 89 | 128 | 170 | 180 | 146 | 135 | 1,314 |
| **10%** | 139 | 73 | 48 | 43 | 55 | 93 | 111 | 159 | 217 | 248 | 208 | 164 | 1,586 |
| **20%** | 159 | 90 | 64 | 66 | 81 | 104 | 140 | 210 | 291 | 338 | 278 | 195 | 2,121 |
| **30%** | 170 | 97 | 75 | 85 | 103 | 125 | 153 | 245 | 347 | 398 | 306 | 222 | 2,449 |
| **40%** | 179 | 105 | 85 | 100 | 119 | 142 | 184 | 271 | 387 | 450 | 368 | 228 | 2,646 |
| **50%** | 182 | 107 | 88 | 105 | 124 | 154 | 189 | 278 | 401 | 464 | 394 | 233 | 2,741 |
| **60%** | 185 | 109 | 90 | 109 | 128 | 160 | 192 | 285 | 410 | 479 | 413 | 241 | 2,824 |
| **70%** | 193 | 111 | 93 | 113 | 132 | 163 | 192 | 291 | 420 | 505 | 445 | 253 | 2,885 |
| **80%** | 199 | 117 | 99 | 122 | 143 | 166 | 195 | 304 | 441 | 529 | 468 | 256 | 2,984 |
| **90%** | 205 | 130 | 107 | 139 | 161 | 178 | 210 | 338 | 496 | 577 | 469 | 280 | 3,156 |
| **Max** | 278 | 243 | 149 | 139 | 161 | 190 | 232 | 338 | 496 | 660 | 539 | 318 | 3,286 |
| **Avg** | 180 | 109 | 83 | 96 | 114 | 142 | 173 | 261 | 373 | 439 | 370 | 230 | 2,571 |
| **C. Intertie Minus No Action** | | | | | | | | | | | | | |
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -1 | -26 | 0 | -12 |
| **10%** | 0 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 1 | 10 | 4 | 0 | 2 |
| **20%** | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 4 | 16 | 3 | 2 | 29 |
| **30%** | 1 | 1 | 1 | 2 | 2 | 1 | -1 | 3 | 5 | 14 | -18 | 7 | 61 |
| **40%** | 1 | 1 | 1 | 2 | 2 | 2 | 9 | 4 | 6 | 13 | 3 | 2 | 39 |
| **50%** | 1 | 1 | 1 | 1 | 2 | 5 | 5 | 3 | 6 | 8 | 9 | 2 | 44 |
| **60%** | 1 | 1 | 1 | 2 | 2 | 6 | 4 | 4 | 6 | 7 | 15 | 1 | 72 |
| **70%** | 3 | 1 | 2 | 3 | 3 | 5 | 0 | 4 | 7 | 11 | 4 | 0 | 48 |
| **80%** | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -1 | 0 | 41 |
| **90%** | 0 | 7 | 2 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | -3 | 1 | 26 |
| **Max** | 0 | 17 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **Avg** | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 5 | 8 | 2 | 2 | 35 |

**Table 3.1-17.** Comparison of Banks Pumping Plant Pumping Monthly Distribution (cfs) for Future No Action and Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 562 | 300 | 1,178 | 228 | 641 | 300 | 300 | 300 | 300 | 513 | 300 | 1,280 | 833 |
| **10%** | 2,095 | 2,206 | 3,878 | 2,923 | 2,447 | 2,275 | 928 | 607 | 468 | 1,115 | 2,200 | 2,656 | 1,969 |
| **20%** | 2,774 | 2,914 | 5,204 | 4,209 | 4,211 | 3,800 | 1,519 | 800 | 820 | 3,051 | 4,122 | 3,587 | 2,797 |
| **30%** | 3,408 | 3,838 | 6,629 | 6,537 | 5,634 | 4,310 | 1,637 | 875 | 2,752 | 4,123 | 4,668 | 4,253 | 2,988 |
| **40%** | 4,178 | 4,432 | 6,938 | 6,954 | 6,694 | 5,951 | 2,067 | 1,291 | 3,619 | 5,333 | 5,351 | 4,987 | 3,478 |
| **50%** | 4,442 | 5,676 | 7,014 | 7,235 | 7,035 | 6,743 | 2,548 | 2,377 | 3,903 | 6,143 | 5,945 | 5,315 | 3,784 |
| **60%** | 5,047 | 5,911 | 7,050 | 7,380 | 7,352 | 6,859 | 3,042 | 2,976 | 4,279 | 6,612 | 6,692 | 5,876 | 3,982 |
| **70%** | 5,424 | 6,680 | 7,072 | 7,489 | 7,541 | 6,944 | 3,919 | 3,464 | 4,726 | 6,923 | 7,054 | 6,727 | 4,103 |
| **80%** | 6,198 | 6,680 | 7,163 | 7,734 | 7,682 | 7,045 | 4,440 | 4,409 | 5,234 | 7,005 | 7,180 | 7,179 | 4,266 |
| **90%** | 6,680 | 6,680 | 7,417 | 8,500 | 8,430 | 7,205 | 5,364 | 5,501 | 6,680 | 7,028 | 7,180 | 7,180 | 4,707 |
| **Max** | 6,680 | 6,680 | 7,678 | 8,500 | 8,500 | 7,561 | 6,125 | 6,087 | 6,680 | 7,180 | 7,180 | 7,180 | 4,922 |
| **Avg** | 4,388 | 4,867 | 6,250 | 6,347 | 6,191 | 5,491 | 2,853 | 2,553 | 3,657 | 5,127 | 5,444 | 5,188 | 3,521 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 362 | 300 | 1,139 | 6 | 649 | 300 | 300 | 300 | 300 | 490 | 300 | 1,236 | 1,003 |
| **10%** | 2,103 | 2,138 | 3,383 | 2,741 | 2,469 | 2,283 | 820 | 602 | 468 | 1,294 | 2,908 | 2,663 | 1,984 |
| **20%** | 2,881 | 2,778 | 5,107 | 4,300 | 4,182 | 3,842 | 1,518 | 800 | 908 | 3,151 | 4,217 | 3,615 | 2,778 |
| **30%** | 3,524 | 3,318 | 6,218 | 6,258 | 5,048 | 5,042 | 1,653 | 1,131 | 2,764 | 4,301 | 4,628 | 4,344 | 3,049 |
| **40%** | 4,020 | 4,273 | 6,980 | 6,566 | 6,509 | 6,089 | 2,067 | 1,418 | 3,601 | 5,767 | 5,392 | 4,861 | 3,464 |
| **50%** | 4,439 | 5,512 | 7,020 | 7,196 | 6,860 | 6,805 | 2,604 | 2,544 | 3,906 | 6,158 | 6,076 | 5,273 | 3,723 |
| **60%** | 4,904 | 5,854 | 7,058 | 7,366 | 7,301 | 6,896 | 3,115 | 3,043 | 4,289 | 6,632 | 6,749 | 5,979 | 3,992 |
| **70%** | 5,454 | 6,675 | 7,080 | 7,457 | 7,447 | 6,948 | 3,919 | 3,521 | 4,712 | 6,997 | 7,110 | 6,712 | 4,092 |
| **80%** | 6,058 | 6,680 | 7,163 | 7,854 | 7,680 | 7,054 | 4,438 | 4,462 | 5,239 | 7,005 | 7,180 | 7,180 | 4,251 |
| **90%** | 6,680 | 6,680 | 7,417 | 8,500 | 8,494 | 7,390 | 5,414 | 5,581 | 6,680 | 7,028 | 7,180 | 7,180 | 4,690 |
| **Max** | 6,680 | 6,680 | 7,678 | 8,500 | 8,500 | 7,561 | 6,125 | 6,087 | 6,680 | 7,180 | 7,180 | 7,180 | 4,924 |
| **Avg** | 4,374 | 4,735 | 6,209 | 6,273 | 6,081 | 5,575 | 2,882 | 2,621 | 3,640 | 5,175 | 5,552 | 5,181 | 3,517 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | -200 | 0 | -39 | -222 | 8 | 0 | 0 | 0 | 0 | -23 | 0 | -44 | 170 |
| **10%** | 9 | -68 | -494 | -182 | 23 | 8 | -108 | -4 | 0 | 179 | 708 | 7 | 15 |
| **20%** | 107 | -136 | -97 | 91 | -29 | 43 | -1 | 0 | 89 | 100 | 95 | 28 | -19 |
| **30%** | 115 | -520 | -411 | -279 | -586 | 732 | 16 | 256 | 13 | 178 | -40 | 91 | 61 |
| **40%** | -158 | -159 | 42 | -387 | -186 | 138 | 0 | 126 | -18 | 434 | 41 | -126 | -14 |
| **50%** | -3 | -164 | 7 | -38 | -175 | 62 | 56 | 167 | 4 | 14 | 131 | -42 | -61 |
| **60%** | -143 | -57 | 8 | -14 | -52 | 37 | 73 | 66 | 10 | 20 | 57 | 103 | 10 |
| **70%** | 30 | -5 | 8 | -33 | -94 | 4 | 0 | 57 | -14 | 74 | 56 | -15 | -11 |
| **80%** | -140 | 0 | 0 | 121 | -2 | 9 | -1 | 53 | 5 | 0 | 0 | 1 | -15 |
| **90%** | 0 | 0 | 0 | 0 | 63 | 185 | 50 | 79 | 0 | 0 | 0 | 0 | -17 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **Avg** | -14 | -132 | -41 | -74 | -110 | 84 | 30 | 68 | -17 | 48 | 108 | -7 | -3 |

**Table 3.1-18.** Comparison of Simulated Monthly Distribution of CVP South-of-Delta Deliveries (taf) for Future No Action and Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 39 | 31 | 30 | 6 | 10 | 12 | 50 | 72 | 103 | 108 | 93 | 59 | 927 |
| **10%** | 88 | 77 | 66 | 16 | 52 | 60 | 114 | 170 | 243 | 261 | 220 | 140 | 2,028 |
| **20%** | 162 | 144 | 124 | 39 | 111 | 194 | 160 | 228 | 303 | 318 | 263 | 197 | 2,674 |
| **30%** | 210 | 194 | 201 | 108 | 183 | 268 | 205 | 274 | 345 | 362 | 337 | 239 | 3,054 |
| **40%** | 233 | 221 | 233 | 143 | 250 | 305 | 268 | 316 | 366 | 381 | 362 | 264 | 3,449 |
| **50%** | 252 | 243 | 266 | 161 | 260 | 344 | 298 | 349 | 401 | 397 | 388 | 286 | 3,684 |
| **60%** | 266 | 258 | 281 | 229 | 331 | 381 | 318 | 375 | 437 | 421 | 424 | 311 | 3,881 |
| **70%** | 287 | 266 | 308 | 255 | 358 | 402 | 334 | 388 | 446 | 450 | 446 | 320 | 4,028 |
| **80%** | 296 | 293 | 322 | 352 | 373 | 408 | 342 | 401 | 458 | 463 | 456 | 329 | 4,114 |
| **90%** | 322 | 317 | 421 | 397 | 380 | 422 | 351 | 411 | 468 | 474 | 466 | 344 | 4,282 |
| **Max** | 414 | 421 | 473 | 442 | 432 | 495 | 427 | 497 | 541 | 551 | 515 | 368 | 5,350 |
| **Avg** | 231 | 222 | 244 | 192 | 252 | 300 | 263 | 316 | 376 | 383 | 365 | 264 | 3,407 |
| **B. Intertie** | | | | | | | | | | | | | |
| **Min** | 38 | 30 | 29 | 6 | 10 | 12 | 48 | 70 | 101 | 108 | 26 | 58 | 1,140 |
| **10%** | 91 | 73 | 63 | 16 | 45 | 53 | 114 | 167 | 236 | 253 | 213 | 137 | 1,979 |
| **20%** | 162 | 144 | 123 | 37 | 111 | 193 | 166 | 229 | 309 | 318 | 267 | 198 | 2,674 |
| **30%** | 210 | 192 | 202 | 111 | 194 | 288 | 203 | 275 | 342 | 362 | 336 | 237 | 3,112 |
| **40%** | 236 | 217 | 233 | 137 | 252 | 313 | 267 | 314 | 367 | 376 | 363 | 263 | 3,474 |
| **50%** | 256 | 238 | 260 | 152 | 262 | 342 | 300 | 349 | 406 | 397 | 392 | 297 | 3,669 |
| **60%** | 274 | 250 | 279 | 225 | 321 | 383 | 320 | 378 | 439 | 433 | 423 | 313 | 3,854 |
| **70%** | 286 | 269 | 305 | 254 | 346 | 402 | 332 | 386 | 445 | 450 | 447 | 322 | 4,026 |
| **80%** | 304 | 293 | 317 | 301 | 370 | 407 | 345 | 400 | 459 | 462 | 451 | 331 | 4,110 |
| **90%** | 323 | 312 | 403 | 396 | 382 | 422 | 351 | 412 | 469 | 478 | 467 | 343 | 4,288 |
| **Max** | 414 | 421 | 474 | 442 | 433 | 495 | 427 | 497 | 541 | 551 | 516 | 368 | 5,355 |
| **Avg** | 233 | 220 | 242 | 187 | 251 | 301 | 263 | 317 | 377 | 385 | 365 | 264 | 3,406 |
| **C. Intertie Minus Future No Action** | | | | | | | | | | | | | |
| **Min** | -1 | -1 | -1 | 0 | 0 | 0 | -1 | -2 | -2 | 0 | -67 | -1 | 213 |
| **10%** | 3 | -5 | -3 | -1 | -6 | -7 | 0 | -4 | -7 | -8 | -7 | -3 | -49 |
| **20%** | 0 | 0 | -1 | -2 | 0 | -1 | 6 | 1 | 6 | 0 | 5 | 1 | 0 |
| **30%** | 0 | -2 | 1 | 4 | 10 | 21 | -2 | 0 | -3 | 1 | -1 | -2 | 58 |
| **40%** | 3 | -4 | 0 | -5 | 3 | 8 | 0 | -2 | 1 | -5 | 0 | -1 | 25 |
| **50%** | 5 | -4 | -5 | -9 | 2 | -2 | 2 | 0 | 5 | 1 | 3 | 11 | -15 |
| **60%** | 8 | -8 | -2 | -4 | -10 | 2 | 3 | 3 | 2 | 12 | -1 | 1 | -27 |
| **70%** | -1 | 3 | -3 | -1 | -12 | 0 | -2 | -2 | -1 | 0 | 2 | 1 | -2 |
| **80%** | 8 | 0 | -5 | -51 | -3 | -1 | 2 | -1 | 1 | -1 | -5 | 2 | -4 |
| **90%** | 0 | -5 | -19 | -1 | 2 | 0 | 0 | 1 | 1 | 4 | 0 | -1 | 6 |
| **Max** | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **Avg** | 2 | -2 | -2 | -5 | -1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | -2 |

**Table 3.1-19.** Comparison of Jones Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Virtual Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No-Action** | | | | | | | | | | | | | |
| **Min** | 1,101 | 600 | 2,165 | 600 | 800 | 599 | 799 | 799 | 798 | 600 | 597 | 1,144 | 1,099 |
| **10%** | 2,639 | 2,103 | 3,320 | 3,647 | 2,127 | 1,152 | 800 | 800 | 800 | 1,195 | 800 | 2,057 | 1,639 |
| **20%** | 2,947 | 3,919 | 4,210 | 4,213 | 2,855 | 1,988 | 1,420 | 800 | 1,980 | 1,987 | 1,803 | 2,869 | 2,034 |
| **30%** | 3,523 | 4,226 | 4,214 | 4,217 | 3,744 | 2,373 | 1,600 | 800 | 2,475 | 2,984 | 3,278 | 4,054 | 2,231 |
| **40%** | 3,997 | 4,240 | 4,219 | 4,222 | 4,221 | 2,709 | 1,926 | 1,125 | 2,475 | 3,569 | 4,449 | 4,437 | 2,453 |
| **50%** | 4,263 | 4,245 | 4,220 | 4,224 | 4,237 | 3,171 | 2,097 | 1,344 | 2,650 | 4,126 | 4,506 | 4,457 | 2,518 |
| **60%** | 4,330 | 4,247 | 4,221 | 4,225 | 4,241 | 3,839 | 2,378 | 1,500 | 2,755 | 4,527 | 4,518 | 4,462 | 2,569 |
| **70%** | 4,337 | 4,248 | 4,221 | 4,226 | 4,242 | 4,155 | 2,547 | 1,762 | 2,955 | 4,553 | 4,523 | 4,465 | 2,618 |
| **80%** | 4,359 | 4,255 | 4,223 | 4,228 | 4,243 | 4,252 | 2,547 | 1,911 | 3,000 | 4,580 | 4,540 | 4,474 | 2,695 |
| **90%** | 4,387 | 4,264 | 4,226 | 4,231 | 4,247 | 4,276 | 2,747 | 3,000 | 3,000 | 4,600 | 4,571 | 4,489 | 2,754 |
| **Max** | 4,387 | 4,264 | 4,226 | 4,231 | 4,253 | 4,300 | 3,518 | 3,000 | 3,000 | 4,600 | 4,571 | 4,490 | 2,899 |
| **Avg** | 3,763 | 3,806 | 4,044 | 3,970 | 3,647 | 3,059 | 2,014 | 1,499 | 2,391 | 3,472 | 3,516 | 3,831 | 2,354 |
| **B. Virtual Intertie** | | | | | | | | | | | | | |
| **Min** | 1,093 | 600 | 1,342 | 104 | 800 | 600 | 800 | 797 | 800 | 600 | 600 | 1,068 | 1,178 |
| **10%** | 2,478 | 2,043 | 3,358 | 3,712 | 2,085 | 1,090 | 800 | 800 | 801 | 1,049 | 800 | 2,056 | 1,639 |
| **20%** | 2,934 | 3,724 | 4,210 | 4,212 | 2,457 | 1,940 | 1,420 | 800 | 2,335 | 2,073 | 1,802 | 2,877 | 2,004 |
| **30%** | 3,298 | 4,221 | 4,212 | 4,215 | 2,774 | 2,180 | 1,603 | 800 | 2,475 | 3,040 | 2,770 | 3,898 | 2,229 |
| **40%** | 4,036 | 4,231 | 4,214 | 4,218 | 3,601 | 2,480 | 1,922 | 1,125 | 2,475 | 3,559 | 4,536 | 4,322 | 2,397 |
| **50%** | 4,278 | 4,233 | 4,214 | 4,219 | 4,222 | 2,656 | 2,082 | 1,362 | 2,650 | 4,338 | 4,600 | 4,415 | 2,480 |
| **60%** | 4,303 | 4,234 | 4,215 | 4,219 | 4,233 | 3,006 | 2,371 | 1,500 | 2,802 | 4,570 | 4,600 | 4,428 | 2,525 |
| **70%** | 4,307 | 4,235 | 4,215 | 4,220 | 4,234 | 3,512 | 2,546 | 1,736 | 2,924 | 4,600 | 4,600 | 4,440 | 2,586 |
| **80%** | 4,320 | 4,239 | 4,216 | 4,221 | 4,235 | 3,887 | 2,547 | 1,911 | 3,000 | 4,600 | 4,600 | 4,461 | 2,648 |
| **90%** | 4,340 | 4,244 | 4,217 | 4,222 | 4,237 | 4,257 | 2,734 | 3,000 | 3,000 | 4,600 | 4,600 | 4,516 | 2,715 |
| **Max** | 4,340 | 4,244 | 4,217 | 4,223 | 4,241 | 4,274 | 3,745 | 3,000 | 3,000 | 4,600 | 4,600 | 4,516 | 2,842 |
| **Avg** | 3,706 | 3,751 | 4,018 | 3,978 | 3,449 | 2,757 | 2,001 | 1,496 | 2,428 | 3,511 | 3,540 | 3,824 | 2,320 |
| **C. Virtual Intertie Minus Future No-Action** | | | | | | | | | | | | | |
| **Min** | -9 | 0 | -822 | -496 | 0 | 1 | 1 | -1 | 2 | 0 | 3 | -76 | 80 |
| **10%** | -161 | -61 | 38 | 65 | -42 | -62 | 0 | 0 | 1 | -146 | 0 | -1 | 0 |
| **20%** | -13 | -195 | 0 | -1 | -398 | -48 | 0 | 0 | 355 | 86 | -2 | 8 | -30 |
| **30%** | -226 | -5 | -2 | -3 | -970 | -193 | 3 | 0 | 0 | 56 | -508 | -156 | -2 |
| **40%** | 39 | -9 | -5 | -4 | -620 | -229 | -4 | 0 | 0 | -11 | 88 | -115 | -56 |
| **50%** | 15 | -12 | -6 | -6 | -15 | -515 | -15 | 18 | 0 | 211 | 94 | -42 | -37 |
| **60%** | -27 | -13 | -6 | -6 | -9 | -833 | -7 | 0 | 47 | 43 | 82 | -34 | -44 |
| **70%** | -30 | -13 | -6 | -6 | -8 | -643 | -1 | -27 | -31 | 47 | 77 | -25 | -31 |
| **80%** | -39 | -16 | -7 | -7 | -8 | -365 | 0 | 0 | 0 | 20 | 60 | -12 | -47 |
| **90%** | -47 | -20 | -9 | -9 | -10 | -19 | -13 | 0 | 0 | 0 | 29 | 26 | -39 |
| **Max** | -47 | -20 | -9 | -8 | -12 | -26 | 228 | 0 | 0 | 0 | 29 | 25 | -58 |
| **Avg** | -56 | -55 | -26 | 8 | -197 | -302 | -13 | -3 | 37 | 39 | 24 | -6 | -33 |

**D. Virtual Intertie Minus Intertie**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -10 |
| **10%** | 0 | 0 | 0 | 112 | 153 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | -46 |
| **20%** | 0 | 0 | -208 | -14 | 97 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | -43 |
| **30%** | 0 | -375 | -388 | -363 | 23 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | -72 |
| **40%** | 0 | -369 | -386 | -382 | 128 | 103 | 0 | 0 | 0 | 0 | 0 | -119 | -70 |
| **50%** | -35 | -367 | -386 | -381 | -18 | 4 | 0 | 0 | 0 | 0 | 0 | -185 | -69 |
| **60%** | -231 | -366 | -385 | -381 | -253 | 195 | 0 | 0 | 0 | 0 | 0 | -172 | -75 |
| **70%** | -293 | -365 | -385 | -380 | -366 | 382 | 0 | 0 | 0 | 0 | 0 | -160 | -83 |
| **80%** | -280 | -361 | -384 | -379 | -365 | 115 | 0 | 0 | 0 | 0 | 0 | -139 | -84 |
| **90%** | -260 | -356 | -383 | -378 | -363 | -159 | 0 | 0 | 0 | 0 | 0 | -84 | -99 |
| **Max** | -260 | -356 | -383 | -377 | -359 | -326 | 0 | 0 | 0 | 0 | 0 | -84 | -82 |
| **Avg** | -122 | -271 | -307 | -269 | -131 | 59 | 0 | 0 | 0 | 0 | 0 | -91 | -68 |

**Table 3.1-20.** Comparison of Banks Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Virtual Intertie

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | taf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Future No Action** | | | | | | | | | | | | | |
| **Min** | 562 | 300 | 1,178 | 228 | 641 | 300 | 300 | 300 | 300 | 513 | 300 | 1,280 | 833 |
| **10%** | 2,095 | 2,206 | 3,878 | 2,923 | 2,447 | 2,275 | 928 | 607 | 468 | 1,115 | 2,200 | 2,656 | 1,969 |
| **20%** | 2,774 | 2,914 | 5,204 | 4,209 | 4,211 | 3,800 | 1,519 | 800 | 820 | 3,051 | 4,122 | 3,587 | 2,797 |
| **30%** | 3,408 | 3,838 | 6,629 | 6,537 | 5,634 | 4,310 | 1,637 | 875 | 2,752 | 4,123 | 4,668 | 4,253 | 2,988 |
| **40%** | 4,178 | 4,432 | 6,938 | 6,954 | 6,694 | 5,951 | 2,067 | 1,291 | 3,619 | 5,333 | 5,351 | 4,987 | 3,478 |
| **50%** | 4,442 | 5,676 | 7,014 | 7,235 | 7,035 | 6,743 | 2,548 | 2,377 | 3,903 | 6,143 | 5,945 | 5,315 | 3,784 |
| **60%** | 5,047 | 5,911 | 7,050 | 7,380 | 7,352 | 6,859 | 3,042 | 2,976 | 4,279 | 6,612 | 6,692 | 5,876 | 3,982 |
| **70%** | 5,424 | 6,680 | 7,072 | 7,489 | 7,541 | 6,944 | 3,919 | 3,464 | 4,726 | 6,923 | 7,054 | 6,727 | 4,103 |
| **80%** | 6,198 | 6,680 | 7,163 | 7,734 | 7,682 | 7,045 | 4,440 | 4,409 | 5,234 | 7,005 | 7,180 | 7,179 | 4,266 |
| **90%** | 6,680 | 6,680 | 7,417 | 8,500 | 8,430 | 7,205 | 5,364 | 5,501 | 6,680 | 7,028 | 7,180 | 7,180 | 4,707 |
| **Max** | 6,680 | 6,680 | 7,678 | 8,500 | 8,500 | 7,561 | 6,125 | 6,087 | 6,680 | 7,180 | 7,180 | 7,180 | 4,922 |
| **Avg** | 4388 | 4867 | 6250 | 6347 | 6191 | 5491 | 2853 | 2553 | 3657 | 5127 | 5444 | 5188 | 3521 |
| **B. Virtual Intertie** | | | | | | | | | | | | | |
| **Min** | 705 | 300 | 1,139 | 6 | 649 | 300 | 300 | 300 | 300 | 490 | 300 | 1,236 | 1,027 |
| **10%** | 2,103 | 2,197 | 3,716 | 2,853 | 2,501 | 2,283 | 820 | 602 | 468 | 1,294 | 2,908 | 2,663 | 2,046 |
| **20%** | 2,881 | 2,779 | 5,367 | 4,662 | 4,204 | 3,842 | 1,518 | 800 | 908 | 3,151 | 4,217 | 3,719 | 2,816 |
| **30%** | 3,524 | 3,649 | 6,662 | 6,473 | 5,157 | 5,106 | 1,653 | 1,131 | 2,764 | 4,301 | 4,628 | 4,462 | 3,107 |
| **40%** | 4,211 | 4,367 | 7,181 | 6,927 | 6,724 | 6,222 | 2,067 | 1,418 | 3,601 | 5,767 | 5,392 | 4,928 | 3,542 |
| **50%** | 4,439 | 5,881 | 7,324 | 7,246 | 6,861 | 6,816 | 2,604 | 2,544 | 3,906 | 6,158 | 6,076 | 5,449 | 3,798 |
| **60%** | 5,118 | 6,467 | 7,376 | 7,444 | 7,352 | 6,946 | 3,115 | 3,043 | 4,289 | 6,632 | 6,749 | 6,053 | 4,038 |
| **70%** | 5,615 | 6,680 | 7,408 | 7,545 | 7,629 | 6,999 | 3,919 | 3,521 | 4,712 | 6,997 | 7,110 | 6,713 | 4,140 |
| **80%** | 6,360 | 6,680 | 7,547 | 7,957 | 7,921 | 7,219 | 4,438 | 4,462 | 5,239 | 7,005 | 7,180 | 7,180 | 4,282 |
| **90%** | 6,680 | 6,680 | 7,678 | 8,500 | 8,500 | 7,480 | 5,414 | 5,581 | 6,680 | 7,028 | 7,180 | 7,180 | 4,752 |
| **Max** | 6,680 | 6,680 | 7,678 | 8,500 | 8,500 | 7,561 | 6,125 | 6,087 | 6,680 | 7,180 | 7,180 | 7,180 | 4,982 |
| **Avg** | 4459 | 4894 | 6473 | 6405 | 6173 | 5634 | 2882 | 2621 | 3640 | 5175 | 5552 | 5234 | 3568 |
| **C. Virtual Intertie minus Future No Action** | | | | | | | | | | | | | |
| **Min** | 142 | 0 | -39 | -222 | 8 | 0 | 0 | 0 | 0 | -23 | 0 | -44 | 194 |
| **10%** | 9 | -9 | -162 | -70 | 55 | 8 | -108 | -4 | 0 | 179 | 708 | 7 | 77 |
| **20%** | 107 | -134 | 162 | 453 | -7 | 43 | -1 | 0 | 89 | 100 | 95 | 132 | 19 |
| **30%** | 115 | -189 | 33 | -63 | -476 | 796 | 16 | 256 | 13 | 178 | -40 | 209 | 119 |
| **40%** | 33 | -64 | 243 | -27 | 30 | 271 | 0 | 126 | -18 | 434 | 41 | -59 | 64 |
| **50%** | -3 | 205 | 310 | 12 | -173 | 73 | 56 | 167 | 4 | 14 | 131 | 134 | 14 |
| **60%** | 71 | 556 | 326 | 64 | 0 | 87 | 73 | 66 | 10 | 20 | 57 | 176 | 55 |
| **70%** | 191 | 0 | 336 | 55 | 88 | 55 | 0 | 57 | -14 | 74 | 56 | -13 | 37 |
| **80%** | 162 | 0 | 384 | 224 | 239 | 174 | -1 | 53 | 5 | 0 | 0 | 1 | 16 |
| **90%** | 0 | 0 | 261 | 0 | 70 | 275 | 50 | 79 | 0 | 0 | 0 | 0 | 45 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| **Avg** | 71 | 27 | 223 | 59 | -18 | 143 | 30 | 68 | -17 | 49 | 108 | 46 | 48 |

**D. Virtual Intertie minus Intertie**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | 343 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| **10%** | 0 | 59 | 332 | 112 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| **20%** | 0 | 2 | 260 | 362 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 104 | 38 |
| **30%** | 0 | 331 | 444 | 215 | 110 | 64 | 0 | 0 | 0 | 0 | 0 | 118 | 58 |
| **40%** | 190 | 94 | 201 | 360 | 215 | 133 | 0 | 0 | 0 | 0 | 0 | 66 | 78 |
| **50%** | 0 | 369 | 304 | 50 | 1 | 11 | 0 | 0 | 0 | 0 | 0 | 176 | 75 |
| **60%** | 214 | 614 | 318 | 78 | 52 | 50 | 0 | 0 | 0 | 0 | 0 | 73 | 46 |
| **70%** | 161 | 5 | 328 | 88 | 182 | 52 | 0 | 0 | 0 | 0 | 0 | 1 | 48 |
| **80%** | 302 | 0 | 384 | 103 | 241 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| **90%** | 0 | 0 | 261 | 0 | 6 | 90 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| **Max** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 |
| **Avg** | 85 | 159 | 263 | 132 | 92 | 59 | 0 | 0 | 0 | 0 | 0 | 53 | 51 |

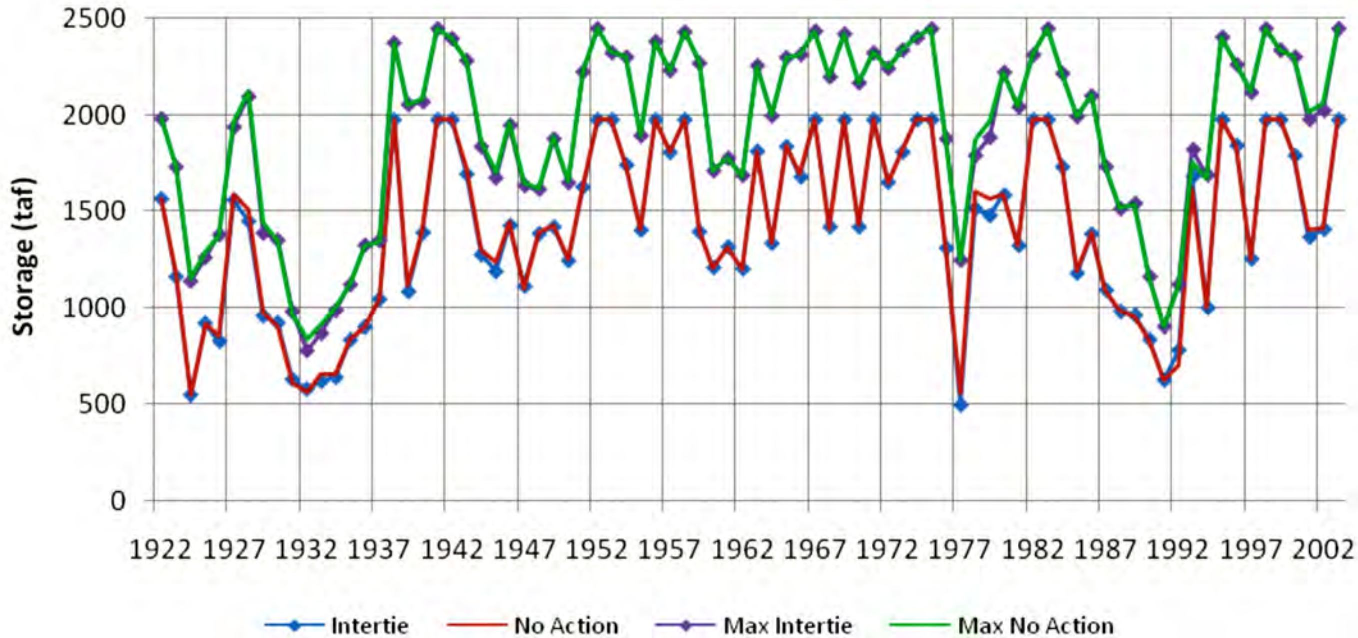


**Figure 3.1-1.** CALSIM-Simulated Trinity Reservoir Annual Minimum and Maximum Storage for 1922–2003

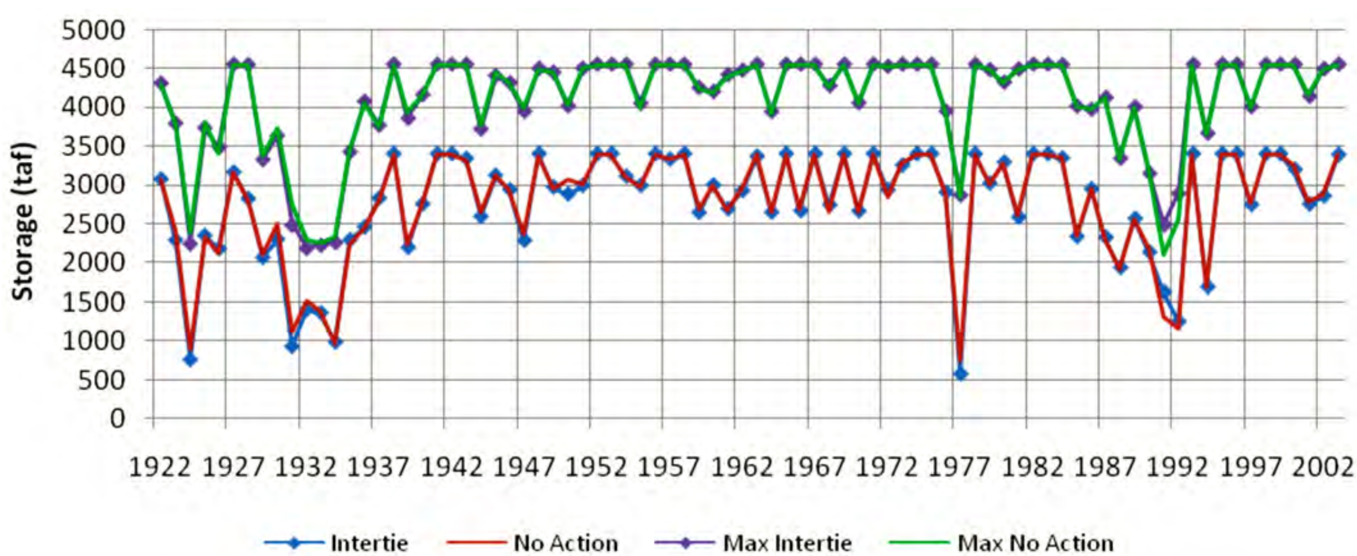


**Figure 3.1-2.** CALSIM-Simulated Shasta Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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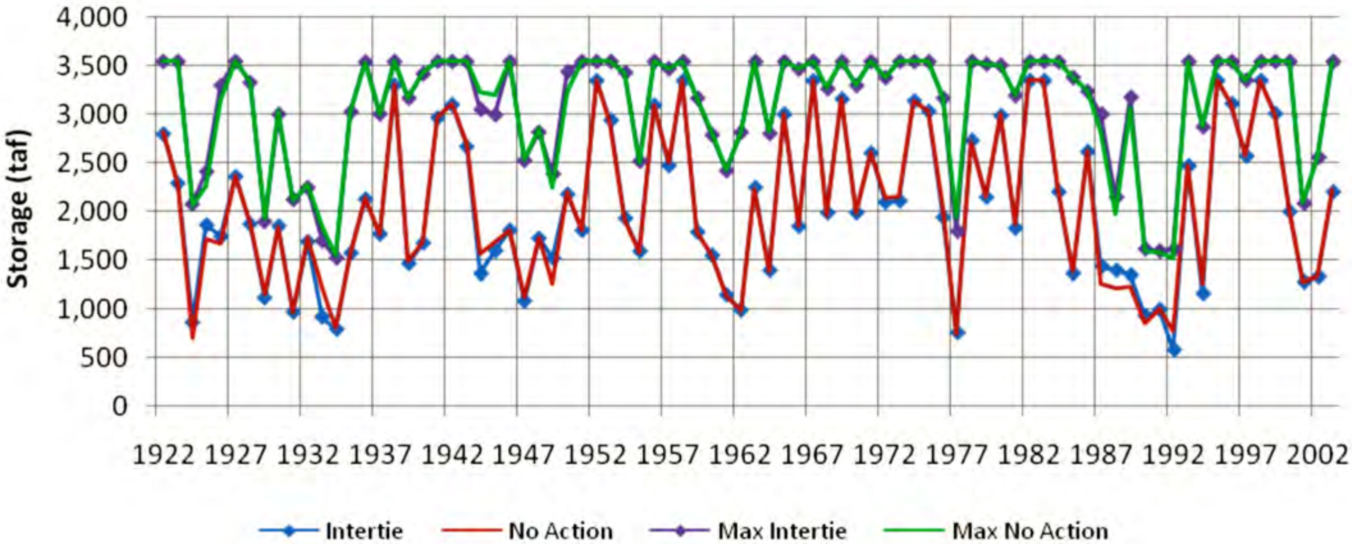


**Figure 3.1-3.** CALSIM-Simulated Oroville Reservoir Annual Minimum and Maximum Storage for 1922–2003

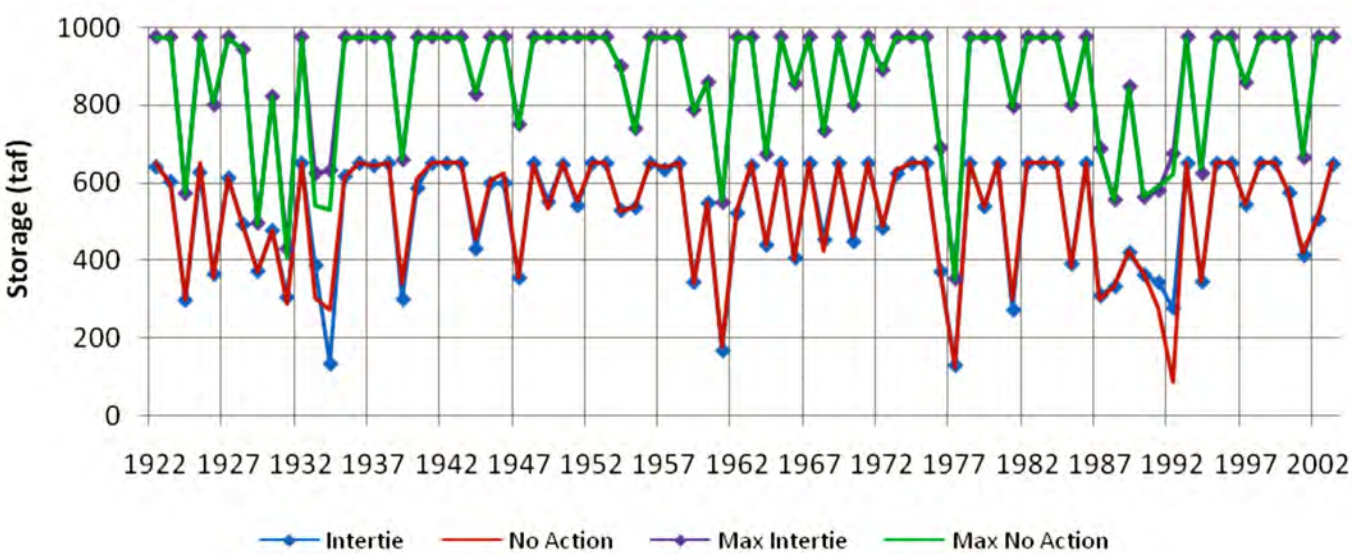


**Figure 3.1-4.** CALSIM-Simulated Folsom Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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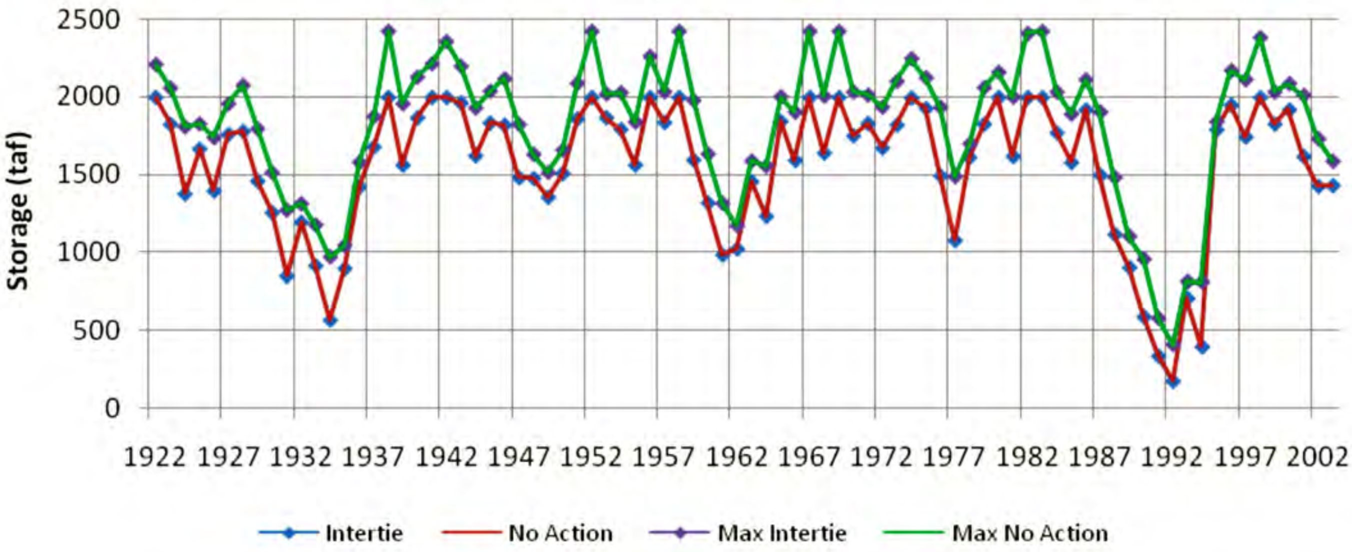


**Figure 3.1-5.** CALSIM-Simulated New Melones Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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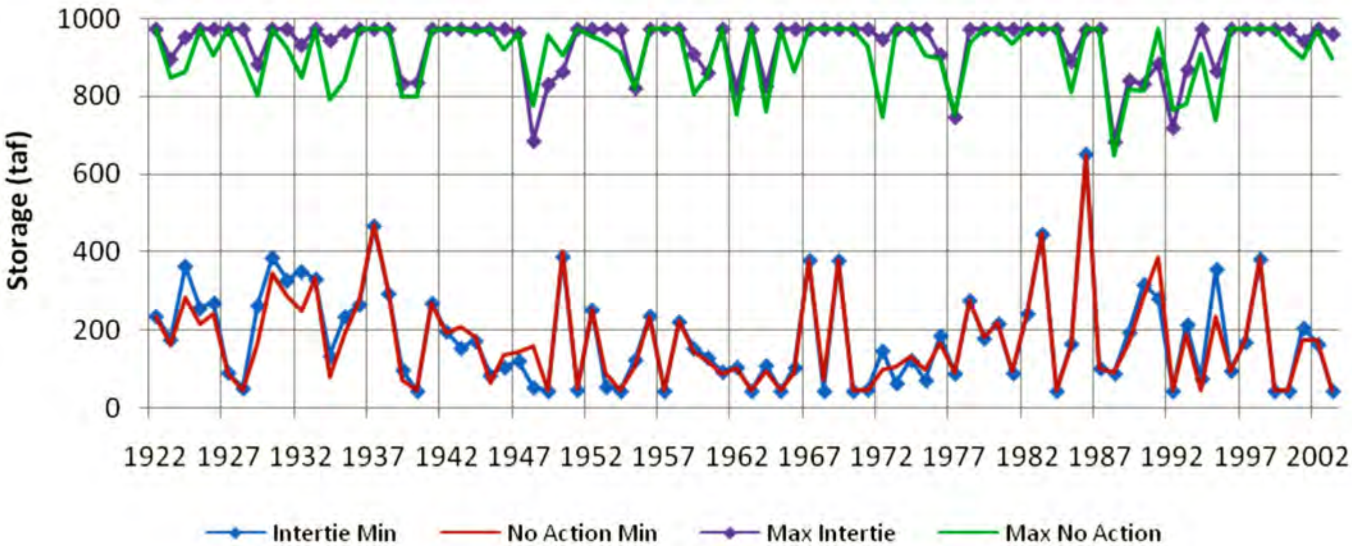


**Figure 3.1-6.** CALSIM-Simulated CVP San Luis Reservoir Annual Minimum and Maximum Storage for 1922–2003

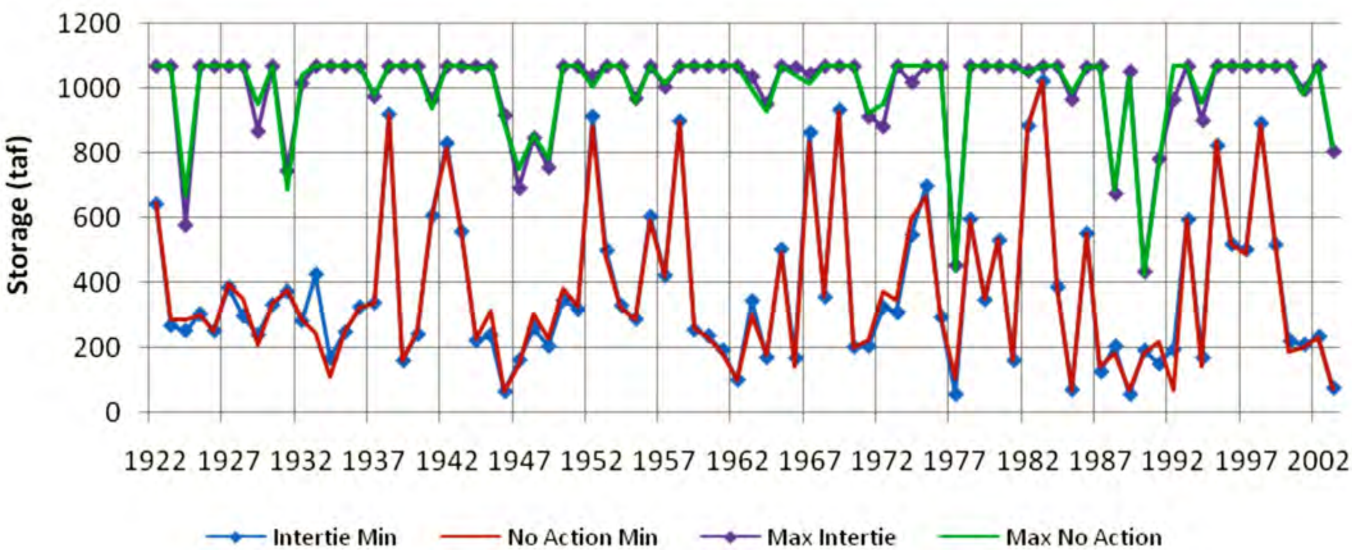


**Figure 3.1-7.** CALSIM-Simulated SWP San Luis Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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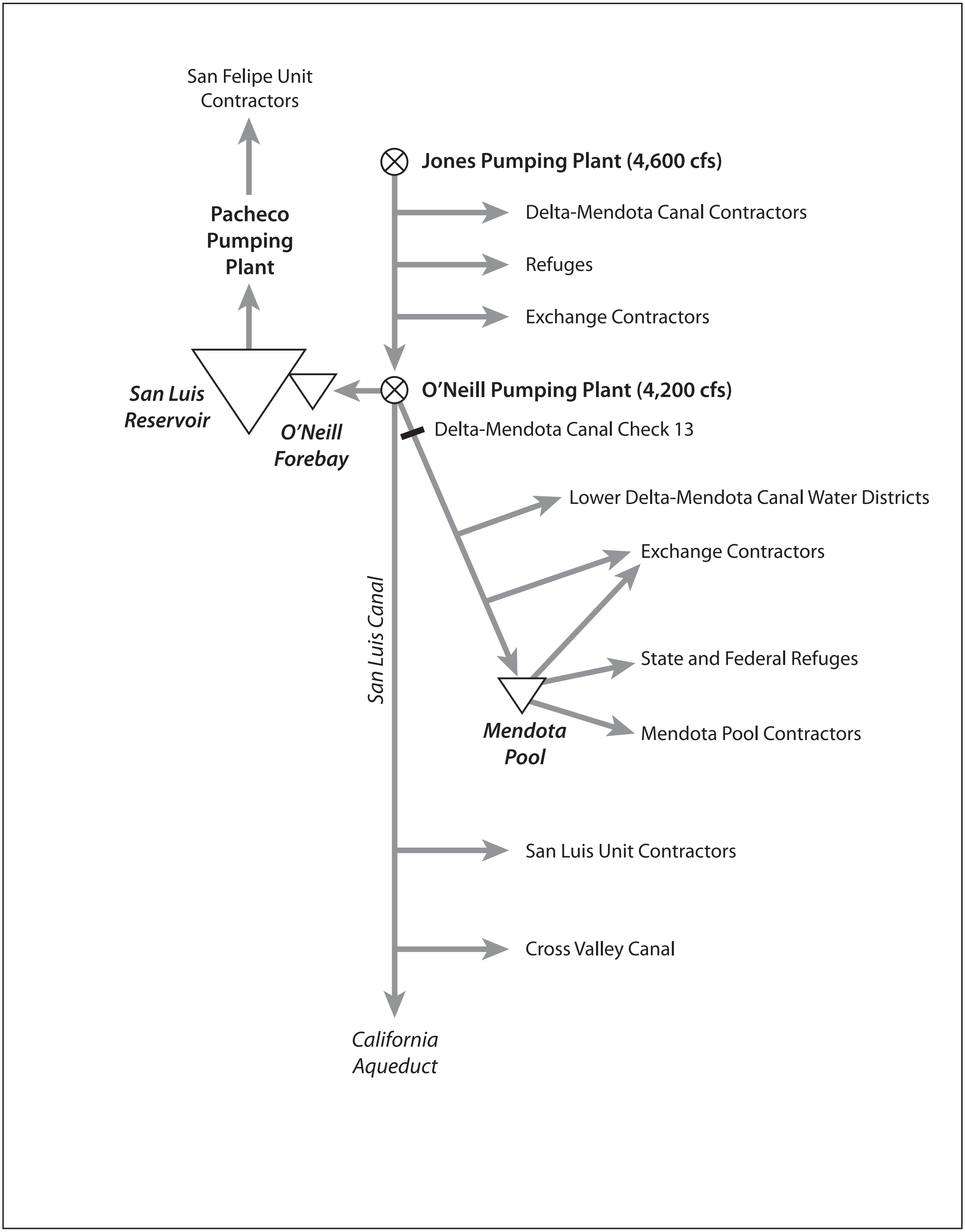


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**Figure 3.1-8**
**Diagram of CVP South-of-Delta Deliveries**

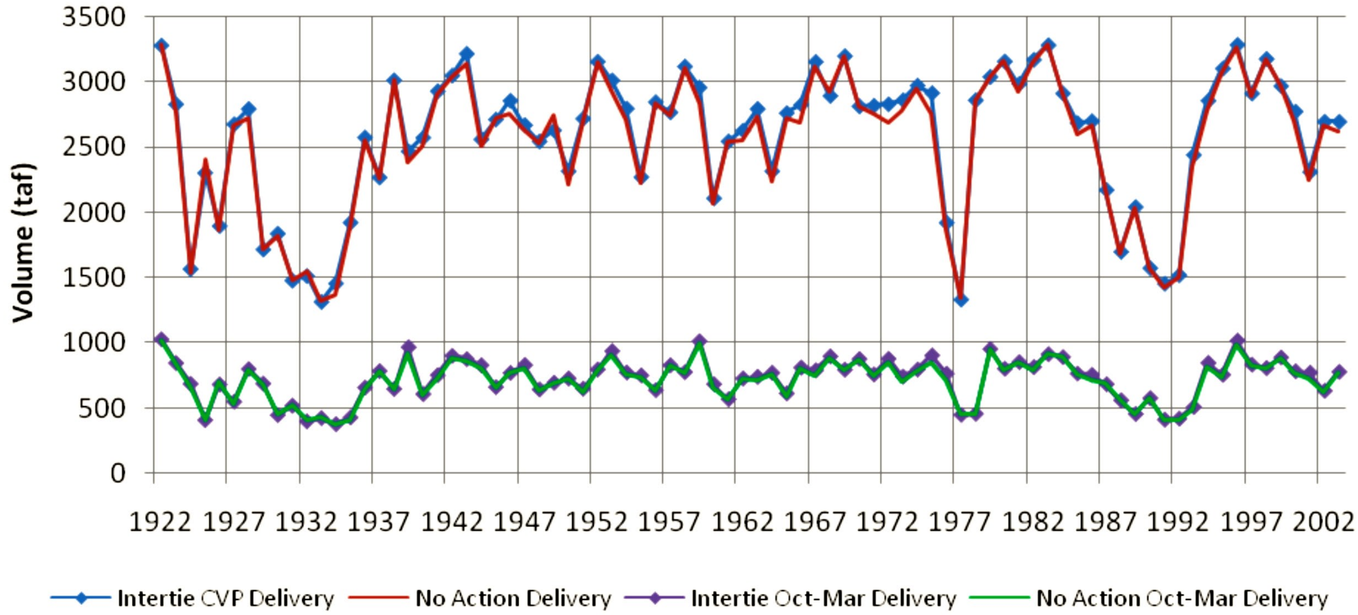


**Figure 3.1-9.** CALSIM-Simulated CVP South-of-Delta Annual Deliveries for 1922–2003

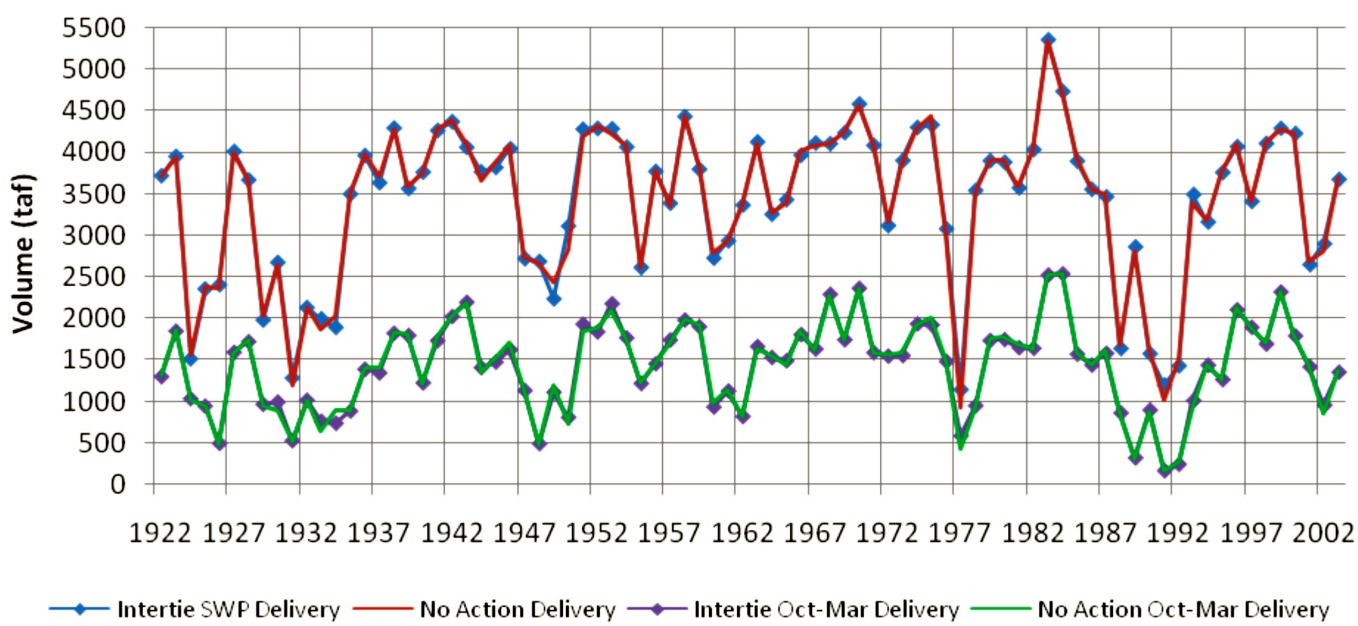


**Figure 3.1-10.** CALSIM-Simulated SWP South-of=Delta Annual Deliveries for 1922–2003

Graphics … 06688.06 (1-09) tm

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# 3.2 Delta Tidal Hydraulics

## 3.2.1 Introduction

Delta tidal hydraulic conditions (hydrodynamics) are the results of the tidal movement of water in Delta channels (e.g., changes in channel elevations, velocities, flows) interacting with the net channel flows caused by Delta inflows, exports, and Delta outflows. This section describes Delta tidal hydraulic conditions and discusses potential effects of Intertie operations on tidal elevations, tidal and net channel flows, and tidal velocities in the Delta channels.

## 3.2.2 Affected Environment

The DMC intake, located on Old River in the south Delta near Tracy, and the Jones Pumping Plant, which pumps water about 200 feet into the upper (upstream) section of the DMC, are directly affected by tidal hydraulic processes. Because the DMC intake is located in the tidal portion of the Old River channel, the water surface elevation varies by about 3-5 feet throughout each day. The Tracy Fish Collection Facility (TFCF) is located at the intake channel on Old River, and the water elevation and approach velocities of the primary louvers (i.e., fish screening facilities) vary considerably with the tides. The Jones Pumping Plant, with a capacity of about 4,600 cfs, produces a constant flow from Old River into the DMC intake channel, while the velocity increases slightly with low tide elevation and decreases slightly with higher tide elevation.

The tidal hydraulic conditions in the Delta with existing CVP and SWP facilities under the D-1641 operations criteria recently have been described and simulated with the DSM2 tidal hydraulic model for the 2008 CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). The CVP/SWP Longterm Operations Plan future conditions assumed the Intertie and the South Delta Improvements Program (SDIP) permanent operable tidal gates as likely near-future CVP and SWP facilities. This section focuses on the differences between the simulated future conditions with the Intertie and the future No Action conditions without the Intertie Project. The CVP and SWP monthly pumping patterns with and without the Intertie first were simulated with the latest version of the CALSIM II model, as described and summarized in Section 3.1, Water Supply and Delta Water Management. The CALSIM-simulated changes in Delta inflows, CVP and SWP exports, and Delta outflow were used as the inputs for the DSM2 modeling of the 1976–1991 representative study period.

#### *Sources of Information*

The major source of information for this section is simulation results from the "hydrodynamic" module of the Delta Simulation Model (DSM2). DSM2 is a one-dimensional hydrodynamic (and water quality) model used to calculate tidal hydraulic conditions in the Delta. The model was developed by DWR and is frequently used to ascertain impacts associated with projects in the Delta, such as changes in exports, diversions, or channel geometry associated with channel dredging or barriers. Monthly flows from CALSIM are used in DSM2 for evaluations of the changes caused by the Intertie from the Future No Action.

Delta hydrodynamic modeling was based on CALSIM II monthly average inflows and exports for the 16-year period of water years 1976–1991, derived from the 2008 OCAP (study 8.0). This standard 16-year simulation is routinely used for impact analysis, including the analysis presented in the CALFED Programmatic EIS/EIR (CALFED Bay-Delta Program 2000) and the SDIP (California Department of Water Resources and U.S. Department of the Interior, Bureau of Reclamation 2005).

The DSM2 simulation results for the No Action (Alternative 1) and the Proposed Intertie (Alternative 2) are fully described and compared in Appendix C, "DSM2 Modeling Studies of the Delta Mendota Canal/California Aqueduct Intertie." The DSM2 was used to analyze Delta tidal hydraulic and water quality conditions for the Future No Action and Intertie alternatives. Like all models DSM2 has limitations, discussed in Appendix C, that need to be kept in mind when interpreting its results. DSM2 is a one-dimensional model which simulates tidal flows in the longitudinal direction. More detailed flows associated with vertical or lateral mixing, flow circulations caused by bends or expansions and contractions of the channels are not simulated. The model uses monthly flows from CALSIM and does not simulate the daily pattern of storm inflows. Despite these limitations, DSM2 has been calibrated to match measured flows and tidal elevations and is appropriate for comparative analyses of the Intertie Alternatives.

## 3.2.3 Environmental Consequences

#### *Approach*

*Methodology*

Channel tidal flows and stage variations at several Delta locations have been reviewed to describe possible effects of Intertie operations on Delta tidal hydraulics. Because the simulated increases in Jones Pumping Plant pumping are relatively small, no changes are expected in the tidal hydraulic conditions at Delta locations other than channels in the south Delta. The locations reviewed for impact assessment are described below.

- **Old River at Clifton Court Ferry**. This station is between Grant Line Canal and the CCF intake gates. It is just downstream of the Jones Pumping Plant intake canal. The CVP and SWP pumping have the greatest combined effect on tidal elevations and flows at this station.
- **Old River at Tracy Road Bridge**. This station is a traditional tidal elevation and EC monitoring location and is upstream of the Old River at Tracy temporary barrier and proposed SDIP permanent tidal gate structure.
- **Old River downstream of the head of Old River**. This station is located just downstream of the temporary barrier and proposed SDIP permanent tidal gate at the head of Old River and is influenced by the San Joaquin River flows and tidal elevations.
- **Grant Line Canal at Tracy Road Bridge**. This station is just upstream of the temporary barrier on Grant Line Canal and about 4 miles upstream of the proposed permanent tidal gate on Grant Line Canal.
- **Middle River at Tracy Road Bridge**. This station is located just upstream of the temporary barrier near Victoria Canal and the proposed SDIP permanent tidal gate.

The No Action and Proposed Action conditions include SDIP permanent tidal gates operated during the irrigation season of May–October to maintain minimum elevations above 0 feet msl for agricultural diversions upstream of the barriers. The head of Old River tidal gate also is included in the modeling scenarios. The head of Old River gate is closed during the VAMP period of April 15–May 15 for protection of migrating juvenile Chinook salmon and in October and November for protection of migrating adult Chinook salmon.

#### *Regulatory Setting*

No state or federal regulatory guidelines or criteria have been established for evaluating effects of tidal hydraulics. There are state and local agreements between DWR and SDWA governing the minimum tidal elevations in south Delta channels during the irrigation season of April through September. The minimum tide elevation of 0.0 feet msl (1929 national geodetic vertical datum [NGVD]) at several locations is included in the State Water Board D-1641 criteria for joint point of diversion approval. The minimum tide elevation criteria have been included in the permanent tidal gate operations assumed for the No Action and Intertie Alternatives.

### 3.2.4 Environmental Effects

The general effects of increased CVP and SWP pumping on south Delta tidal hydraulics were simulated with a range of representative pumping flows to characterize the changes in tidal hydraulics caused by increased pumping. Tidal elevation and flow variations were simulated with a relatively low San Joaquin River inflow of 1,500 cfs and several constant pumping cases for a typical month of measured tidal elevations at Martinez (August 1997), and adjusted Sacramento River daily inflows to maintain an outflow of about 5,000 cfs. Results for no CVP or SWP pumping were compared both to results with 4,600-cfs Jones Pumping Plant pumping and to results with 6,680-cfs Banks Pumping Plant pumping to identify the maximum tidal effects of the CVP and SWP pumping without south Delta tidal gates or barriers. These model results are considered typical of the maximum potential effects of the Jones Pumping Plant and the maximum allowed Banks Pumping Plant pumping with associated CCF gate operations. Compared to these large changes in CVP and SWP pumping, the Intertie alternatives impact assessment considers only the relatively small CVP pumping change from about 4,200 cfs to about 4,600 cfs.

Review of the DSM2 results for this typical month indicates that the constant Jones Pumping Plant pumping and the tidal diversion of water into CCF for Banks Pumping Plant pumping both will cause an increase in the tidal and net flows moving from the San Joaquin River toward the pumping plants. The increased flow will move along all three pathways from the San Joaquin River:

- from the head of Old River and Grant Line Canal to the DMC,
- from the mouth of Middle River and Columbia Cut and Turner Cut to Victoria Canal and the Old River channel, and
- from the mouth of Old River or Dutch Slough through Franks Tract and down the Old River channel to the CCF gates and the DMC.

The effects of the maximum existing CVP and SWP pumping (11,280 cfs) on tidal elevations in the south Delta can be seen as a change of more than 1 foot at the head of Old River but cannot be detected (less than 1 inch) in the central Delta at the mouth of Middle River or the mouth of Old River.

Figure 3.2-1 provides a summary of the tidal elevation variations during the simulated typical month for Old River at Tracy Road and Grant Line Canal at Tracy Road. The simulated effects of total pumping increasing from 11,280 cfs to 13,100 cfs (an increase of 1,820 cfs) were less than 1 inch reduction in maximum and minimum tidal elevations at both locations. The Intertie would allow the CVP pumping to increase a maximum of about 400 cfs.

Figure 3.2-2 shows the simulated effects of the full range of CVP and SWP export pumping on the tidal elevations in Old River at Clifton Court Ferry and in Middle River at Tracy Road. The simulated effects were greatest at the Clifton Court Ferry location because it is closest to the DMC and CCF intakes. The simulated changes in tidal elevations (low tide and high tide) for increased pumping between 11,280 cfs and 13,100 cfs were less than 1 inch at these locations as well. Therefore the incremental effects of the 400-cfs maximum additional CVP

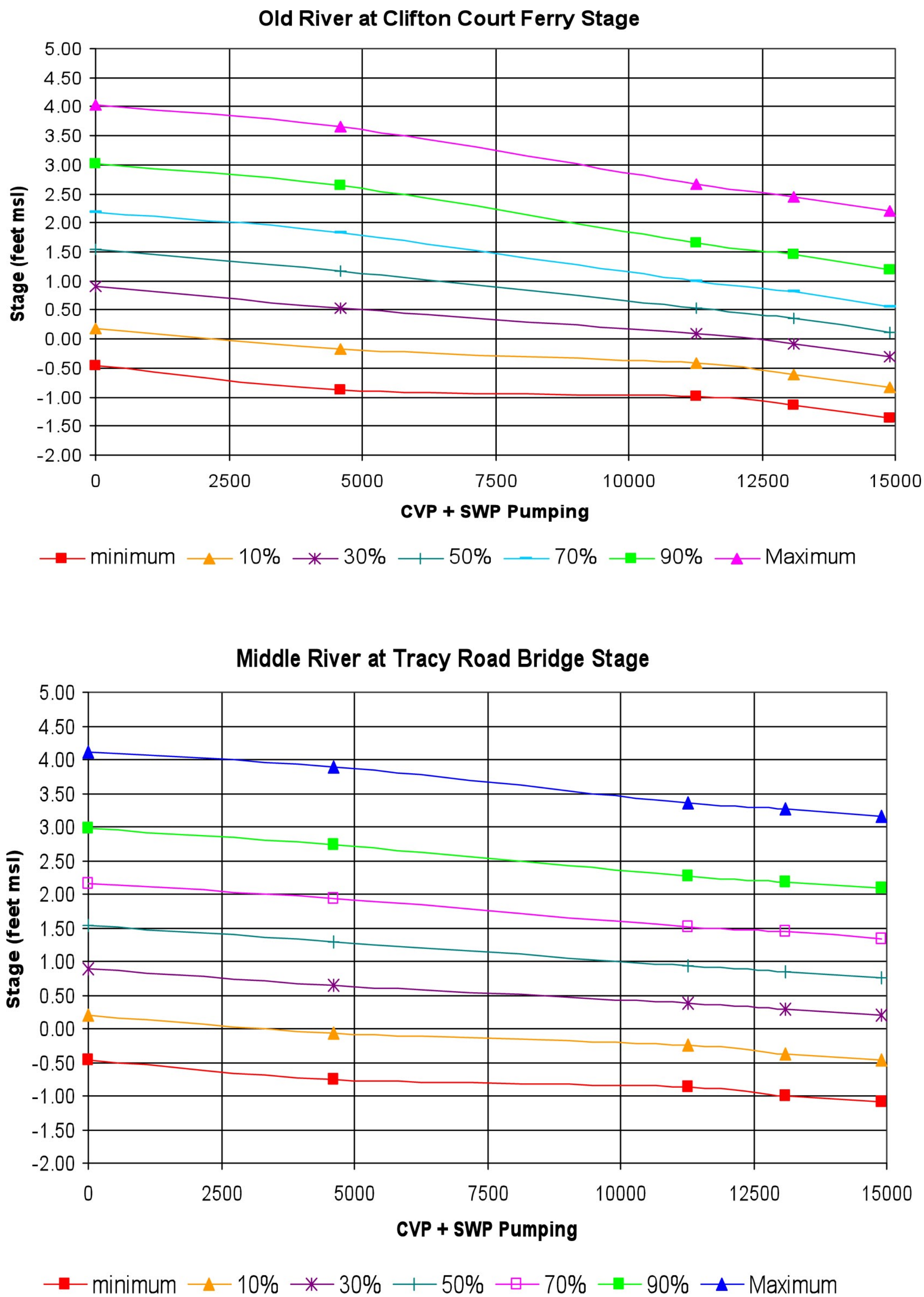


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**Figure 3.2-1**
**Summary of DSM2–Simulated Effects of Export Pumping on the Tidal Stage Ranges in Old River at Tracy Road and in Grant Line Canal at Tracy Road for August 1997 Tides and San Joaquin River Flow of 1,500 cfs**

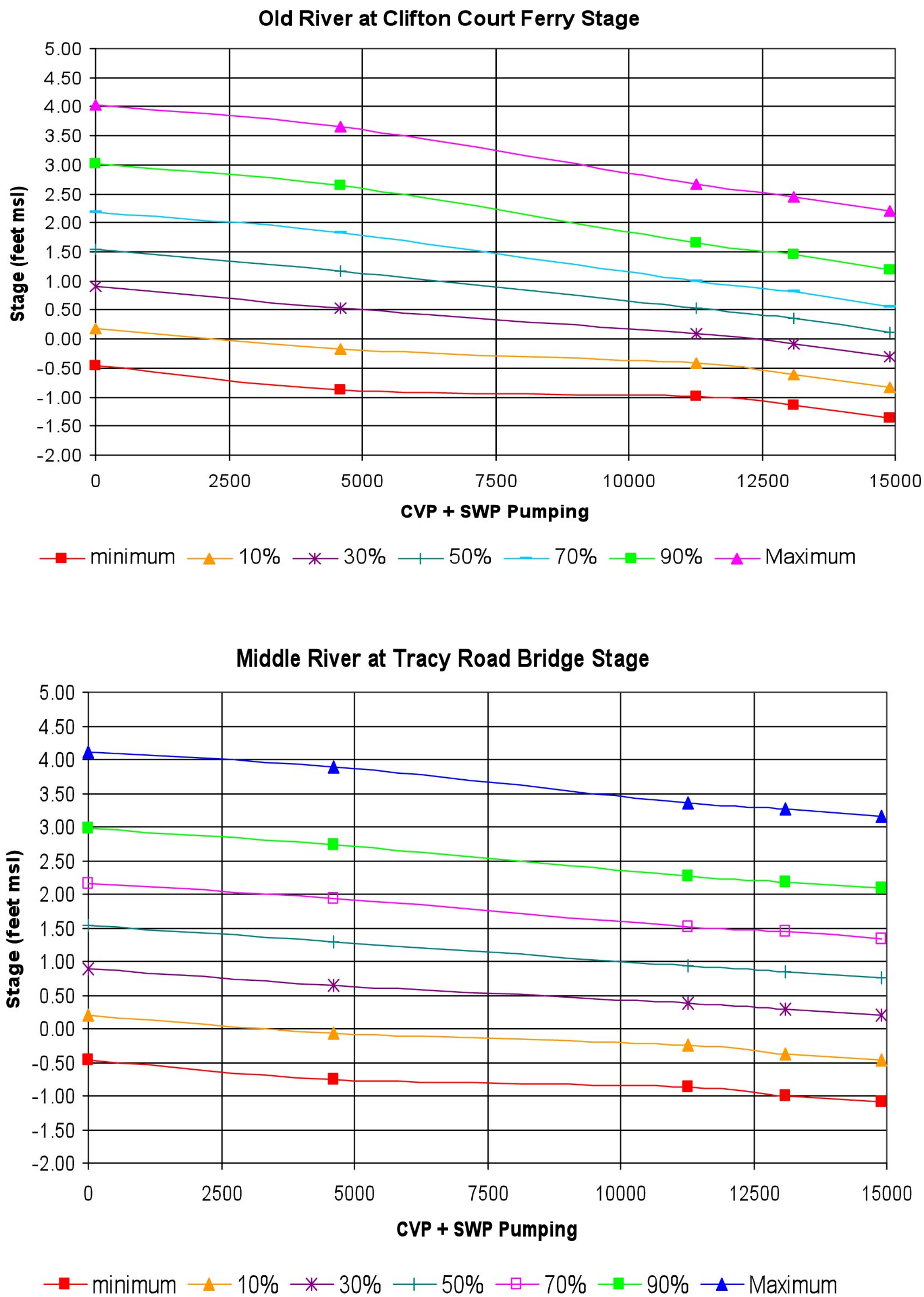


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**Figure 3.2-2**
**Summary of DSM2–Simulated Effects of Export Pumping on the Tidal Stage Ranges in Old River at Clifton Court Ferry and in Middle River at Tracy Road for August 1997 Tides and San Joaquin River Flow of 1,500 cfs**

pumping on tidal elevations (low tide and high tide) hardly would be measurable at these south Delta locations, even without the low tide protection provided with the temporary agricultural barriers.

Figure 3.2-3 shows the DSM2-simulated 15-minute interval tidal elevations and tidal flows in Old River at Clifton Court Ferry for November 1975. This month was selected because the SWP pumping was at 6,680 cfs, and the No Action Jones Pumping Plant pumping was about 4,200 cfs. The Intertie Alternative increased the Jones Pumping Plant pumping to 4,600 cfs. This month therefore represents the largest direct effect of the Intertie pumping. The simulated tidal elevations were only slightly lower with the additional Intertie pumping. The difference cannot be identified from the graph, but the Intertie simulated tidal elevations were an average of 0.5 inches (0.045 feet) lower than the No Action tidal elevations. The simulated tidal flows were an average of 400 cfs more than the No action tidal flows. The tidal flows are shifted by the constant CVP pumping and there is almost no downstream tidal flow towards the CCF intake. The tidal flows are always upstream, with the peak upstream flow of about 10,000 cfs during the major flood tide period each day. These DSM2-simulated tidal hydraulic effects are representative of changes that would be expected in other months with the additional 400 cfs of CVP pumping that the Intertie Alternatives would allow.

### *No Action (Alternative 1)*

Under the No Action Alternative, an Intertie would not be constructed or operated, and as a result no change in future Delta tidal hydraulic conditions would occur. There may be some future changes in the Delta channels or gate operations, but hydraulic conditions would remain largely the same as they are today under D-1641 operating criteria with the temporary south Delta barriers. There are no construction or operation effects for the Future No Action.

### *Proposed Action (Alternative 2)*

#### *Construction Effects*

There are no tidal hydraulic effects during construction. Construction will be confined to local effects along the DMC and the California Aqueduct and will not change Jones Pumping Plant or Banks Pumping Plant pumping.

*Operation Effects*

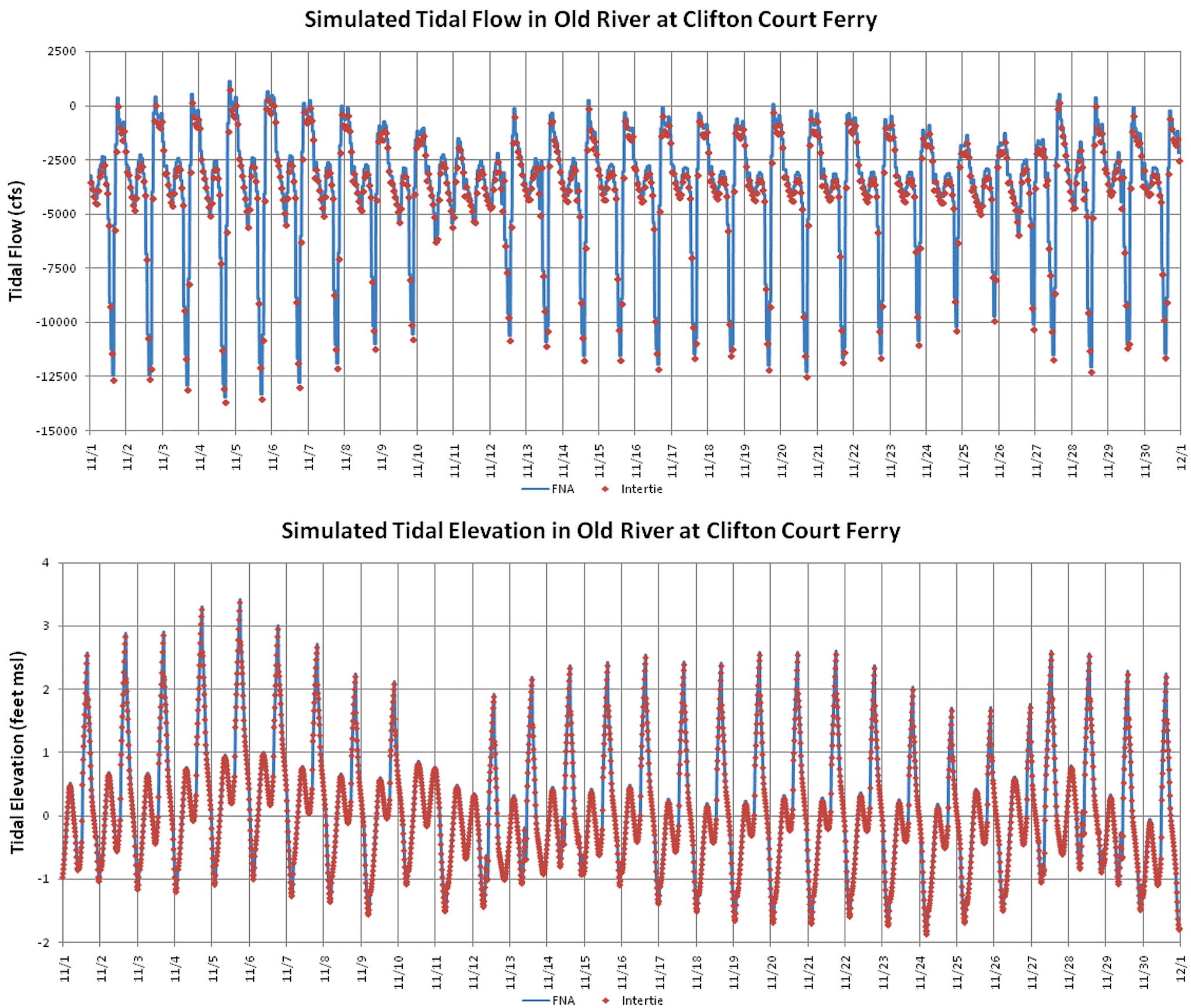
**Impact HYD-1: Effects of Intertie Pumping on Tidal Elevations and Flow in Old River at Clifton Court Ferry**

The Old River at Clifton Court Ferry station is just downstream of the mouth of Grant Line Canal and about 1 mile north of the Jones Pumping Plant intake canal. The stages at this station are directly influenced by CVP and SWP pumping. The maximum Jones Pumping Plant pumping reduces the stage in Old River about 6 inches uniformly at all tidal stages. This drawdown of 6 inches provides the required change in water surface slope along Old River to supply 4,600 cfs to the Jones Pumping Plant intake. The incremental effects of the 400 cfs of additional pumping that the Intertie would allow therefore would be a 0.5-inch reduction in tidal elevations at the Jones Pumping Plant. Because the full 4,600-cfs pumping currently occurs during the summer months, this slight reduction in tidal elevations is already observed in the Future No Action summer conditions.

The maximum Banks Pumping Plant pumping with CCF gate operations would have an additional effect on the Clifton Court Ferry stage. The low tides are not lowered by as much as the higher tide stages because the diversions into CCF are generally much less during periods of low tide. The 6,680-cfs SWP pumping reduces the high-tide stages by 18–24 inches, depending on the CCF gate diversions. The low tides at Clifton Court Ferry are reduced by less than 6 inches with the maximum CVP pumping. The low-tide reductions at all other south Delta locations would be less than the 6-inch decline that was simulated at Clifton Court Ferry with the maximum CVP and SWP pumping.

Figure 3.2-4 shows the 16-year period of monthly minimum, average, and maximum tidal elevation and tidal flows in Old River at Clifton Court Ferry (just upstream of the CCF intake) for the simulated Future No Action and Proposed Intertie conditions. Figure 3.2-4 graphically represents how small a change in minimum, average, and maximum tidal stage and tidal flow actually occurs as a result of Proposed Action operations. The minimum stage objective of 0 feet msl does not apply at this location, which is downstream of the permanent tidal gates protection zone. There are a few months when the Intertie elevations and tidal flows are slightly more or less than the No Action, because of major changes in simulated CVP or SWP pumping. But these indirect effects from CVP and SWP operations are within the normal range of exports, and are not considered a significant change in south Delta tidal conditions.

Because the maximum change in elevation caused by the Intertie pumping is about 0.5 inches, and because this tidal elevation caused by full Jones Pumping Plant pumping of 4,600 cfs is already observed during the summer period each year, the Intertie impacts on tidal elevation and tidal flow would be minor and are not considered adverse.




Note:
Clifton Court Ferry is located between DMC intake and CCF intake.

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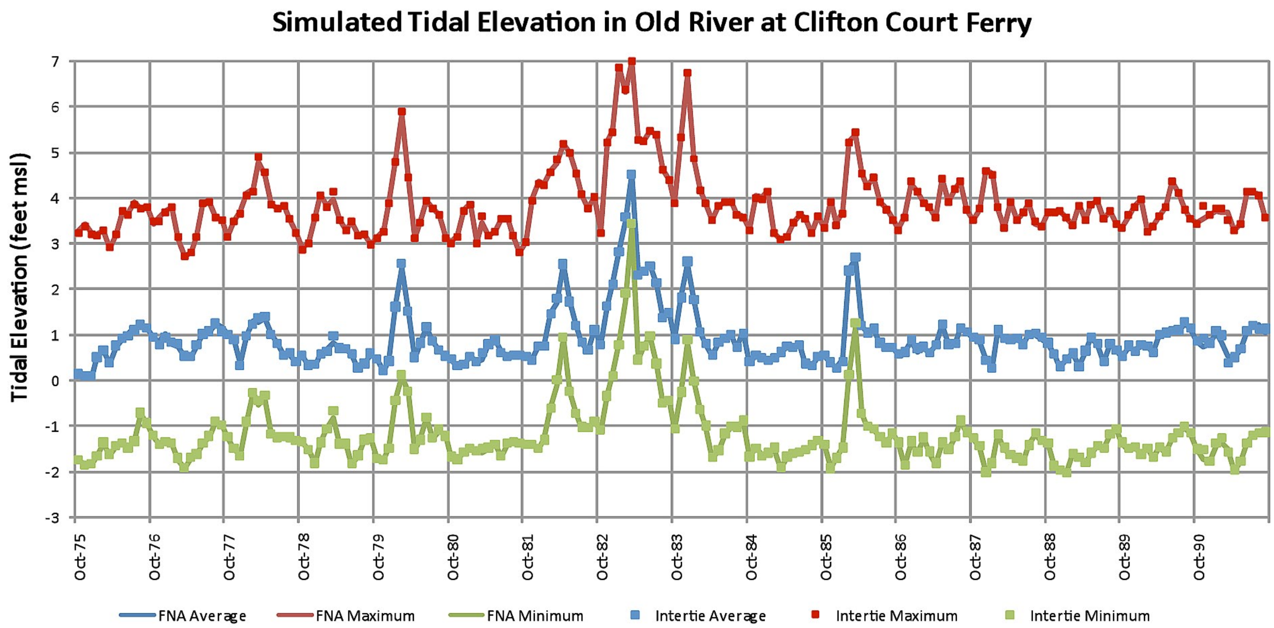
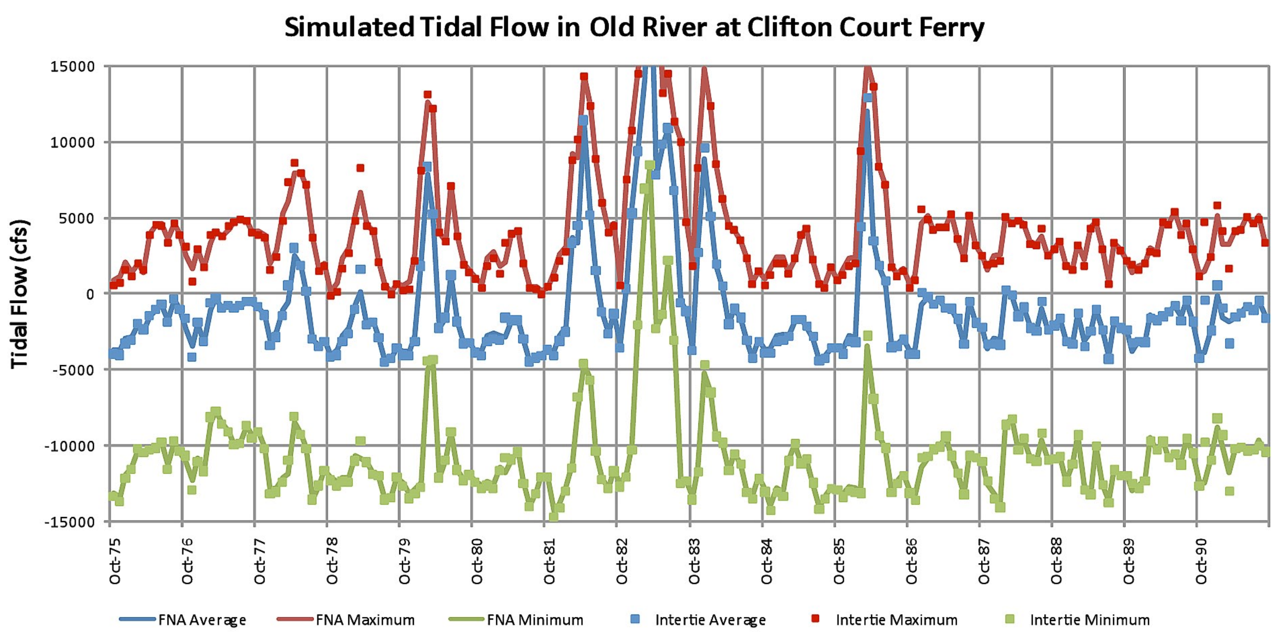
**Figure 3.2-3**
**Comparison of DSM2-Simulated Tidal Elevations and Tidal Flows for the Intertie (4,600 cfs CVP Pumping) and No Action Alternative (4,250 cfs CVP Pumping) in Old River at Clifton Court Ferry for November 1975**




Note:
Clifton Court Ferry is located between DMC intake and CCF intake.



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**Figure 3.2-4**
**Comparison of DSM2-Simulated Monthly Range (Maximum, Average, and Minimum) for Tidal Elevations and Tidal Flows for the Intertie and No Action Alternatives in Old River at Clifton Court Ferry for 1976–1991**

### *Alternative 3 (TANC Intertie Site)*

#### *Construction Effects*

There are no tidal hydraulic effects during construction. Construction will be confined to local effects along the DMC and the California Aqueduct and will not change Jones or Banks Pumping Plant pumping.

#### *Operation Effects*

The operational effects are the same as for Alternative 2 (Proposed Action). The operational effects of Alternative 3 on tidal hydraulics are not considered adverse.

### *Alternative 4 (Virtual Intertie)*

#### *Construction Effects*

There are no tidal hydraulic effects during grading of the temporary pumping pad for the portable pumps that will be used during emergency operations with the Virtual Intertie Alternative.

#### *Operation Effects*

The operational effects of the Virtual Intertie Alternative on tidal hydraulics are less than those described for the Proposed Action because the additional pumping would occur at the Banks Pumping Plant. The CCF intake gates are operated to avoid tidal effects by closing during low tides and also closing during the flood tide (about 4 hours) prior to the higher-high tide each day. The operational effects on hydraulics are minor and are not considered adverse.

# 3.3 Delta Water Quality

## 3.3.1 Introduction

This section describes the existing Delta environmental conditions and the consequences of constructing and operating the project alternatives on Delta water quality.

## 3.3.2 Affected Environment

Beneficial uses of Delta water depend on suitable water quality conditions (e.g., salinity [EC], water temperature, dissolved oxygen [DO], and dissolved organic carbon [DOC]) in Delta waters. This section describes these key water quality variables, the objectives associated with maintaining beneficial uses of Delta waters, existing (i.e., historical) Delta water quality conditions, and potential impacts of Intertie operations on key water quality variables in Delta channels and exports.

### *Sources of Information*

The historical salinity and other water quality data collected in the Delta by Reclamation, DWR, and other Interagency Ecological Program (IEP) agencies are the primary source of information for this section. Comprehensive evaluation of the historical salinity data from Suisun Bay and the western Delta recently has been presented by CCWD:

- *Trends in Hydrology and Salinity in Suisun Bay and the Western Delta*.

DWR Division of Operations and Maintenance recently has reviewed salinity and total organic carbon concentrations in the south Delta and CVP and SWP exports in the following reports:

- *Factors Affecting the composition and salinity of exports from the south Delta* (California Department of Water Resources 2004).
- *Factors Affecting Total Organic Carbon and Trihalomethane Formation Potential in Exports from the South Delta and down the California Aqueduct* (California Department of Water Resources 2005).
- *Sources of Salinity in the South Delta* (California Department of Water Resources 2007).

The DSM2 model results, based on CALSIM monthly Delta inflows, diversions, and exports, for the Future No Action and Intertie Proposed Project conditions are the primary source of potential salinity impact assessment information. These modeling methods and results are presented in Appendix C, “DSM2 Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie.”

The historical water quality data that provide the basis for calibration of the water quality simulations from the DSM2 model and the existing conditions for the other water quality variables are collected under the following water quality monitoring and sampling programs.

#### *Interagency Ecological Program*

The IEP, previously the Interagency Ecological Study Program (IESP), was initiated in 1970 by DWR, DFG, Reclamation, and USFWS to provide information about the effects of CVP and SWP exports on fish and wildlife in the Bay-Delta estuary. Other agencies (e.g., State Water Board, EPA, the USACE, and U.S. Geological Survey [USGS]) have joined the IEP and provide staff members and funding to assist in obtaining biological, chemical, and hydrodynamic information about the San Francisco Bay and Sacramento–San Joaquin Delta estuary.

Agencies participating in the IEP conduct extensive programs of monitoring of tidal stage and flows, salinity (electrical conductivity [EC]) measurements, routine water quality, and fish sampling, as well as more intensive special studies, in the Delta. IEP maintains its data in an extensive centralized database (www.IEP.ca.gov). Technical IEP reports are issued, and newsletters and annual meetings provide participants and the interested public with timely information about study results.

#### *Municipal Water Quality Investigations Program*

DWR’s Municipal Water Quality Investigations (MWQI) program encompasses the previous Interagency Delta Health Aspects Monitoring Program (IDHAMP) and Delta Island Drainage Investigations (DIDI). IDHAMP was initiated by DWR in 1983 to provide a reliable and comprehensive source of water quality information for judging the suitability of the Delta as a source of drinking water (California Department of Water Resources 1989). The major issue of concern was the potential formation of disinfection byproducts (DBPs) such as trihalomethanes (THMs) and bromate in treated drinking water from the Delta.

MWQI studies have documented that Delta exports contain relatively high concentrations of DOC, a THM precursor. Agricultural drainage discharges containing natural decomposition products of peat soil and crop residues are considered dominant sources of DOC in Delta waters (California Department of Water Resources 1994). Additionally, DOC is contributed to Delta waters by Delta inflows.

The MWQI program has determined that bromide in Delta water contributes significantly to formation of the THMs observed in treated drinking water from the Delta. Sources of bromide in Delta water are seawater intrusion, San Joaquin River inflow containing agricultural drainage, and possibly groundwater. Bromide concentrations have been found to be a relatively constant fraction of chloride concentration in the Delta.

The Delta agricultural drainage component of the MWQI program sampled discharge points of irrigation drainage water in the Delta from 1985 to about 1997. In general, intensive surveys of agricultural drains on Delta islands have shown high DOC concentrations that may represent a significant contribution to DOC concentrations in Delta waters. The salt content and DOC concentrations of the drainage water are found to be greatest during October–March as a result of the leaching of salts from Delta island soils during major rainfall periods. The salt and DOC concentrations tend to accumulate in the soil pore water during the growing season.

#### *Compliance Monitoring Program for Delta Standards*

D-1485 (State Water Resources Control Board 1978), issued by the State Water Board in August 1978, amended previous water right permits of DWR and Reclamation for the SWP and CVP facilities, respectively. D-1485 also set numerical water quality objectives and requirements for Delta outflow, export pumping rates, salinity (as measured by EC), and chloride to protect three broad categories of beneficial uses: fish and wildlife, agriculture, and municipal and industrial water supply. The standards included adjustments to reflect hydrologic conditions under different water-year types.

D-1485 has required DWR and Reclamation to conduct comprehensive water quality monitoring of the Delta. Annual reports have been prepared on observed water quality conditions in the Delta and compliance with limits set in D-1485 (State Water Resources Control Board 1978). DWR and Reclamation are responsible for adjusting their operations to satisfy the applicable flow and salinity objectives. Most of these compliance stations have continuous EC monitors; others are sampled routinely for chemical and biological measurements. D-1641, which implements the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (1995 WQCP), provides an update and continuation of the D-1485 monitoring program.

EC monitors at Jersey Point and Emmaton (agricultural salinity compliance stations from April through August) are especially important for managing the linkage between upstream reservoir releases and export pumping that will maintain sufficient Delta outflow to satisfy Delta water quality objectives. The CVP and SWP operations staffs have access to telemetered data (i.e., CDEC) from these and several other EC monitors. The DWR Delta Operations Water

Quality Section prepares and distributes a daily report of data on flows and EC to assist in decision making on Delta CVP and SWP water project operations.

## 3.3.3 Environmental Consequences

### *Regulatory Setting*

*Federal*

**Clean Water Act**

The Clean Water Act (CWA) generally applies to all navigable waters of the United States. However, the CWA is administered in California by the State Water Board and the RWQCBs. The San Francisco RWQCB has jurisdiction for Suisun Marsh and Suisun Bay. The Central Valley RWQCB has jurisdiction in the Delta and in the upstream rivers and tributaries. They issue water quality criteria for beneficial uses, including fish and wildlife. They develop and implement Basin Plans and total maximum daily load (TMDL) plans for specific constituents, chemicals, and pollutants, such as DO, mercury, and selenium.

**Public Law 108-361 (CALFED Bay-Delta Authorization Act)**

PL 108-361, Section 103(d)(2)(D) requires that Reclamation develop and initiate implementation of a program to meet all existing water quality standards and objectives for which CVP has responsibility prior to increasing deliveries through an intertie between the California Aqueduct and Delta-Mendota Canal. In 2006, Reclamation prepared such a plan. As such, the Intertie is consistent with PL 108-361.

*State*

**Salinity**

The State Water Board specified salinity standards for the protection of the Delta beneficial uses, including municipal and agricultural water supply as well as fish and wildlife in the 1978 Delta WQCP and in D-1485. Salinity standards (EC) were established at Emmaton and Jersey Point for agricultural diversions, and at other places in the Delta and in the Suisun Marsh. They also required a Delta outflow of more than 10,000 cfs from February to May of wet water years (i.e., classification based on runoff) and other Delta outflow requirements in other months and water year types. Salinity objectives were established in D-1485 at the CCWD Rock Slough Pumping Plant for chloride.

The 1995 WQCP retained many of the D-1485 monthly standards for the Delta and Marsh. The 1995 WQCP included a new salinity objective in Suisun Bay known as X2. X2 is defined as the location of the 2 parts per thousand (ppt) salinity contour (isohaline), 1 meter off the bottom of the estuary, as measured in kilometers upstream from the Golden Gate Bridge. Biologists have determined that regulating the location of X2 in the months of February–June downstream of Collinsville in Honker Bay or Suisun Bay provides benefits to fish species. The X2 objectives may provide additional benefits to fish habitat in the marsh. Reclamation and DWR are jointly responsible for meeting these salinity objectives throughout the Delta; the major control mechanism is through regulating Delta outflow.

**Dissolved Oxygen**

DO is important for fish and other aquatic species. The State Water Board and the Central Valley RWQCB established a DO objective for the Stockton Deep Water Ship Channel (DWSC) of 5 mg/l throughout the year and 6 mg/l during the adult Chinook salmon migration season of September–November.

**Temperature**

The State Water Board WQCP for temperature includes standards for estuaries. For estuaries, the temperature rise of surface water must be less than 4ºF (outside a mixing zone), and the change in 25% of the cross section of a river must be less than 1ºF. These limits were developed to control major thermal power plant cooling discharges. No monthly temperature standards are applied.

**Suspended Sediment**

The San Francisco and Central Valley Basin Plans each include objectives for turbidity and suspended sediment concentrations. Generally a discharge or dredging activity should not increase the turbidity by more than about 20%.

**Other Water Quality Parameters**

The San Francisco and Central Valley Basin Plans have many criteria for chemical parameters that protect fish and wildlife and drinking water beneficial uses within San Francisco Bay and the estuary. The assessment of potential impacts on these water quality parameters relies on a qualitative evaluation of likely effects from the programmatic and Step 1 alternatives.

*Local*

There are no county or local regulations affecting water quality in the Delta or Suisun Marsh. The several municipal wastewater treatment plants that discharge into the Delta channels (i.e., Sacramento, Stockton, Tracy, Delta Diablo) are regulated under State Waste Discharge Reports and National Pollutant Discharge Elimination System (NPDES) discharge permits, which are administered and updated through the RWQCBs.

### *Approach*

Water quality changes generally are caused by the discharge of materials (e.g., treated wastewater, agricultural drainage) into the river inflows or directly to the Delta channels. Agricultural drainage and treated wastewater discharges are the two most common sources of salt, nutrients, DOC, and other water quality constituents. Temperature is the result of heat exchange with the atmosphere, and DO is a balance between decay and photosynthesis processes in the water and aeration from the atmosphere.

There may be indirect effects from river diversions. A water diversion will reduce the river flow downstream of the diversion, and reduce the dilution of any downstream discharge and therefore may indirectly increase the downstream river concentrations of salt, nutrients, or DOC.

In the Delta, increased water diversions reduce the Delta outflow and may cause higher salinity, resulting from increased seawater intrusion during periods of relatively low Delta outflow. Increased water diversions also may draw a slightly different mixture of water from the Delta inflows and Delta channels. For example, increased Jones Pumping Plant pumping may draw slightly more San Joaquin River water or more agricultural drainage into the DMC. The dominant indirect water quality effect of increased Jones Pumping Plant pumping is expected to be the reduced Delta outflow and increased seawater intrusion into the western Delta. The DSM2 modeling was used to fully evaluate these potential impacts.

Water quality conditions in the Delta are influenced by natural hydrology (i.e., runoff) and environmental (geological and chemical and biological) processes, water management operations (reservoir storage and release), agricultural diversions and drainage, and treated wastewater discharge practices. Delta water quality conditions can vary dramatically because of year-to-year differences in runoff and water storage releases and seasonal fluctuations in Delta flows (Contra Costa Water District 2007).

Concentrations of materials in the river inflows often are related to streamflow volume and seasonal conditions. Transport and mixing of materials in the Delta channels are strongly dependent on river inflows, tidal flows, agricultural diversions, drainage flows, wastewater effluents, exports, and cooling water flows. The following Delta water quality variables are included in this analysis:

- EC (salinity),
- DOC (THM and other DBP precursor),
- temperature, and
- suspended solids (turbidity).

Water quality impacts of salinity increases were assessed for Jersey Point, Old River at Rock Slough and SR 4 Bridge (representative of diversions at CCWD Rock Slough and Los Vaqueros intakes), Banks Pumping Plant, and Jones Pumping Plant. DOC changes were evaluated at the two CCWD intake locations and the Banks and Jones Pumping Plants. Temperature and suspended sediments were evaluated qualitatively throughout the Delta. The evaluation of these selected variables may be representative of changes in other specific chemicals and constituents.

### *Modeling Results*

The CALSIM model was used to determine likely future monthly Delta inflows and exports associated with Future No Action and the Intertie Proposed Action. The DSM2 model was used to simulate tidal and net channel flows in the major Delta channels for a 16-year sequence of water years, 1976–1991. This period is considered to be typical of the longer hydrological record used in the CALSIM model, and includes the 1977 drought and the 1987–1991 dry year sequence, as well as the 1983 and 1986 wet years. The DSM2 water quality model was used to simulate EC for this same 16-year sequence. These water quality modeling results are described and compared in this section.

The likely water quality effects of the Intertie were evaluated by comparison of the Future No Action and the Proposed Intertie Alternatives, as simulated by the CALSIM and DSM2 models. There are many unpredictable processes and events that may affect water quality in the Delta that could not be simulated with the assessment models used for evaluating likely water quality effects of the Intertie operations. Examples of unpredictable factors that influence Delta water quality conditions are occasional periods of relatively high-salinity pulses of San Joaquin River inflows, intensive agricultural-salt leaching following periods of drought, and short-term increases in DOC concentrations associated with storm runoff.

### Suisun Bay Salinity

Salinity in Suisun Bay and the western Delta (i.e., San Francisco Estuary) is controlled by the effective monthly Delta outflow (Contra Costa Water District 2007). Figure 3.3-1 shows the historical and DSM2-simulated monthly average EC for the Future No Action and Intertie Alternatives at three Suisun Bay stations, including the downstream model boundary at Martinez. There is a strong seasonal pattern corresponding to the Delta outflows, with the highest EC values in the fall and early winter months with relatively low outflow, and the lowest EC values in the winter and spring months with higher outflow. The historical EC was sometimes higher than the simulated Future No Action EC because the minimum outflow objectives for previous water rights decisions (e.g., D-1485 applied in 1978–1994) were lower than current D-1641 outflow criteria.

The historical and DSM2-simulated Delta outflow for the Future No Action and Intertie Alternatives are shown in Figure 3.3-2. The DSM2 results generally are confirmed by comparing observed and simulated EC values, although the simulated sequence of Delta outflow was different from the historical outflows. When the historical outflow was lower than the simulated Future No Action or Intertie Alternative outflows, the corresponding historical EC at Chipps Island and Collinsville (as well as other Suisun Bay and western Delta stations) was higher than the simulated future EC conditions.

This basic salinity gradient within Suisun Bay and the western Delta is controlled by the seasonal Delta outflow and will not be substantially changed by the additional Jones Pumping Plant pumping allowed by the Intertie Proposed Project. Figure 3.3-1 indicates that the seasonal variation in EC at each western Delta station is very large relative to the changes that were simulated for the Intertie pumping compared to the Future No Action. For example, the maximum salinity at the Martinez boundary is simulated to be less than 25,000 microSiemens per centimeter (µS/cm), because the minimum Delta outflow as regulated under D-1641 is greater than 3,000 cfs in the fall months.

The minimum salinity at Martinez (and other locations) depends on the peak winter outflow. In years when the peak monthly outflow was more than 50,000 cfs, the minimum EC at Martinez was about 1,000 µS/cm. This general relationship between outflow and salinity at several Suisun Bay and western Delta locations is described further in the next section.

*Salinity Effects from Changes in Delta Outflow*

The observed relationships between Delta outflow and salinity at selected locations can be used to describe and summarize the likely effects of changes in Delta outflow caused by Intertie operations compared to the Future No Action. The DSM2 modeling results confirm this basic relationship between Delta outflow and salinity at each Delta location.

The effective Delta outflow is the steady- state outflow that would maintain the observed EC value at a particular monitoring station. This methodology was introduced by CCWD staff (Denton 1993) as an appropriate calculation for understanding the response of salinity in western Delta locations to changes in Delta outflow. It was referred to as the *G-model* by CCWD staff. Calculation of the effective outflow incorporates the sequence of previous Delta outflows (i.e., moving average). The end-of-month effective outflow is calculated as a function of the previous month’s effective outflow and this month’s average outflow:

> End-of-Month Effective Outflow (cfs) = Outflow (cfs) /
> {1 + [Outflow/Previous Effective Outflow – 1] [exp (– Outflow/Response [cfs])]}

A value of 6,600 cfs is the monthly response factor suggested by CCWD staff. A second adjustment is made to calculate the monthly average effective outflow, assuming that the monthly average flow is held constant through the month. A change in the monthly outflow will cause a delayed change in the effective monthly outflow and corresponding EC values.

Figure 3.3-3a compares the monthly average and effective outflow for the Future No Action with the historical effective outflow for 1976–1991. Some of the historical effective outflow values were less than 4,000 cfs. Figure 3.3-3b shows the relationship between the historical EC or simulated No Action EC and the Delta outflow, without calculating the effective outflow. The historical EC at Chipps Island and Collinsville were highest during periods of lowest Delta outflow (e.g., water year [WY] 1977), with a maximum EC of about 17,500 µS/cm at Chipps Island and a maximum of about 12,500 µS/cm at Collinsville. Because the D-1641 outflow objectives maintain the Delta outflow above 3,000 cfs, with the effective outflow above 4,000 cfs, the simulated EC for the Future No Action are limited to a maximum of about 15,000 µS/cm at Chipps Island and a maximum of about 10,000 µS/cm at Collinsville.

The monthly average EC at a selected western Delta station can be estimated from the monthly effective outflow as a negative exponential relationship. The equations for Collinsville, Antioch, Jersey Point, and Rock Slough are similar:

Collinsville EC (µS/cm) = 25,000 [exp (-0.00030 *effective outflow)] + 250

Antioch EC (µS/cm) = 20,000 [exp (-0.00035 *effective outflow)] + 250

Jersey Point EC (µS/cm) =20,000 [exp (-0.00050 * effective outflow)] + 250

Rock Slough EC (µS/cm) = 5,000 [exp (-0.00050 * effective outflow)] + 250

During high outflows, salinity intrusion from the bay will be at a minimum, and the negative exponential equations will approach the assumed background EC value. The higher negative exponent for upstream stations gives lower EC values. The stations farther upstream will reach background Sacramento River EC values at much lower effective outflow than the stations located in Suisun Bay. Comparing the G-model estimates to the DSM2 results provides further confirmation of the DSM2 results, because the G-model equations have been calibrated with historical EC measurements.

Figure 3.3-4a shows the times series of measured monthly EC and estimated EC calculated from the historical effective outflow and the assumed negative exponential equation at Martinez, Chipps Island, and Collinsville for the 1976–1991 period. Figure 3.3-4b shows that the negative exponential shape with effective Delta outflow does describe the majority of the variation in monthly average EC values. Some of the differences between the predicted EC values (G-model estimates) and the measured EC may be caused by uncertainty in the Delta outflow, which must be estimated from measured inflows minus exports and minus approximate net Delta channel depletions.

Figure 3.3-5 shows the historical and DSM2-simulated monthly average EC for the Future No Action and Intertie Alternatives at Antioch and Jersey Point for 1976–1991. The seasonal patterns of simulated monthly EC values generally match the historical measured monthly EC values at each of these stations. The historical monthly EC values at Antioch were greater than 6,000 µS/cm in 1977 and for several months in the 1988–1991 dry period, whereas the simulated Future No Action EC values were limited to a maximum of about 6,000 µS/cm in the fall of these dry years. The DSM2 simulated Future No Action and Intertie EC values at Jersey Point were limited to a maximum of about 3,000 µS/cm. The simulated Future No Action and Intertie EC values at Jersey point were more consistently high in the fall months. The historical data included several years when the EC remained lower than the Future No Action EC values in the fall, presumably because historical effective outflow remained higher (Figure 3.3-3).

Comparison of the simulated Jersey Point EC values for the Future No Action and the Intertie were nearly identical except for December 1997, when the Intertie EC was slightly higher, and in November 1991, when the Intertie EC was lower. This reduced EC value in November 1991 was simulated for all the Suisun Bay and western Delta stations, because the CALSIM-simulated outflow was increased from indirect effects of the Intertie operation.

Figure 3.3-6 shows the historical and DSM2-simulated monthly average EC for the Future No Action at Rock Slough (Contra Costa Canal Intake) and Los Vaqueros Intake (Old River near SR 4) for 1976–1991. There is a general match of the simulated seasonal EC variation with the measured monthly EC values at these two stations. The greatest differences occur in a few specific periods when the historical Delta outflows would not have been permitted under the D-1641 objectives. The historical monthly EC values at Rock Slough were greater than 1,000 µS/cm in 1977 and in a few months during the 1988–1991 dry period, whereas the simulated Future No Action EC values were above 1,000 µS/cm in the fall of several years. The DSM2 simulated Future No Action and Intertie maximum EC values at the Los Vaqueros Intake were about 200 µS/cm lower than the simulated Rock Slough EC values in many years.

The Intertie EC values were slightly different from the Future No Action EC values in a few months, caused by the indirect effects of slightly different CVP and SWP project operations on Delta outflow. Historical EC data from West Canal (at CCF intake) are compared with the Los Vaqueros Intake EC values. Also shown is the historical EC from Victoria Canal (near the new CCWD intake locations). The peak Victoria Canal EC generally was about 100 µS/cm lower than the maximum West Canal EC data, because of the greater fraction of Sacramento River water in Victoria Canal (from Middle River) than in Old River.

Comparison of the simulated Los Vaqueros intake EC values for the Future No Action and the Intertie were nearly identical except for December 1997, when the Intertie EC was slightly higher, and in November of 1991 when the Intertie EC was lower. This reduced EC value in November 1991 was simulated for all the

Suisun Bay and western Delta stations, because the CALSIM-simulated outflow was increased from indirect effects of the Intertie operation on upstream CVP and SWP reservoir releases.

*Historical and Simulated South Delta Salinity (EC) Results*

The south Delta salinity is most directly influenced by the San Joaquin River inflow and salinity, as well as by the CVP and SWP exports that draw Sacramento River water from the central Delta into the south Delta through Middle River and Old River channels. Although the DCC and Georgiana Slough diversions from the Sacramento River are not changed by CVP or SWP exports, the volume of water flowing upstream in Middle River and Old River toward the pumping plants is controlled by the total pumping. Increasing CVP pumping with the Intertie facility would cause slightly more central Delta water to flow toward the south Delta and would have a slight effect on the SWP and CVP export EC values.

Figure 3.3-7a shows the historical San Joaquin River Vernalis EC for the 1976–1991 study period compared to the DSM2-model input EC values for the Future No Action and Intertie EC. The San Joaquin River Vernalis EC value is actually estimated in CALSIM and is identical for the Future No Action and the Intertie Proposed Alternative. The monthly Vernalis and south Delta EC objectives (D-1641) for 700 µS/cm from April through August and 1,000 µS/cm from September to March are shown for comparison (implemented in 1995). The historical EC values were higher than these objectives because they did not apply in the historical period.

Figure 3.3-7b shows the historical and simulated Future No Action San Joaquin River flows for 1976–1991. New Melones Reservoir was not filled until 1982, so the historical San Joaquin River flows were much lower and the historical EC values were much higher than the simulated values in the 1977 and 1987–1991 dry periods. Comparison of the monthly flow and EC data shown in these graphs indicates that the San Joaquin River EC is reduced substantially during periods of high flow. The historical EC-flow and the simulated EC-flow follow similar EC-dilution patterns. The San Joaquin River EC is less than 200 µS/cm (similar to Sacramento River EC) when the San Joaquin River flow is greater than 10,000 cfs. The simulated Future No Action Vernalis flow is generally lower in the summer period than the historical flows, so the simulated EC approaches the maximum allowed EC of 700 µS/cm in these summer months. However, because the Intertie operations will not change CVP pumping in the summer period, no changes in CVP or SWP export EC are expected during the summer period. Differences between the historical and the Future No Action conditions do not change the potential EC impacts of the Intertie Project, which are evaluated as the difference between the Future No Action and the Intertie simulations.

Figure 3.3-8 shows the historical and simulated EC at the Jones Pumping Plant (Figure 3.3-8a) and the Banks Pumping Plant (Figure 3.3-8b) for WYs 1976–1991. These historical and simulated Future No Action EC conditions at these two nearby pumping intakes are very similar. Although detailed examination shows that there is more San Joaquin River water at the Jones Pumping Plant than at the Banks Pumping Plant, the major variations in the historical and simulated EC values are dominated by the sequence of wet years and dry years, and by the seasonal pattern of seawater intrusion in the fall months.

The simulated Future No Action and simulated Intertie EC values are nearly identical except for a few periods when the simulated Delta outflow was different because of indirect effects of the Intertie on upstream reservoir releases. The effects of these CALSIM-simulated changes in Delta outflow on EC values were described above for the Jersey Point EC results (see Figure 3.3-5). Sometimes the Delta outflow is increased so that the EC is reduced slightly, and sometimes the Delta outflow is reduced, so that the EC is increased slightly. These changes are very small and occurred only in a few months.

## 3.3.4 Environmental Effects

### *No Action (Alternative 1)*

For EC analysis, DSM2 computer modeling was used as the basis for developing the No Action Alternative. The No Action Alternative was plotted and compared with the Intertie Proposed Action Alternative in several of the figures presented above to describe the historical and No Action salinity conditions in Suisun Bay and the Delta.

For the No Action Alternative, the Intertie would not be constructed or operated and, as a result, water quality conditions would remain similar to recent historical conditions as regulated by D-1641 objectives. The No Action Alternative would not have any significant adverse water quality effects.

Changes in operations would not occur at the Jones Pumping Plant or in the DMC; therefore, the Jones Pumping Plant would remain limited to less than the full 4,600 cfs capacity during the fall and winter months when upper DMC deliveries are less than 400 cfs.

### *Proposed Action (Alternative 2)*

There would be no substantial water quality effects during construction of the Intertie facilities. Temporary cofferdams would be used to isolate the DMC and California Aqueduct from the intakes and gate structures that would be constructed at the edge of these two canals. Dewatering of shallow groundwater for the foundation of the pumping plant, if necessary, would be discharged as local drainage and infiltrate to the shallow groundwater, with no expected water quality effects. The only possible water quality effects would result from changes in Delta flows as a direct or indirect effect of Intertie operations, as described below.

*Electrical Conductivity*

Proposed Action impacts were evaluated based on changes in the simulated Intertie Alternative monthly EC values compared to the monthly values simulated for the No Action Alternative. The monthly EC results for the 1976–1991 period simulated by the DSM2 model are used for the assessment. The most accurate monthly changes are considered to be those simulated by DSM2, which is able to evaluate effects from outflow changes as well as shifts in the contributions from agricultural drainage and San Joaquin River inflows. Monthly changes in Delta outflow for the entire 1922–2003 period simulated by the CALSIM model also were evaluated because the relationship between EC and effective Delta outflow has been well established at the Delta locations with EC objectives.

**Impact WQ-1: Delta Salinity Changes at Jersey Point**

Figure 3.3-5 shows the monthly EC value comparison between the Proposed Action and No Action conditions for 1976–1991 as simulated by the DSM2 model. Applicable EC objectives for Jersey Point for April to August range from 450 µS/cm to 2,200 µS/cm, depending on water-year type. Many months (September–March) have no EC objectives at Jersey Point.

Table 3.3-1 indicates that the average Existing Condition EC at Jersey Point for the 16-year period simulated with the DSM2 model was 1,111 µS/cm. In comparison, the average simulated EC for the Proposed Action was 1,116 µS/cm. The average increase at Jersey Point therefore was 5 µS/cm (0.5% of the simulated No Action average). There were 10 months (out of 192) with EC changes greater than 100 µS/cm, but these were in the fall months when there is no EC objective at Jersey Point. Because this long-term increase is much less than 5% of the simulated No Action average, the change is minor and there would be no adverse effect.

**Table 3.3-1.** DSM2-Simulated Average EC (µS/cm) for Intertie and No Action Alternatives for 1976–1991 at Jersey Point, CCWD Rock Slough and Los Vaqueros Intakes, and Banks and Jones Pumping Plants

| | Jersey Point | Rock Slough Intake | Los Vaqueros Intake | Banks Pumping Plant | Jones Pumping Plant |
|---|---|---|---|---|---|
| Intertie | 1,116 | 570 | 487 | 473 | 495 |
| Future No Action | 1,111 | 571 | 485 | 471 | 494 |
| Increase | 5 | -1 | 2 | 1 | 1 |
| Maximum increase | 274 | 49 | 126 | 136 | 100 |
| Number of months with increase >100 µS/cm | 10 | 0 | 1 | 1 | 1 |
| Number of months with increase >10 µS/cm | 47 | 21 | 29 | 19 | 17 |

## Impact WQ-2: Delta Salinity Changes at Rock Slough

Figure 3.3-6 shows the monthly EC values at Rock Slough for the Proposed Action and No Action condition for 1976–1991 as simulated by DSM2. The applicable EC objective at Rock Slough is 1,000 µS/cm.

Table 3.3-1 indicates that the average simulated No Action EC at Rock Slough was 571 µS/cm. This is about half of the average EC at Jersey Point. In comparison, the average simulated EC for the Proposed Action was 570 µS/cm. The average Rock Slough EC would decrease by about 1 µS/cm (0.5% of the No Action average). There was no months with a simulated change of more than 100 µS/cm. The largest change of about 50 µS/cm occurred during 1991 when CALSIM-simulated Delta outflow was reduced from indirect upstream reservoir release changes. There were other months with reductions in EC. Any changes are generally minor and major changes would occur infrequently. There would be no adverse effect.

## Impact WQ-3: Delta Salinity Changes at Los Vaqueros Intake

Figure 3.3-6 shows the monthly EC values at the Los Vaqueros intake on Old River for the Proposed Action and No Action condition for 1976–1991 as simulated by DSM2. There is no applicable EC objective at Los Vaqueros Intake, but the EC objective of 1,000 µS/cm for other water supply intakes is assumed as appropriate.

Table 3.3-1 indicates that the average simulated No Action EC at the Los Vaqueros intake was 485 µS/cm. This was about 100 µS/cm less than the average at Rock Slough. The average simulated EC for the Proposed Action was 487 µS/cm. The average simulated EC increase at Los Vaqueros intake was about

2 µS/cm (0.5% of the No Action average). The largest increase was one month with an increase of 126 µS/cm, caused by a CALSIM-simulated reduction in Delta outflow in 1991. There would be no substantial change in EC at the Los Vaqueros intake.

**Impact WQ-4: Delta Salinity Changes at Banks Pumping Plant**

Figure 3.3-8b shows the monthly EC values comparison between the simulated Intertie and No Action, for 1976–1991 as simulated by DSM2. The applicable EC objective at the Banks Pumping Plant is 1,000 µS/cm.

Table 3.3-1 indicates that the average No Action EC at Banks Pumping Plant was 471 µS/cm. In comparison, the average simulated EC for the Proposed Action was 473 µS/cm. The average increase at the Banks Pumping Plant therefore was only about 2 µS/cm (0.5% of the simulated Future No Action average). Changes in average monthly EC values also were small, and there would be no adverse effect.

**Impact WQ-5: Delta Salinity Changes at Jones Pumping Plant**

Figure 3.3-8a shows the monthly EC values comparison between the Proposed Action and No Action conditions for 1976–1991 as simulated by DSM2. The applicable EC objective at the Jones Pumping Plant is 1,000 µS/cm.

Table 3.3-1 indicates that the simulated average No Action EC at Jones Pumping Plant was 494 µS/cm. This EC is slightly higher than the average Banks Pumping Plant EC because the Jones Pumping Plant facility pumps more of the San Joaquin River water that is diverted down Old River and Grant Line Canal. In comparison, the average simulated EC for the Proposed Action was 495 µS/cm. The average increase at the Jones Pumping Plant therefore was only 1 µS/cm (0.2% of the simulated Future No Action average), which would not result in an adverse effect on CVP water quality.

*Dissolved Organic Carbon*

The DOC concentrations in the Delta will be higher than the river inflow concentrations because of the contribution of agricultural drainage DOC. The DOC in the CVP exports is often very similar to the San Joaquin River inflow DOC. Periods with high agricultural drainage contributions in the winter will raise the CVP and SWP export DOC concentrations to above the San Joaquin River concentration.

The DOC concentrations at the SWP and CCWD water supply intakes will be higher than the river inflow concentrations because of the agricultural drainage DOC. The DOC in the Rock Slough intake is closer to the Sacramento River inflow DOC than the SR 4 intake. Both of these CCWD intakes can have a high contribution from the San Joaquin River DOC at times of high San Joaquin River flow. Periods with high agricultural drainage contributions in the summer will raise the Rock Slough and SR 4 DOC concentrations to above the San Joaquin River concentration.

**Impact WQ-6: Increases in Dissolved Organic Carbon at CCWD, SWP, or CVP Intakes**

DOC concentrations at the CCWD, SWP, or CVP intakes depend on the sources of DOC (river inflows and Delta drainage or vegetation sources) in combination with the water transport from these DOC source locations to the Delta diversions. Because of the relatively small changes in CVP and SWP exports under the Proposed Intertie Alternative compared to the No Action, there are no substantial changes in the water transport patterns within the Delta. Therefore, the DOC concentrations at the Rock Slough, Los Vaqueros, SWP, and CVP intakes in the south Delta are not expected to change, and there would be no adverse effect.

*Temperature*

Water temperatures are determined predominantly by surface heat exchange processes, which are a function of weather. Delta temperatures are influenced only slightly by water management activities, which have a very small effect on water travel times. The most common environmental impacts associated with water temperatures are localized effects of discharges of water at substantially elevated temperatures (e.g., thermal shock). Historical temperature measurements from several locations within the Delta channels are consistently similar to each other, following the seasonal weather conditions. Only at Freeport and Vernalis are there periods when the river temperatures are lower than (i.e., still warming) the measured Delta temperatures which are in equilibrium with the seasonal meteorology. Therefore, no significant temperature impacts are expected from the Proposed Action, because most changes in Sacramento River inflow, CVP and SWP exports, and Delta outflow are relatively small. Large (>1,000 cfs) simulated changes in Sacramento inflow and Delta outflow occur in only a few months because of indirect changes in CVP and SWP reservoir operations. These potential temperature changes will be within the normal seasonal variability of water temperatures in the Delta.

*Suspended Sediments*

Higher suspended sediments (SS) concentrations, often measured as turbidity, are a general indicator of surface erosion during runoff or re-suspension of bottom sediment materials. Following major storms, water quality often is degraded by inorganic and organic solids and associated adsorbed contaminants, such as metals, nutrients, and agricultural chemicals, which are re-suspended or introduced in runoff. Such runoff and re-suspension episodes are relatively infrequent and persist for only a limited time; therefore, they are not often detected in regular sampling programs.

The attenuation of light in Delta waters is controlled by SS concentrations (with some effects from chlorophyll concentrations). SS concentrations often are elevated as a result of increased flocculation (i.e., aggregation of particles) in the estuarine salinity gradient (i.e., freshwater-saltwater interface). High winds and tidal currents also contribute to higher SS concentrations in Suisun Bay. The Proposed Action will not change these storm-related and entrapment zone effects of SS concentrations and associated contaminants. No substantial change in SS concentrations is expected from the Proposed Action.

### *Alternative 3*

The water quality effects of Alternative 3 would be identical to the effects of Alternative 2, described above, because the same Intertie facility would be used in the same manner. The only difference between Alternatives 2 and 3 is the location of the Intertie, which does not affect operations or related water quality changes. There would be no adverse effects on water quality.

### *Alternative 4 (Virtual Intertie)*

The water quality effects from Alternative 4 would be nearly identical to those simulated by CALSIM for Alternative 2 because the periods of Intertie pumping with concurrent increases in Jones Pumping Plant pumping would be replaced with pumping of the same magnitude at Banks Pumping Plant. Because CVP San Luis Reservoir would fill earlier in the same years, there would be the same reduction in Jones Pumping Plant pumping in those years. More indirect effects on upstream CVP operations would also remain the same. The Banks Pumping Plant pumping limits only occasionally would limit the ability to pump the Intertie increment, and these months of slightly reduced SWP Article 21 pumping often would be recovered in subsequent months when Jones Pumping Plant pumping was reduced. Spreadsheet calculations of the Virtual Intertie pumping at Jones and Banks Pumping Plants indicated that the pattern of total Intertie pumping changes and Virtual Intertie pumping changes were nearly identical.

Therefore, the changes in Delta inflows and outflows for Alternative 4, which might cause small salinity changes, are assumed to be nearly identical to the changes in Delta inflow and outflow simulated for Alternative 2. Thus, there are no adverse effects on water quality.

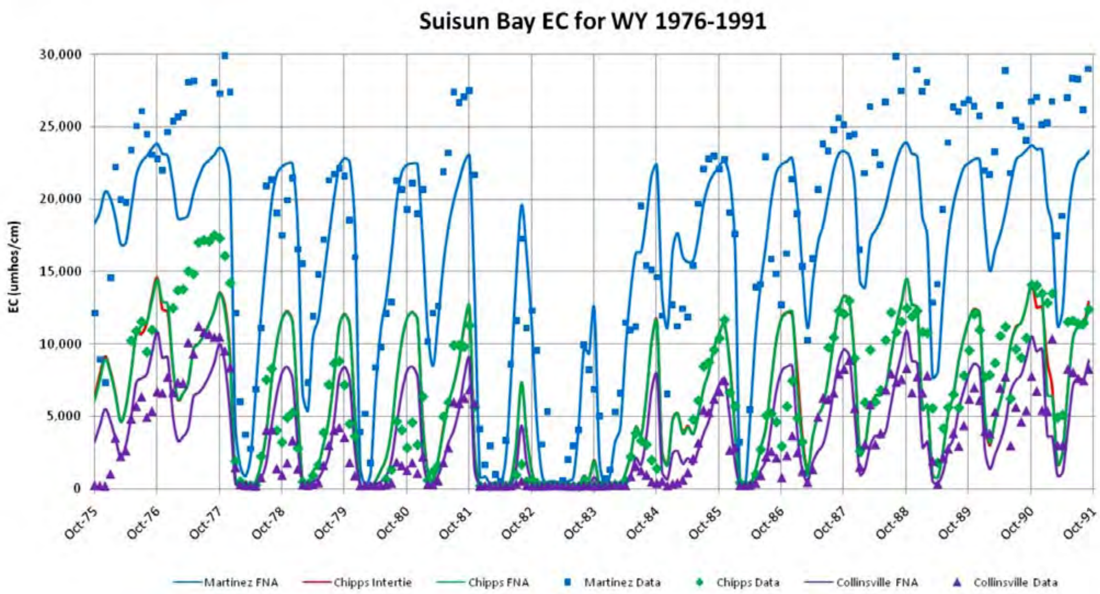


**Figure 3.3-1.** The Historical and Simulated Monthly Average EC for the No Action and Intertie Alternatives at Three Suisun Bay Stations for Water Years 1976–1991

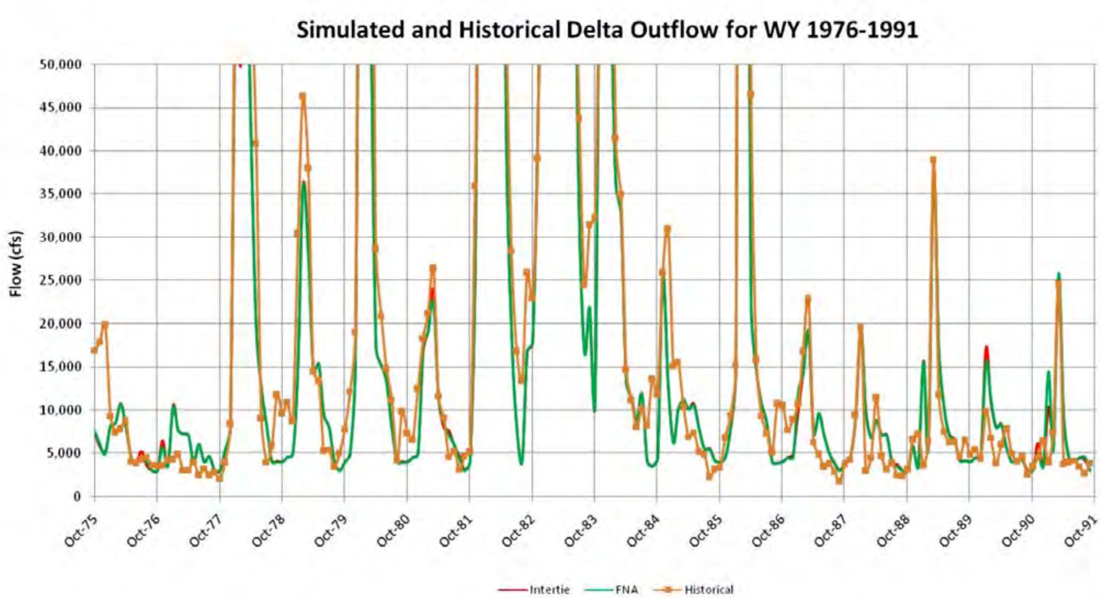


**Figure 3.3-2.** Simulated and Historical Delta Outflow for Water Years 1976–1991

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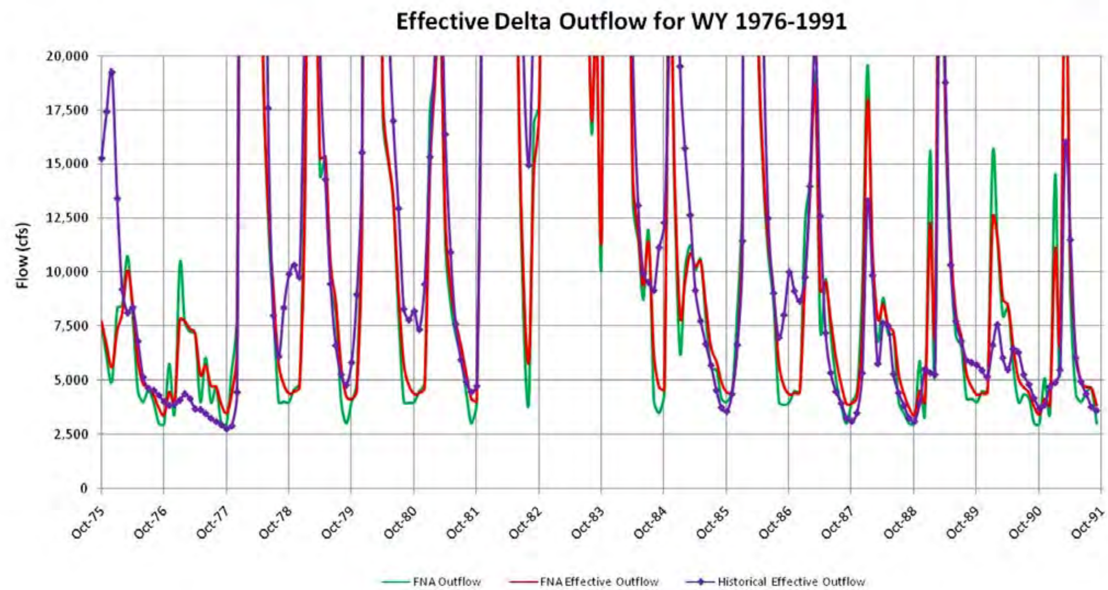


**Figure 3.3-3a.** Simulated No Action Outflow and Effective Outflow Compared to Historical for Water Years 1976–1991

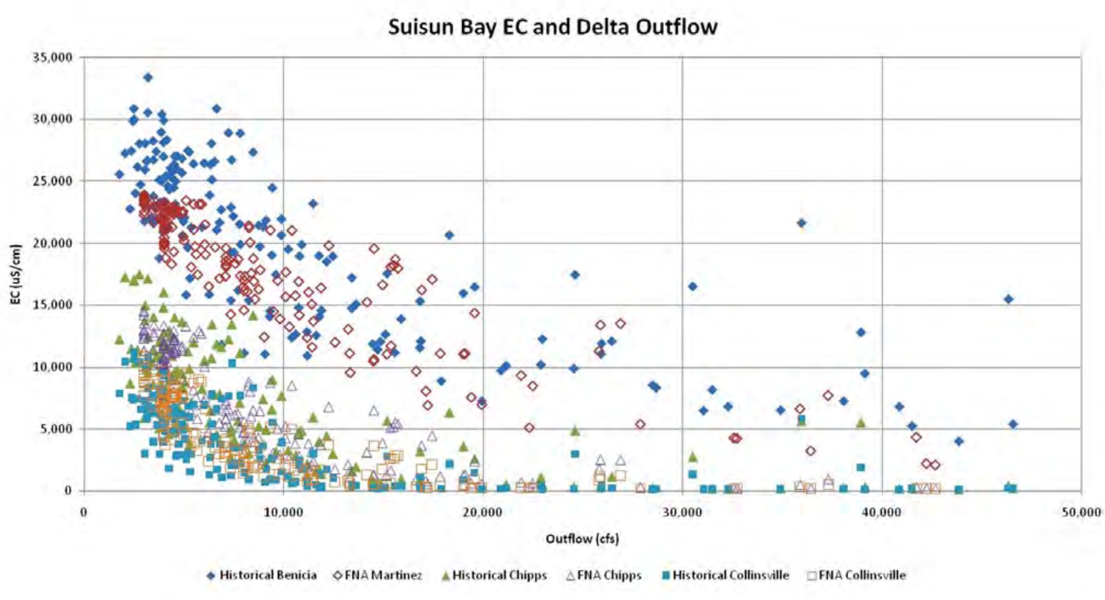


**Figure 3.3-3b.** Relationship between Delta Outflow and EC at Martinez, Chipps Island and Collinsville

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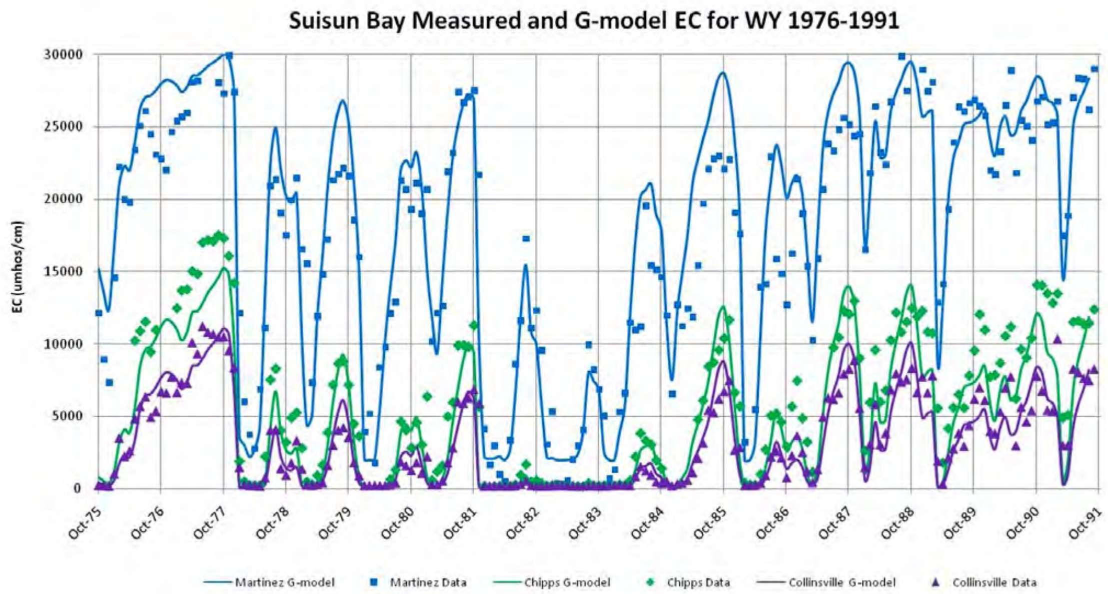


**Figure 3.3-4a.** Comparison of Measured and G-model Estimated EC for Suisun Bay Stations for Water Years 1976–1991

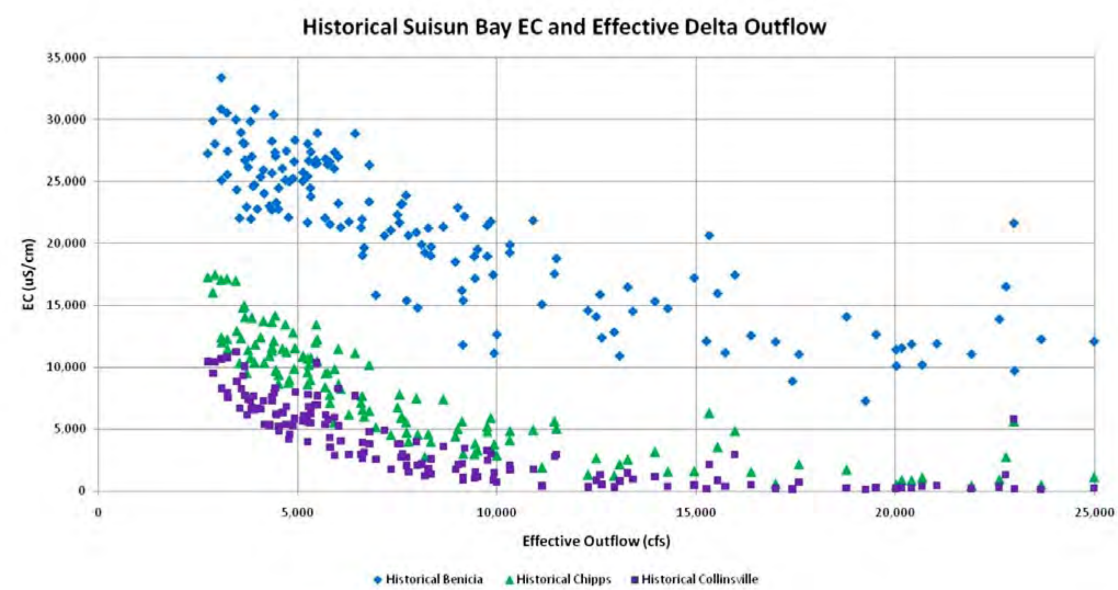


**Figure 3.3-4b.** Relationship between Effective Delta Outflow and Historical EC at Suisun Bay Stations

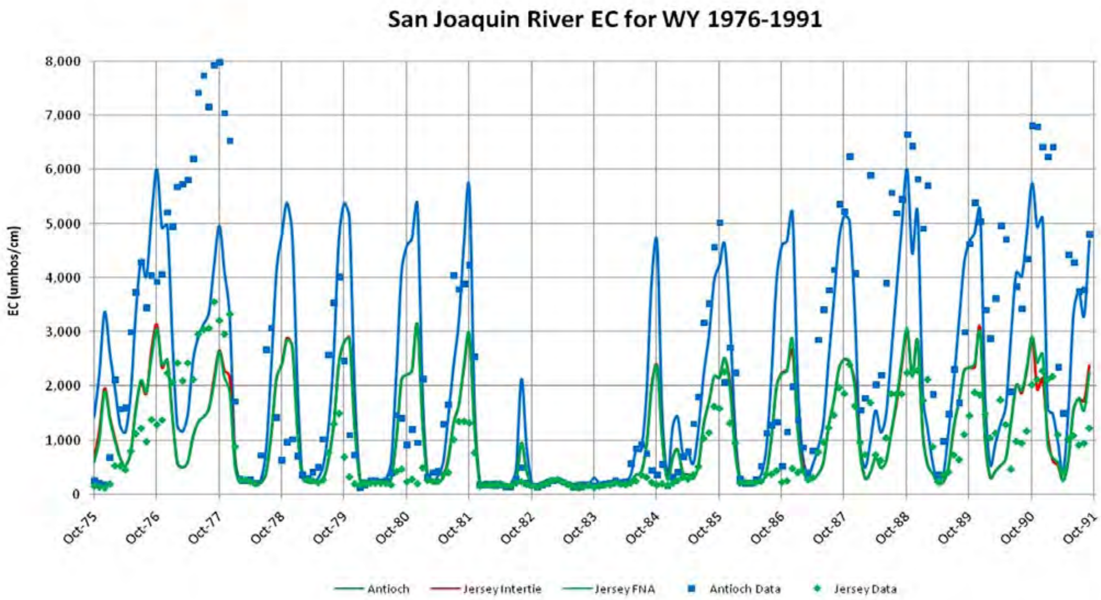


**Figure 3.3-5.** Comparison of Historical and Simulated No Action and Intertie EC at Antioch and Jersey Point for Water Years 1976–1991

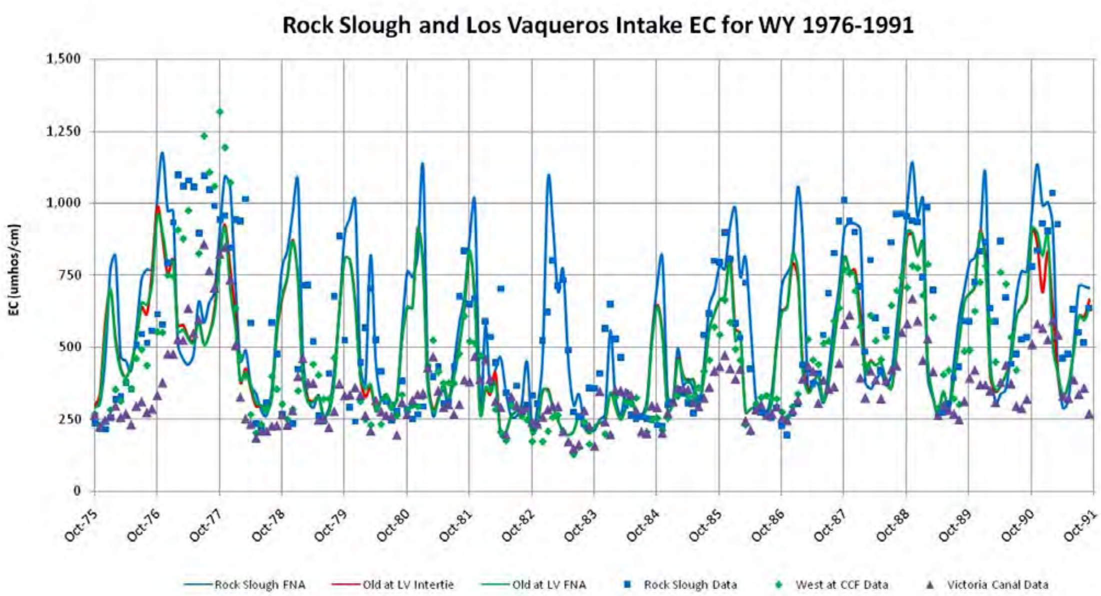


**Figure 3.3-6.** Comparison of Historical and Simulated No Action and Intertie EC at Rock Slough and Los Vaqueros Intake for Water Years 1976–1991

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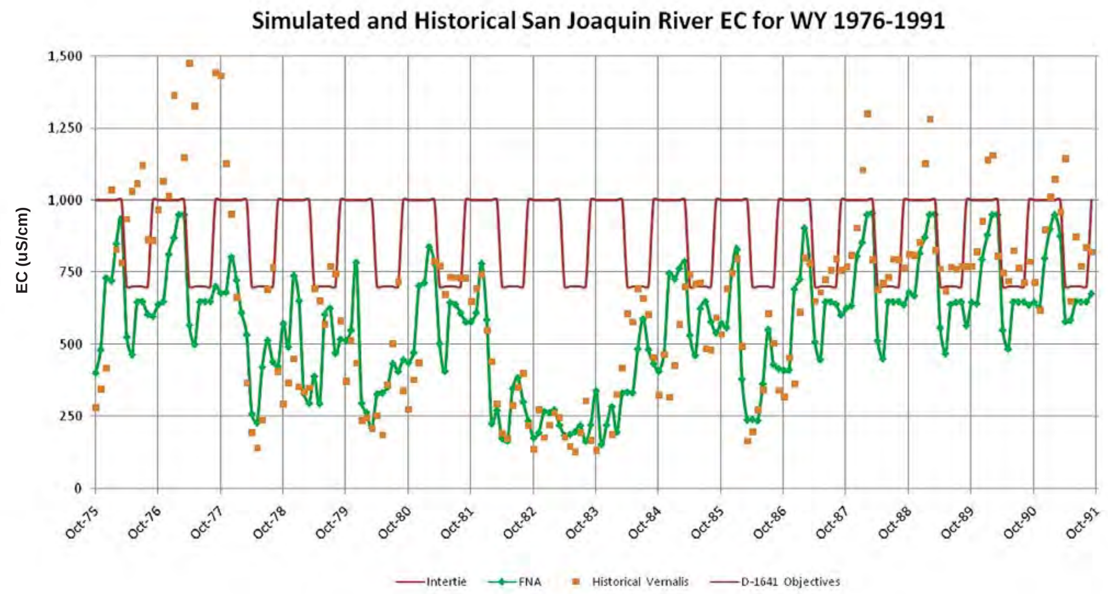


**Figure 3.3-7a.** Historical and Simulated No Action and Intertie EC at Vernalis for Water Years 1976–1991

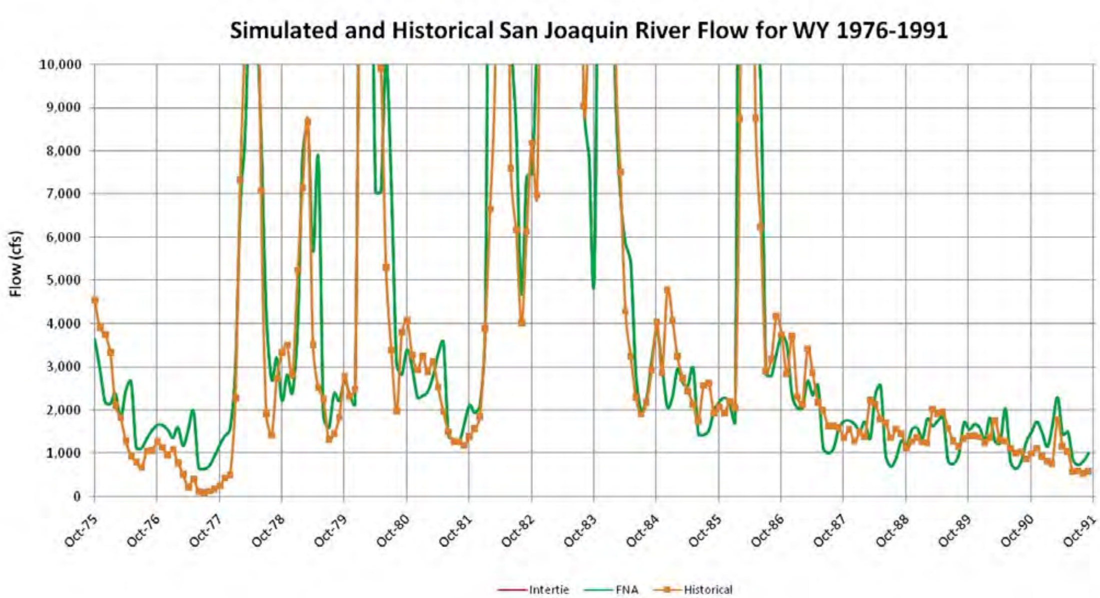


**Figure 3.3-7b.** Historical and Simulated No Action and Intertie Flow at Vernalis Flow for Water Years 1976–1991

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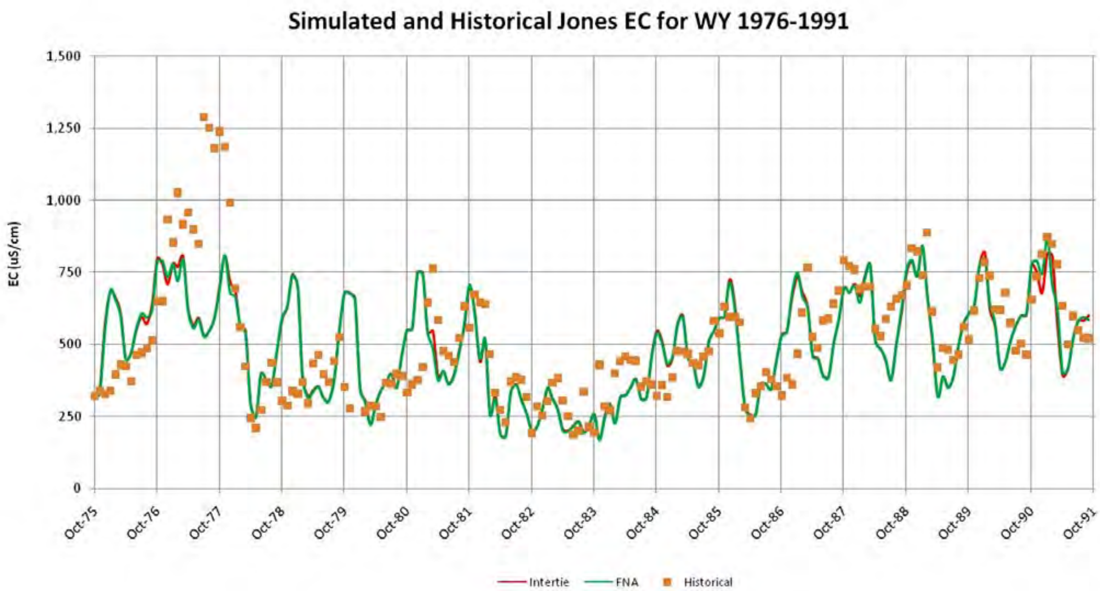


**Figure 3.3-8a.** Historical and Simulated No Action and Intertie EC at CVP Jones Pumping Plant for Water Years 1976–1991

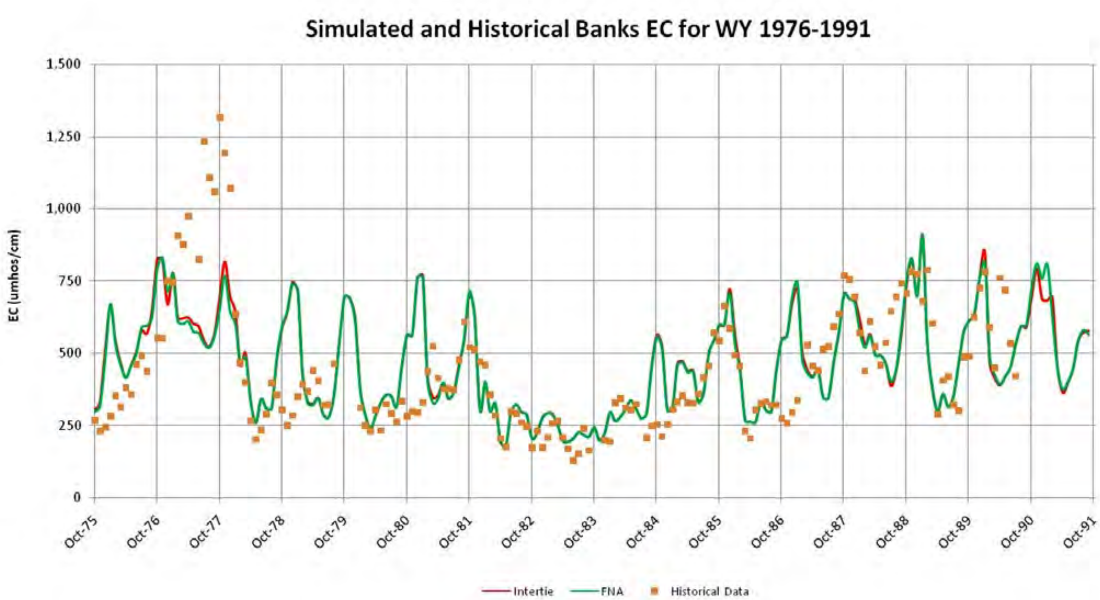


**Figure 3.3-8b.** Historical and Simulated No Action and Intertie EC at SWP Banks Pumping Plant for Water Years 1976–1991

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# 3.4 Geology and Soils

## 3.4.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on geology and soils. Mineral resources are not discussed because the Proposed Action and alternatives would not affect mineral resources in the area.

## 3.4.2 Affected Environment

### *Sources of Information*

The following key sources of information were used in the preparation of this section:

- maps and reports by the USGS,
- maps and reports by the California Geological Survey (CGS),
- maps and report by Natural Resources Conservation Service (NRCS),
- maps and reports by the International Conference of Building Officials, and
- geotechnical investigations conducted by Reclamation.

### *Regional Geology and Stratigraphy*

This section addresses the regional and project area geology and topography. Quaternary sediments and geologic hazards pertaining to the project area are emphasized. The project area is located in the westernmost edge of the Great Valley geomorphic province adjacent to the Coast Ranges geomorphic province.

#### *Regional and Project Area Topography*

The project area is located at the boundary of the Great Valley and Coast Ranges geomorphic provinces. The Great Valley of California, also called the Central Valley of California, is a nearly flat alluvial plain extending from the Tehachapi Mountains at the south to the Klamath Mountains at the north, and from the Sierra Nevada on the east to the Coast Ranges on the west. The valley is about 450 miles long and has an average width of about 50 miles. Elevations of the alluvial plain are generally just a few hundred feet msl, with extremes ranging from a few feet below msl to about 1,000 feet above msl (Hackel 1966).

The Coast Ranges geomorphic province includes many separate ranges; coalescing mountain masses; and several major structural valleys of sedimentary, igneous, and metamorphic origin. The southern Coast Ranges extend from the San Francisco Bay area south to the northern edge of the Transverse Ranges geomorphic province. On average, they extend from the coastline to 50–75 miles inland. The southern Coast Ranges parallel the Great Valley geomorphic province throughout their length. The main topographic features of the region consist of dissected uplands, low alluvial plains and fans, constructed canals, and the Delta to the north. At the proposed intertie sites, both the DMC and the California Aqueduct are located in and along the eastern foothills of the Diablo Range in the central Coast Ranges on the west side of the San Joaquin Valley. The topography of the project area is typical of an alluvial fan setting and is influenced by sediment introduction from the Coast Ranges to the west. Between the DMC and the California Aqueduct, elevations presently range from approximately 260 feet to approximately 200 feet.

#### *Regional and Project Area Geology*

Geologically, the Great Valley geomorphic province is a large, elongated, northwest-trending asymmetric structural trough that has been filled with an extremely thick sequence of sediments ranging in age from Jurassic to Recent. This asymmetric geosyncline has a long stable eastern shelf supported by the subsurface continuation of the granitic Sierran slope and a short western flank expressed by the upturned edges of the basin sediments (Hackel 1966).

The Coast Ranges geomorphic province includes many separate ranges, coalescing mountain masses, and several major structural valleys. Typical tectonic, sedimentary, and igneous processes of the Circum-Pacific orogenic belt have influenced the evolution of the Coast Ranges. The Coast Ranges geomorphic province is characterized by the presence of two entirely different core complexes, one being a Jurassic-Cretaceous eugeosynclinal assemblage (the Franciscan rocks) and the other consisting of Early Cretaceous granitic intrusives and older metamorphic rocks. The two unrelated, incompatible core complexes lie side by side, separated from each other by faults. A large sequence of Cretaceous and Cenozoic clastic deposits covers large parts of the province. The rocks in the province are characterized by many folds, thrust faults, reverse faults, and strike-slip faults that have developed as a consequence of Cenozoic deformation (Page 1966). The canal alignments traverse rolling hills consisting of folded eastward-dipping Cretaceous and Tertiary sedimentary rocks overlain by flat-lying Holocene alluvium and/or colluviums. Sedimentary rock units consist of thick Holocene (early Quaternary) non-marine (continental) sedimentary alluvial fan deposits, including variably indurated shale, claystone, sandstone, and siltstone (Sherer 2003; Wagner et al. 1990). These sediments were deposited from former streams emerging from highlands surrounding the Great Valley geomorphic province, specifically the Coast Ranges.

The dominant subsurface geologic formation encountered during geotechnical investigations is the Neroly formation. This unit is a Miocene-Pliocene, moderately well indurated and jointed, massive sandstone with interbedded claystone and siltsone (Sherer 2003).

### *Project Area Soils*

The soils in the project area have been mapped by the Natural Resources Conservation Service and are described in the Soil Survey of Alameda Area (Welch et al. 1966). The Altamont-Diablo soil association occurs in the project area (Table 3.4-1).

**Table 3.4-1.** Soil Association of the Project Area

| Soil Association | Soil Description |
|---|---|
| Altamont-Diablo | Moderately sloping to very steep, brownish and dark-gray, moderately deep soils on soft sedimentary rocks |

Source: Welch et al. 1966.

According to the soil survey, soils in the project area comprise predominantly clay loams. Table 3.4-2 summarizes soil characteristics for the project area. The soils generally have a variable runoff rate and variable erosion hazard. Moderate to high shrink-swell potential (i.e., expansive soils) in the Rincon clay loam, and severe erosion hazard in Linne clay loam are the most limiting factors.

No information is available about the corrosivity of the soil to coated steel or plastic pipes, but other soils in the region have high or very high corrosivity to uncoated steel (Welch 1977). Standard engineering design practices dictate the selection of a pipe material that could resist corrosion from the soil.

**Table 3.4-2.** Detailed Soil Characteristics of the Project Area

| Soil Map Unit | Shrink-Swell Potential | Erosion Hazard[a] | Runoff Rate |
|---|---|---|---|
| Linne clay loam, 30%–45% slopes, eroded | Low | Severe | Medium to rapid |
| Rincon clay loam, 0%–3% slopes | Moderate | Slight to moderate | Slow to medium |

Note:

[a] Erosion hazard consists of susceptibility to water and wind erosion. The Soil Survey of the Alameda Area (Welch et al. 1966) does not differentiate between the two.

Source: Welch et al. 1966.

Three drill holes were completed along the Intertie alignment near Mile 7.7 of the DMC. The purpose of the associated geotechnical investigation was to determine foundation conditions along the alignment. In brief, depth of the drill holes was approximately 40 to 50 feet below the ground surface. Subsurface soils range from clay to silty sand. Refer to Reclamation's 2003 *Delta-Mendota Canal, California Aqueduct Intertie Project, Geologic Design Data Report, Central Valley Project Delta Division* (Sherer 2003).

Six drill holes were completed along the Intertie alignment near Mile 7.2 of the DMC. The purpose of the associated geotechnical investigation was to determine foundation conditions along the alignment. In brief, depth of the drill holes was approximately 50 feet below the ground surface. Subsurface soils range from clay to gravel. Refer to Reclamation's 2004 *Addendum to the Geologic Report for Central Valley Project, Delta Division, Delta-Mendota Canal, California Aqueduct Intertie Project* (Mongano 2004).

### *Potential Geologic Hazards*

#### *Seismic Conditions*

Seismic hazards are earthquake fault ground rupture and ground shaking (primary hazards) and liquefaction and earthquake-induced slope failure (secondary hazards). Ground shaking is the most significant seismic hazards in the project area.

Alameda County is located in one of the most seismically active regions in the United States. Major earthquakes have occurred in the vicinity of the project area in the past and can be expected to occur again in the near future. The 2002 Working Group on California Earthquake Probabilities estimated that there is a 62% probability of at least one earthquake, magnitude 6.7 or greater, to occur on one of the major faults in the San Francisco Bay region before 2030 (Working Group on California Earthquake Probabilities 2003). Furthermore, in a previous study, it was determined that there is a 30% chance of one or more magnitude 6.7 or greater earthquakes occurring somewhere along the Calaveras, Concord, Green Valley, Mount Diablo Thrust, or Greenville faults before 2030, faults very close to the project area (Working Group on California Earthquake Probabilities 1999).

#### **Surface Rupture and Faulting**

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) is to regulate development near active faults to mitigate the hazard of surface rupture. Faults in an Alquist-Priolo Earthquake Fault Zone are typically active faults. As defined under the Alquist-Priolo Act, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). An early Quaternary fault is one that has had surface displacement during Quaternary time (the last 1.6 million years). A pre-Quaternary fault is one that has had surface displacement before the Quaternary period. Only faults officially recognized by the State of California under the Alquist-Priolo Act or faults recognized by the Uniform Building Code (UBC) are subject to mitigation (Hart and Bryant 1997).

The project area is subject to seismic hazards because of its proximity to active faults, fault systems, and fault complexes. Some of the officially recognized (e.g., by the State of California or UBC) active faults are located within a 20-mile radius of the project area. Active faults within a 20-mile radius of the project area include the Greenville, Marsh Creek, Pleasanton, and Calaveras faults (Hart and Bryant 1997; International Conference of Building Officials 1997; Jennings 1994). All of these faults except the Pleasanton fault are in Alquist-Priolo Earthquake Fault Zones[1] (Hart and Bryant 1997).

Other Quaternary faults within a 20-mile radius of the project area are the San Joaquin, Williams, Las Positas, Midway, Black Butte, and Vernalis faults (Jennings 1994; Wagner et al. 1990). None of these faults are in Alquist-Priolo Earthquake Fault Zones (Hart and Bryant 1997). Various pre-Quaternary faults are also present within an approximately 20-mile radius, including the Stockton fault and the Midland fault zone. Finally, there are a series of unnamed pre-Quaternary faults present within an approximately 20-mile radius of the project area. None of these are in Alquist-Priolo Earthquake Fault Zones (Hart and Bryant 1997). Of all faults described above, the Midway fault is closest to the project area, located within a few miles of it.

### Ground-Shaking Hazard

The project area is located in UBC Seismic Hazard Zone 3. Structures must be designed to meet the regulations and standards associated with Zone 3 hazards. Furthermore, the project area is located in a region of California characterized by locally moderate to very high historical seismic activity. The UBC recognizes active seismic sources in the project area vicinity (International Conference of Building Officials 1997), including the Calaveras fault (Type A seismic source) and the Greenville fault (Type B seismic source).

Accordingly, earthquake-induced ground shaking poses a significant hazard. The measurement of the energy released at the point of origin, or epicenter, of an earthquake is referred to as the magnitude, which is generally expressed in the Richter Magnitude Scale or as moment magnitude. The scale used in the Richter Magnitude Scale is logarithmic so that each successively higher Richter magnitude reflects an increase in the energy of an earthquake of about 31.5 times. Moment magnitude is the estimation of an earthquake magnitude by using seismic moment, which is a measure of an earthquake size using rock rigidity, amount of slip, and area of rupture.

The greater the energy released from the fault rupture, the higher the magnitude of the earthquake. Earthquake energy is most intense at the fault epicenter; the

[1] The Marsh Creek fault is partially zoned.

farther an area from an earthquake epicenter, the less likely that ground shaking will occur there. Geologic and soil units comprising unconsolidated, clay-free sands and silts can reach unstable conditions during ground shaking, which can result in extensive damage to structures built on them (see Liquefaction and Related Hazards below).

Ground shaking is described by two methods: ground acceleration as a fraction of the acceleration of gravity (g) or the Modified Mercalli scale, which is a more descriptive method involving 12 levels of intensity denoted by Roman numerals. Modified Mercalli intensities range from I (shaking that is not felt) to XII (total damage).

The intensity of ground shaking that would occur in the project area as a result of a nearby earthquake is related to the size of the earthquake, its distance from the project area, and the response of the geologic materials within the project area. As a rule, the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of ground shaking. When various earthquake scenarios are considered, ground-shaking intensities will reflect both the effects of strong ground accelerations and the consequences of ground failure.

*Estimates of Earthquake Shaking*

The project area is located in a region of California characterized by a moderate ground-shaking hazard. Based on a probabilistic seismic hazard map that depicts the peak horizontal ground acceleration values exceeded at a 10% probability in 50 years (Cao et al. 2003; California Geological Survey 2006), the probabilistic peak horizontal ground acceleration values in the project area range from 0.3 to 0.4 g, where one g equals the force of gravity, thus indicating that the ground-shaking hazard in the project area is moderate. Furthermore, based on shaking intensity maps and information from the Association of Bay Area Governments (ABAG), ground-shaking hazard in the project area is moderate (Association of Bay Area Governments 2003). Farther to the west, the ground-shaking hazard increases, coinciding with the increase in abundance of associated faults and fault complexes (Cao et al. 2003; California Geological Survey 2006).

### Liquefaction and Related Hazards

Liquefaction is a phenomenon in which the strength and stiffness of unconsolidated sediments are reduced by earthquake shaking or other rapid loading. Poorly consolidated, water-saturated fine sands and silts having low plasticity and located within 50 feet of the ground surface typically are considered to be the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction (California Division of Mines and Geology 1997). Based on the composition of the soils and sediments and proximity to groundwater, liquefaction susceptibility is expected to be relatively low in the vicinity of the project area. Liquefaction susceptibility maps produced by the ABAG (2005) verify that the project area is not highly susceptible to liquefaction.

Two potential ground failure types associated with liquefaction in the region are lateral spreading and differential settlement (Association of Bay Area Governments 2001). Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a gently sloping surface toward a river channel or other open face. Lateral spreading is not a significant concern in the project area.

Another common hazard in the region is differential settlement (also called ground settlement and, in extreme cases, ground collapse) as soil compacts and consolidates after the ground shaking ceases. Differential settlement occurs when the layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills. Settlement can range from 1% to 5%, depending on the cohesiveness of the sediments (Tokimatsu and Seed 1984). In the project area, differential settlement is not expected to be a significant hazard.

#### *Slope Stability*

The portion of the project area beyond the canals is not prone to landslides or slope instability because of its moderately sloping topography. The canals themselves, however, are more prone to localized slope instability (at least during the construction process). Thirty-one slope failures occurred in the vicinity of the project area during the construction of the California Aqueduct. All failures occurred on the west cutslope of the canal prism and were associated with east-dipping bedding planes. Nearly all failures occurred above the existing water table along bedding planes dipping into the west canal prism cutslope at angles flatter than the prism slope (Sherer 2003).

## ***Regulatory Setting***

### *Federal Regulations*

### **Clean Water Act**

Section 402 of the CWA is directly relevant to excavation. Amendments in 1987 to the CWA added Section 402p, which establishes a framework for regulating municipal and industrial stormwater discharges under the NPDES program. The EPA has delegated to the State Water Board the authority for the NPDES program in California, which is implemented by the state’s nine RWQCBs. Under the NPDES Phase II Rule, construction activity disturbing 1 acre or more must obtain coverage under the state’s General Permit for Discharges of Storm Water Associated with Construction Activity (General Construction Permit). General Construction Permit applicants are required to prepare a notice of intent and a

SWPPP and implement and maintain BMPs to avoid adverse effects on water quality as a result of construction activities, including earthwork.

The Proposed Action construction activities would disturb more than 1 acre and therefore would be subject to NPDES requirements. The Central Valley RWQCB administers the stormwater permit program in the project area.

**Uniform Building Code (International Building Code)**

The design and construction of engineered facilities in the state of California must comply with the requirements of the Uniform Building Code. The International Code Council (ICC) was established in 1994 as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes, or Uniform Building Codes. The founders of the ICC are Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International, Inc. (SBCCI). Since the early twentieth century, these nonprofit organizations developed the three separate sets of model codes used throughout the United States. Although regional code development has been effective and responsive in the past, a single set of codes was developed. The nation's three model code groups responded by creating the ICC and by developing codes without regional limitations, the International Codes.

*State Regulations*

**Alquist-Priolo Earthquake Fault Zoning Act**

California's Alquist-Priolo Act (PRC 2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994, is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along active faults (Earthquake Fault Zones). It also defines criteria for identifying active faults, giving legal weight to terms such as *active* and establishes a process for reviewing building proposals in and adjacent to Earthquake Fault Zones.

Under the Alquist-Priolo Act, faults are zoned, and construction along or across them is strictly regulated if they are "sufficiently active" and "well-defined." A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for the purposes of the act as within the last 11,000 years). A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant 1997).

### Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC 2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: The state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development within mapped Seismic Hazard Zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans.

### California Building Code Commission

Established in 1953 by the California Building Standards Law, the California Building Standards Commission (BSC) is an independent commission within the State and Consumer Services Agency. The BSC's mission is to produce sensible and usable state building standards and administrative regulations that implement or enforce those standards. As provided in established laws and rules, the BSC is charged with:

- assisting state agencies in producing high-quality amendments;
- working to repeal unnecessary building regulations and see that ambiguous regulations are more clearly written;
- assisting various constituents and special interest groups in making their needs known to various code-writing departments;
- administering a public appeal process;
- educating the public about the state's building code and helping them understand and comply with it; and
- ensuring a high-quality CCR, Title 24, with minimal errors.

The State of California's minimum standards for structural design and construction are given in the CBSC (CCR Title 24). The CBSC is based on the UBC (International Code Council 1997), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity will be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, certain aspects of the Proposed Action would be required to comply with all provisions of the CBSC.

*Local Regulations*

**Geotechnical Investigations**

Local jurisdictions typically regulate construction activities through a multistage permitting process that may require the preparation of a site-specific geotechnical investigation. The purpose of a site-specific geotechnical investigation is to provide a geologic basis for the development of appropriate construction design. Geotechnical investigations typically assess bedrock and Quaternary geology, geologic structure, soils, and the previous history of excavation and fill placement.

The Alameda County General Plan (Alameda County 1982) requires all new development to be designed and constructed to minimize risk from geologic and seismic hazards, with geotechnical investigations to be performed prior to any planning or construction activities.

Two site-specific geotechnical investigations providing a geologic basis for the development of appropriate construction design have been completed for the project area (Mongano 2004; Sherer 2003). All relevant recommendations from these reports are incorporated into the project design. See the Impact Analysis section for further information.

**Local Grading and Erosion Control Ordinances**

Many counties have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit typically is required for construction-related projects. As part of the permit, the project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP.

As per the Alameda County General Ordinance Code (Alameda County 2006), the County's Grading Ordinance, Chapter 15.36, "Grading, Erosion and Sediment

Control," outlines regulations and practices relevant to construction and grading activities within the county. Typically, a grading permit is required for all construction and grading activities within the county (Chapter 15.36.050 explains the exemptions for grading permits).

## 3.4.3 Environmental Consequences

### *Assessment Methods*

Evaluation of the geology, seismicity, and soils impacts in this section is based on the results of technical maps, reports, and other documents that describe the geologic, seismic, and soil conditions of the project area, and on professional judgment. The analysis assumes that the project applicants will conform to the latest UBC standards, CBSC standards, County grading ordinance, NPDES requirements, and geotechnical investigations.

## 3.4.4 Environmental Effects

### *Alternative 1 (No Action)*

The No Action Alternative would not include any direct ground-disturbing activities or operational changes that could result in changes in geology, seismicity, soils, or mineral resources. Therefore, there would be no effects on these resources attributable to implementation of this alternative.

### *Alternative 2 (Proposed Action)*

*Construction Effects*

**Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction**

Grading, excavation, removal of vegetation cover, and loading activities associated with construction activities could temporarily increase erosion, runoff, and sedimentation. Construction activities also could result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at the construction sites and staging areas.

However, as mentioned in the Environmental Commitments section of the Project Description (Chapter 2), a SWPPP will be developed by a qualified engineer or erosion control specialist and implemented before construction. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB. The objectives of the SWPPP will be to: (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity; and (2) identify, construct, and implement stormwater pollution prevention measures to reduce pollutants in stormwater discharges during and after construction. Therefore, the SWPPP will include a description of potential pollutants, the management of excavated soils, and hazardous materials present on the site during construction (including vehicle and equipment fuels). The SWPPP also will include details of how the sediment and erosion control practices, referred to as BMPs, will be implemented. Implementation of the SWPPP will comply with state and federal water quality regulations.

Furthermore, compliance with the County's Grading Ordinance also would minimize any negative effects associated with erosion and sedimentation. The County's Grading Ordinance, Chapter 15.36, "Grading, Erosion and Sediment Control," outlines regulations and practices relevant to construction and grading activities in the county. Typically, a grading permit is required for all construction and grading activities in the county.

The inclusion of these environmental commitments would ensure that there are no adverse effects related to erosion.

### Impact GEO-2: Potential Slope Failure along Canals Resulting from Project Construction

The portion of the project area beyond the canals is not prone to landslides or slope instability because of its moderately sloping topography. The canals themselves, however, are more prone to localized slope instability (at least during the construction process). Thirty-one slope failures occurred in the vicinity of the project area during the construction of the California Aqueduct. All failures occurred on the west cutslope of the canal prism and were associated with east-dipping bedding planes. Nearly all failures occurred above the existing water table along bedding planes dipping into the west canal prism cutslope at angles flatter than the prism slope (Sherer 2003). Additionally, the drainage ditches may be prone to localized slope instability, especially the human-made drainage ditch, with 30- to 40-foot-high cutslopes, that was constructed to channelize and divert a natural drainage beneath the California Aqueduct and over the DMC. However, the proposed intertie is approximately 100 feet away from this drainage ditch while still maintaining the required 100-foot setback from the overhead high-tension power lines (Mongano 2004). Furthermore, the excavated sideslopes would be shored using sheet piling, and a dewatering system would be installed outside as necessary to maintain reduced groundwater levels in the construction area. These measures would ensure the stability of the excavation, allow construction to proceed in dry conditions, and minimize slope failure.

These design features would ensure that there are no adverse effects related to slope instability.

### Impact GEO-3: Potential Structural Damage from Fault Displacement and Ground Shaking during a Seismic Event

Based on available knowledge of fault locations and locations of earthquake epicenters, the risk of surface fault rupture in the project area is generally high because of its proximity to active faults. Fault rupture has the potential to compromise the structural integrity of proposed new facilities (including the proposed pumping plant and pipelines) and cause injury to workers and operators. Furthermore, a large earthquake on a nearby fault could cause moderate ground shaking in the project area, potentially resulting in liquefaction and associated ground failure, such as lateral spreading or differential settlement, which in turn could increase the risk of structural loss, injury, and death.

However, the project applicant is required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential fault rupture hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to fault displacement and ground shaking.

### Impact GEO-4: Potential Structural Damage from Development on Materials Subject to Liquefaction

Liquefaction susceptibility maps compiled by ABAG and professional judgment indicate that the project area is not susceptible to liquefaction. Nonetheless, as part of the design process described above, the project applicants are required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential liquefaction hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to liquefaction.

### Impact GEO-5: Potential Structural Damage from Development on Expansive Soils

Moderate shrink-swell potential (i.e., expansive soils) in the Rincon clay loam is a limiting factor for development within the project area. Expansive soils have the potential to compromise the structural integrity of proposed new facilities (including the proposed pumping plant and new roadway). However, as part of the design process described above, the project applicants are required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential shrink-swell hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to expansive soils.

**Impact GEO-6: Potential Rupture of Pipelines Caused by Expansive Soils and Pipeline Corrosion**

As mentioned above, moderate shrink-swell potential (i.e., expansive soils) in the Rincon clay loam is a limiting factor for development in the project area. Furthermore, the soils of the area may be highly corrosive to uncoated steel and moderately corrosive to concrete. This corrosivity poses a threat to the long-term viability of the pipelines.

The project pipelines and other facilities would be constructed to reduce the potential for corrosion and eventual failure, to the extent feasible. Measures to avoid that potential could be to:

- construct pipelines and other project facilities to withstand the effects of soil corrosion using standard and tested methods of pipeline protection, such as pipeline coating; and
- conduct regular inspections of the pipelines during operation at an interval that is in accordance with safe and standard operating practices (visual inspection or inspection with specialized equipment used to detect potential damage and leaks).

Because the project facilities would be constructed to minimize damage to pipelines from corrosion, there would be no adverse effect.

**Operation**

Operation of the Intertie would have no effects on geology or soils.

***Alternative 3 (TANC Intertie Site)***

*Construction Effects*

**Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction**

Alternative 3 is the same as Alternative 2 but would be constructed in a location just south of Alternative 2. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. As described above, environmental commitments for erosion control would be implemented. The inclusion of these environmental commitments would ensure that there are no adverse effects related to erosion.

**Impact GEO-2: Potential Slope Failure along Canals Resulting from Project Construction**

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. As described above, the excavated sideslopes would be shored using sheet piling, and a dewatering system would be installed outside as necessary to maintain reduced groundwater levels in the construction area. These measures would ensure the stability of the excavation, allow construction to proceed in dry conditions, and minimize slope failure.

These design features would ensure that there are no adverse effects related to slope instability.

**Impact GEO-3: Potential Structural Damage and Threat to Public Safety from Fault Displacement and Ground Shaking during a Seismic Event**

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to fault displacement and ground shaking.

**Impact GEO-4: Potential Structural Damage from Development on Materials Subject to Liquefaction**

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to liquefaction.

**Impact GEO-5: Potential Structural Damage from Development on Expansive Soils**

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to expansive soils.

**Impact GEO-6: Potential Rupture of Pipelines Caused by Expansive Soils and Pipeline Corrosion**

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. The project pipelines and other facilities would be constructed to reduce the potential for corrosion and eventual failure, to the extent feasible. Because the project facilities would be constructed to minimize damage to pipelines from corrosion, there would be no adverse effect.

*Operation*

Operation of the Intertie would have no effects on geology or soils.

### *Alternative 4 (Virtual Intertie)*

*Construction Effects*

**Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction**

Alternative 4 involves the placement of an emergency temporary pipeline connecting the DMC and California Aqueduct. During placement of the pipeline, pumps, and other structures, there is an increased risk of erosion. As described above and in Chapter 2, erosion control would be implemented. Accordingly, there would be no adverse effect.

**Impact GEO-3: Potential Structural Damage from Fault Displacement and Ground Shaking during a Seismic Event**

If ground shaking or other consequences of a seismic event occur while the temporary pipeline is in place, there is potential for structural damage to the pipelines, pumps, and other associated structures. However, the risk for a seismic event to occur at the same time that the emergency pipeline is in place is low. Additionally, the structures are intended to be temporary and could be easily replaced if damaged. Accordingly, there would be no adverse effect.

*Operation*

Operation of the temporary intertie would have no effects on geology or soils.

# 3.5 Transportation

## 3.5.1 Introduction

This section describes the existing transportation conditions within the immediate project area, discloses the potential changes in transportation that could occur as a result of constructing and operating the Intertie, and recommends mitigation for substantial adverse changes. Changes in transportation are not expected to occur outside the immediate project area; therefore, regional transportation is not discussed.

This section describes: (1) the existing condition of the roadways that make up the routes that are expected to be used during project construction and the potential effects on those roadways from construction vehicles; and (2) the potential changes in capacity on those roads.

Changes in vehicle/capacity ratios and levels of service (LOS) of affected roadways, and potential impacts on LOS, were not evaluated in this document because construction impacts would be minimal and short-term; permanent changes resulting from roadway modifications and facility operations also would be minimal and would be confined to private roads currently used for O&M activities.

Additionally, aviation, navigation, and public transportation are not evaluated because the Proposed Action and alternatives would have no effect on these transportation modes. Bikeways are described and evaluated because there are paths near or in the project area.

## 3.5.2 Affected Environment

### *Sources of Information*

The following key sources of information were used in the preparation of this section:

- Roadway maps of the project area; and
- Information provided in Chapter 2, *Proposed Action and Alternatives*.

### *Roadways*

The immediate project area is rural in character and generally is served by two-lane roads. The routes used to access the project area consist of major transportation facilities (Interstate 5 [I-5], Interstate 205 [I-205], Interstate 580 [I-580]); major rural circulation roads (Grant Line Road, Altamont Pass Road);

and connector roads (narrower county and private roadways). The condition of these roadways is shown in Table 3.5-1.

**Table 3.5-1.** Existing Roadway Condition of Roads Used to Access Project Area

| Roadway | Number of Lanes | Shoulders | Existing Road Condition[a] |
|---|---|---|---|
| Interstate 5 | 6–10 | Yes | Excellent |
| Interstate 205 | 4–6 | Yes | Excellent |
| Interstate 580 | 8 | Yes | Excellent |
| Grant Line Road (Alameda County) | 2 | No | Good/Excellent[c] |
| W. Grant Line Road (San Joaquin County) | 2 | No | Poor [b] |
| Altamont Pass Road | 2 | No | Fair/Good[c] |
| Midway Road | 2 | No | Excellent[c] |
| Mountain House Parkway | 2 | Yes | Excellent[b] |
| W. Patterson Pass Road—from Alameda County line to 4,120 feet east of Alameda County Line (San Joaquin County) | 2 | No | Very Poor[b] |
| W. Patterson Pass Road—from 4,120 feet east of Alameda County line to I-580 (San Joaquin County) | 2 | No | Excellent [b] |
| W. Schulte Road | 4 | Yes | Good |
| Hansen Road | 2 | No | Fair |
| Kelso Road | 2 | No | Fair |

[a] Roadway Condition Ratings:
**Excellent—**pavement in good condition, exhibits good geometrics (i.e., the road is straight and it has large curves to allow cars to maintain their speed while going around the curves), and it has good shoulders.
**Good—**pavement in pretty good shape, some patching of the roadway, shoulders not well-maintained, road able to handle project traffic.
**Fair**—very patched road is starting to deteriorate, could potentially be affected by the project.
**Poor—**many visible potholes and would definitely be adversely affected by the project.

[b] Source: Shellie Aldama pers. comm.

[c] Source: Paul Crawford pers. comm.

These rural roads provide local access to individual properties, and access to I-580 and I-205. I-580 and I-205 are both east-west trending roadways. I-5 is just east of the project area and is a major north-south trending transportation corridor (Figure 3.5-1). Locally important roads in the project area are Grant Line Road, Altamont Pass Road, Midway Road, Patterson Pass Road, South Patterson Pass Road, and Mountain House Parkway. In addition to these public roadways, DWR and Reclamation maintain roads along the SWP and CVP, respectively, for O&M activity purposes. These roads generally run alongside the aqueducts in a north-south direction.

Access to the CVP side of the proposed Intertie from I-5 is via I-205, Grant Line Road, Midway Road, and private CVP roads. Access to the SWP side would be from SWP private roads via Midway Road. Access to the temporary pipeline,

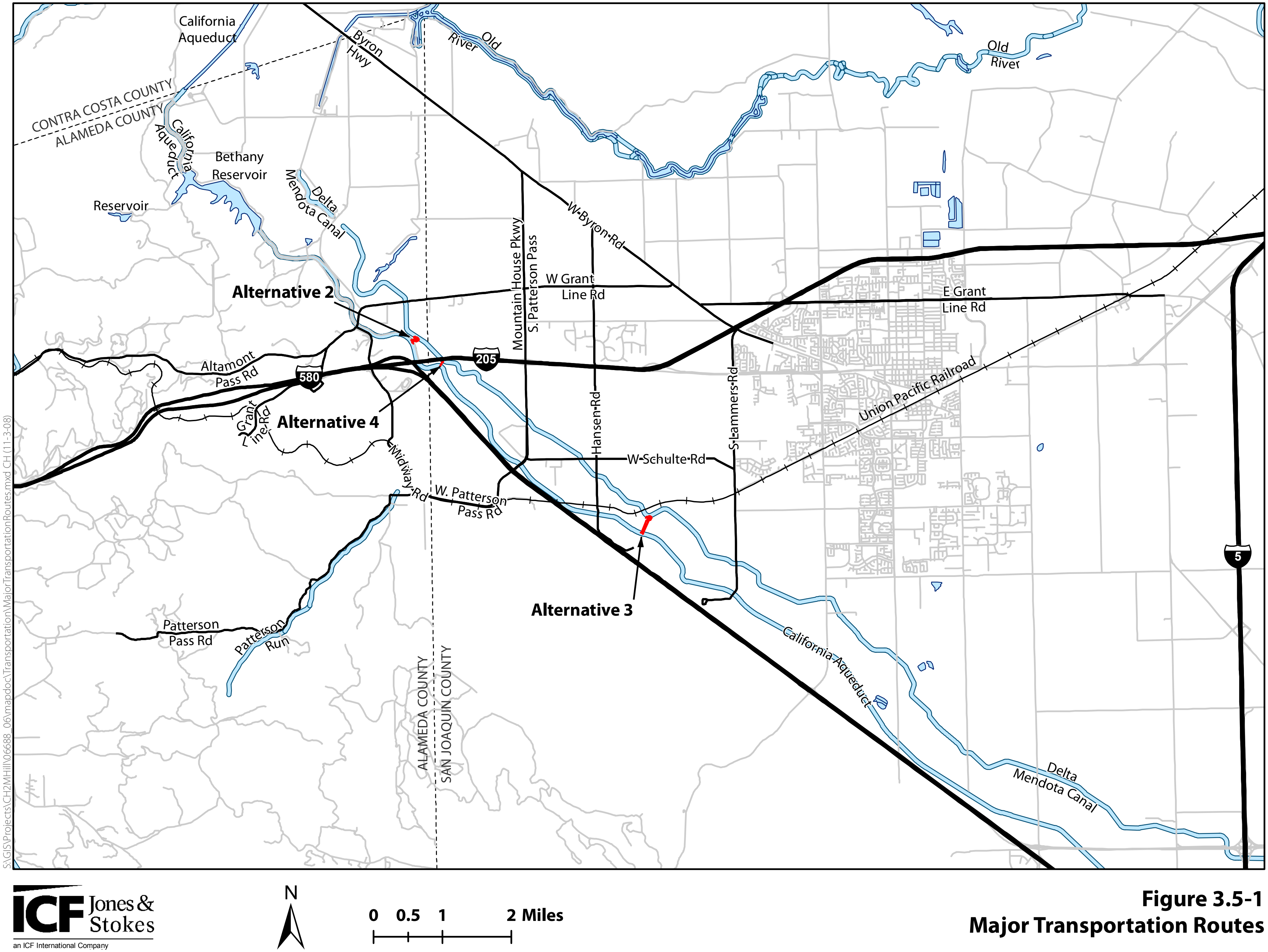

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**Figure 3.5-1**
**Major Transportation Routes**

which would be installed periodically under Alternative 4, from I-580 or I-205 is via Mountain House Parkway/South Patterson Pass Road (Figure 3.5-1). The intersection of Mountain House Parkway/South Patterson Pass Road and the DMC is the only entrance to the site. At this location, the DMC operation and maintenance road (an unimproved roadway) provides the only access to the site.

#### *Bikeways*

A Class I[1] bike route, the California Aqueduct Bikeway, exists along the California Aqueduct at Bethany Reservoir in Alameda County. An additional Class II and Class III[1] bikeway extends along Midway Road, crosses the DMC and California Aqueduct, intersects I-580, and then joins a bikeway along Patterson Pass Road.

#### *Rail*

A Union Pacific rail line crosses the project study area northwest of the proposed TANC (Alternative 3) site (Figure 3.5-1).

### 3.5.3 Environmental Consequences

#### *Assessment Methods*

For the purposes of analysis, the types of potential transportation changes were divided into two categories: changes to roadways, safety, and roadway surface conditions as a result of truck and commute trips during construction and changes in transportation patterns caused by the creation of new roadways; and operation of the alternatives.

### 3.5.4 Environmental Effects

#### *Alternative 1 (No Action)*

Under the No Action alternative, there would be no new facilities constructed or operated and there would be no construction or operation effects on transportation or circulation.

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[1] Class I—a completely separated right-of-way for the exclusive use of bicycles or pedestrians with cross-flow minimized. Class II—a striped lane for one-way bike travel in each direction within the paved area (typically on the shoulder) on a street or highway. Class III—shared use of lanes with pedestrian or motor vehicle traffic (typically at the right edge of the traveled way without a bike lane stripe).

### *Alternative 2 (Proposed Action)*

*Construction Effects*

#### Impact TN-1: Changes in Roadway Capacity as a Result of Truck and Commute Trips

Several truck trips for delivering construction materials and commute trips for construction workers would be required during construction of the Intertie and appurtenant structures. These trips would occur on both local roads (likely Grant Line Road, Altamont Pass Road and/or Mountain House Parkway/S. Patterson Pass Road, Kelso Road) and highways (I-205 and I-580). It is expected that there would be a maximum of 48 round-trip commute trips and two round-trip truck trips per day of construction. Because the regional highways are designed to accommodate high traffic volumes and the local roads are rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. However, as part of the environmental commitments described in Chapter 2, a Traffic Control Plan would be implemented to minimize the potential for road hazards, maintain access for emergency services, and maintain access for landowners adjacent to affected areas. Incorporation of this environmental commitment would ensure that there would be no adverse effects on roadway capacity.

#### Impact TN-2: Damage to Roadways during Construction

The operation of heavy construction vehicles and equipment on rural roads could result in damage to roadways during construction. During construction of project components (e.g., pumping plant and intake structure, California Aqueduct turnout, pipeline and pipeline structures) various materials would be transported to the construction area in load-bearing trucks. Haul routes would be limited to major roads where feasible. In general, roadways used for hauling construction materials to the Alternative 2 site are assumed to include I-205, I-580, Grant Line Road, Altamont Pass Road, Kelso Road, Mountain House Parkway/S. Patterson Pass Road, and the DMC access road. Major highways such as I-205 and I-580 are designed to handle wear from large vehicles. However, local roadways may not be, and damage may occur during construction of the Intertie. As described in Chapter 2, if damage to the local roadways occurs as a result of the truck trips, Reclamation will compensate for that damage. Therefore, no adverse effects are expected to occur.

#### Impact TN-3: Disruption to Bikeways during Construction

Construction equipment may need to traverse designated bikeways. This could result in minor temporary disruptions to the bikeways. This disruption would affect primarily the California Aqueduct Bikeway. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Additionally, construction would occur over a period of

12 to 15 months, 6 days a week, and overall bike path usage is minimal during weekdays. No adverse effects on bike paths would occur.

*Operation Effects*

**Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility**

New roadways and existing roadway improvements would be constructed to accommodate the construction equipment necessary for Intertie construction. This would result in an improvement to the overall transportation system in the local area. However, because this area is rural, it is not expected that these changes would result in substantial changes in roadway patterns or circulation.

Operation of the Intertie may require vehicular trips to the Intertie during its initial start-up phases. Approximately one trip would occur every week. Once the Intertie is able to function remotely, only routine maintenance trips would be necessary. These rare trips would not result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

### *Alternative 3 (TANC Intertie Site)*

*Construction Effects*

**Impact TN-1: Changes in Roadway Capacity as a result of Truck and Commute Trips**

Under Alternative 3, the changes in roadway capacity during construction activities would be similar to impacts identified for Alternative 2. Similar to Alternative 2, several truck trips would be required to deliver construction materials, and commute trips for construction workers would be required during construction of the TANC Intertie and appurtenant structures. These trips would occur on both local roads and highways. Local roads used to access the TANC Intertie site could include Mountain House Parkway/S. Patterson Pass Road, Hansen Road, and W. Schulte Road. It is expected that there would be no more than 48 commute trips daily and no more than 2 daily truck trips. Because the regional highways are designed to accommodate high traffic volumes and the local roads are rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. Implementation of a Traffic Control Plan (described in Chapter 2) would ensure that there would be no adverse effects on roadway capacity.

**Impact TN-2: Damage to Roadways during Construction**

Under Alternative 3, damage to roadway surfaces from construction activities would be similar to impacts identified for Alternative 2. However, with the exception of I-205, I-280, and Mountain House Parkway/S. Patterson Pass Road, the roadways used for hauling construction materials would be different. Local roadway haul routes would likely include Hansen Road and W. Schulte Road. Should damage to local roadways occur as a result of truck trips, Reclamation will compensate for that damage (refer to Traffic Control Plan, Chapter 2). Therefore, no adverse effects are expected to occur.

**Impact TN-3: Disruption to Bikeways during Construction**

Under Alternative 3, minor temporary disruptions to bikeways could result from construction-related trucks using roadways. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Construction would occur over a period of 12 to 15 months, and overall bike path usage in the area is minimal during weekdays. No adverse effects on bike paths would occur.

**Impact TN-5: Disruption of Railroad Line or Service during Construction**

Alternative 3 is located just south of an existing Union Pacific rail line, and the associated transmission line would cross the railroad to connect to the Tracy substation. As described in Chapter 2, Reclamation would consult with Union Pacific to ensure that adequate vertical clearance from the transmission line is established and that no ground-disturbing activities occur within the railroad right-of-way or in areas determined to be unsafe. It is not expected that rail service would be disrupted as construction of the transmission line would be timed to avoid such effects. With the incorporation of measures outlined in the permit and through consultation with Union Pacific, it is not expected that there would be any adverse effects on the railroad line or service.

**Impact TN-6: Disruption to I-205 during Construction**

Installation of the segment of transmission line crossing I-205 could result in temporary disruptions to traffic on I-205. As described in Chapter 2, as part of the Traffic Control Plan, Reclamation would coordinate with Caltrans and the California Highway Patrol prior to and during installation of this segment of the transmission line to avoid or minimize adverse effects to I-205 traffic circulation, especially during peak travel times. Additionally, Implementation of Mitigation Measure TN-MM- would reduce any adverse effects to traffic circulation on I-205.

*Mitigation Measure TN-MM-1: Non-Peak Hour Installation of I-205 Transmission Line Segment*

Using non-peak hour scheduling for delivery of equipment and materials, as well as for construction activities associated with the installation of the transmission line segment crossing I-205, would reduce the potential for project-related traffic congestion on I-205.

*Operation Effects*

**Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility**

Under Alternative 3, changes in transportation patterns from facility operations would be similar to the impacts identified for Alternative 2, except the roadways created under Alternative 3 would be different and different roadways would be used to access the facility for routine maintenance. Similar to Alternative 2, operation of the TANC Intertie may require vehicle trips to the facility during its initial start-up phases. Approximately one trip would occur every week. Once the TANC Intertie is able to function remotely, only routine maintenance trips would be necessary. These occasional trips would not result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

***Alternative 4 (Virtual Intertie)***

*Construction Effects*

**Impact TN-1: Changes in Roadway Capacity as a Result of Truck and Commute Trips**

When the temporary pipeline is installed under this alternative, some truck trips and commute trips for construction workers would be required. These trips would occur on both local roads and highways (I-205 and I-580). The intersection of the Mountain House Parkway/S. Patterson Pass Road and the DMC (Figure 3.5-1) provides the only entrance to the site.

It is not expected that the installation of the temporary pipeline will require a substantial number of trips. Because the regional highways are designed to accommodate high traffic volumes and Mountain House Parkway/S. Patterson Road south of I-205 is rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. However, as part of the environmental commitments, described in Chapter 2, a Traffic Control Plan would be implemented to ensure that safety on these roadways is maintained; incorporation of this environmental commitment would ensure that there would be no adverse effect on roadway capacity.

**Impact TN-2: Damage to Roadways during Construction**

The operation of heavy construction vehicles and equipment on rural roads could result in damage to roadways during construction. However, activities associated with the installation of the temporary intertie likely would occur over a period of 5 to 7 days and would occur infrequently. Additionally, should damage to local roadways occur as a result of truck trips, Reclamation will compensate for that damage (refer to Traffic Control Plan, Chapter 2). Therefore, there would be no adverse effect.

**Impact TN-3: Disruption to Bikeways during Construction**

Minor temporary disruptions to bikeways could result from construction-related trucks using roadways. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Construction would occur over a period of 12 to 15 months, and overall bike path usage in the area is minimal during weekdays. No adverse effects on bike paths would occur.

*Operation Effects*

**Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility**

Once installed, operation of the temporary Intertie would require a daily vehicle trip in order to refuel the fuel storage tanks of the pumps. It is possible that occasional vehicle trips may be required for inspection and maintenance of the temporary intertie; however, neither these rare trips nor the daily refueling trips would result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

# 3.6 Air Quality

## 3.6.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on air quality.

## 3.6.2 Affected Environment

The Intertie would be located within the boundary of Alameda County, which is in the San Francisco Bay Area Air Basin (SFBAAB). The primary factors that determine air quality are the locations of air pollutant sources, the amount of pollutants emitted, and meteorological and topographical conditions affecting their dispersion. Atmospheric conditions, including wind speed, wind direction, and air temperature gradients, interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. The following paragraphs briefly describe the existing environment as it relates to climate, meteorological conditions, and ambient air quality conditions.

### *Sources of Information*

The following key sources of information were used in the preparation of this section:

- ARB Databases: Aerometric Data Analysis and Management System (ADAM) (California Air Resources Board 2008b),
- AirData (U.S. Environmental Protection Agency 2008), and
- 40 CFR 51.853.

### *Climate and Topography*

The Delta is transitional between the coastal and inland climatic extremes. The topography of the Delta is characterized as two distinct geographic components: the lowlands and the uplands. The lowlands consist of generally flat lands ranging in elevation from below sea level to about 10 feet above mean sea level, and the uplands, a gently sloping alluvial plain rising from about 10 to 100 feet above mean sea level. Some lands in the central and western Delta are more than 15 feet below sea level. The effects of the local topography and the continuous interaction of maritime and continental air masses provide a varied climate.

The prevailing winds in the Bay Area during summer are from the west and northwest, reinforced by an inland movement of air caused by the solar heating of the air masses in the Central Valley. This heating effect is greatest during the day and causes a marked diurnal, as well as a seasonal, pattern in wind speed. These prevailing winds are strongest at Carquinez Strait. In the Delta, such winds often blow continuously day and night and are generally from the west-southwest. Winds reach peak speeds of 10–15 miles per hour in the early evening. The summer air flow at Stockton is also strongest in the afternoon and throughout the day and generally blows from the west-northwest.

The topography and climate have great effects on the area's air quality. Relatively light winds, surrounding higher terrain, and frequent warm temperatures are conducive to the creation of ozone. In winter months, high atmospheric stability, calm winds, and cold temperatures combine to create ideal conditions for the buildup of pollutants such as carbon monoxide (CO) and particulate matter (particulate matter smaller than 10 microns or less in diameter [PM10] and particulate matter 2.5 microns or less in diameter [PM2.5]).

### *Criteria Pollutants*

The federal and state governments have established ambient air quality standards for the following six criteria pollutants: ozone, CO, nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), particulate matter (PM10 and PM2.5), and lead. Ozone, $NO_2$, and particulate matter generally are considered to be regional pollutants, as these pollutants or their precursors affect air quality on a regional scale. Pollutants such as CO, $SO_2$, lead, and particulate matter are considered to be local pollutants that tend to accumulate in the air locally. In the Proposed Action area, CO, PM10 and ozone are considered pollutants of concern. Toxic air contaminants are also discussed below, although no state or federal ambient air quality standards exist for these pollutants. Brief descriptions of these pollutants are provided below, and a complete summary of California ambient air quality standards (CAAQS) and national ambient air quality standards (NAAQS) is provided in Table 3.6-1.

**Table 3.6-1.** Ambient Air Quality Standards Applicable in California

| Pollutant | Symbol | Average Time | Standard (ppm) California | Standard (ppm) National | Standard (μg/m³) California | Standard (μg/m³) National | Violation Criteria California | Violation Criteria National |
|---|---|---|---|---|---|---|---|---|
| Ozone* | $O_3$ | 1 hour | 0.09 | NA | 180 | NA | If exceeded | NA |
| | | 8 hours | 0.070 | 0.075 | 137 | 147 | If exceeded | If fourth highest 8-hour concentration in a year, averaged over 3 years, is exceeded at each monitor within an area |
| Carbon monoxide | CO | 8 hours | 9.0 | 9 | 10,000 | 10,000 | If exceeded | If exceeded on more than 1 day per year |
| | | 1 hour | 20 | 35 | 23,000 | 40,000 | If exceeded | If exceeded on more than 1 day per year |
| (Lake Tahoe only) | | 8 hours | 6 | NA | 7,000 | NA | If equaled or exceeded | NA |
| Nitrogen dioxide | $NO_2$ | Annual arithmetic mean | 0.030 | 0.053 | 57 | 100 | If exceeded | If exceeded on more than 1 day per year |
| | | 1 hour | 0.18 | NA | 339 | NA | If exceeded | NA |
| Sulfur dioxide | $SO_2$ | Annual arithmetic mean | NA | 0.030 | NA | 80 | NA | If exceeded |
| | | 24 hours | 0.04 | 0.14 | 105 | 365 | If exceeded | If exceeded on more than 1 day per year |
| | | 1 hour | 0.25 | NA | 655 | NA | If exceeded | NA |
| Hydrogen sulfide | $H_2S$ | 1 hour | 0.03 | NA | 42 | NA | If equaled or exceeded | NA |
| Vinyl chloride | $C_2H_3Cl$ | 24 hours | 0.01 | NA | 26 | NA | If equaled or exceeded | NA |
| Inhalable particulate matter | PM10 | Annual arithmetic mean | NA | NA | 20 | NA | NA | NA |
| | | 24 hours | NA | NA | 50 | 150 | If exceeded | If exceeded on more than 1 day per year |
| | PM2.5 | Annual arithmetic mean | NA | NA | 12 | 15 | NA | If 3-year average from single or multiple community-oriented monitors is exceeded |
| | | 24 hours | NA | NA | NA | 35 | NA | If 3-year average of 98th percentile at each population-oriented monitor within an area is exceeded |
| Sulfate particles | $SO_4$ | 24 hours | NA | NA | 25 | NA | If equaled or exceeded | NA |
| Lead particles | Pb | Calendar quarter | NA | NA | NA | 1.5 | NA | If exceeded no more than 1 day per year |
| | | 30-day average | NA | NA | 1.5 | NA | If equaled or exceeded | NA |
| | | Rolling 3-Month average | NA | NA | NA | 0.15 | If equaled or exceeded | Averaged over a rolling 3-month period |

Notes: All standards are based on measurements at 25ºC and 1 atmosphere pressure. National standards shown are the primary (health effects) standards.
NA = not applicable.

* The EPA recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 part per million. The EPA issued a final rule that revoked the 1-hour standard on June 15, 2005. However, the California 1-hour ozone standard will remain in effect.

Source: California Air Resources Board 2008a.

### *Ozone*

Ozone is a respiratory irritant that increases susceptibility to respiratory infections. It is also an oxidant that can cause substantial damage to vegetation and other materials. Ozone is a severe eye, nose, and throat irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. Ozone cause causes extensive damage to plants by leaf discoloration and cell damage.

Ozone is not emitted directly into the air but is formed by a photochemical reaction in the atmosphere. Ozone precursors—reactive organic gases (ROG) and oxides of nitrogen ($NO_X$)—react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. The ozone precursors, ROG and $NO_X$, are emitted mainly by mobile sources and by stationary combustion equipment.

### *Carbon Monoxide*

CO is essentially inert to plants and materials but can have significant effects on human health. CO is a public health concern because it combines readily with hemoglobin and reduces the amount of oxygen transported in the bloodstream. CO can cause health problems such as fatigue, headache, confusion, dizziness, and even death.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

### *Inhalable Particulates*

Particulates can damage human health and retard plant growth. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates also reduce visibility and corrode materials. Particulate emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic and construction equipment, and secondary aerosols formed by reactions in the atmosphere.

#### *Toxic Air Contaminants*

Toxic air contaminants (TACs) are pollutants that may be expected to result in an increase in mortality or serious illness or that may pose a present or potential hazard to human health. Health effects of TACs include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that lead to death. In October 2000, California Air Resources Board (ARB) identified diesel exhaust particulate matter as a TAC.

### *Existing Air Quality Conditions*

#### *Monitoring Data*

Existing air quality conditions in the project area can be characterized in terms of the ambient air quality standards that the federal and state governments have established for various pollutants (Table 3.6-2) and by monitoring data collected in the region. Monitoring data concentrations typically are expressed in terms of ppm or $\mu g/m^3$. The nearest air quality monitoring stations in the vicinity of the project area that have2005–2007 data are the Tracy-Airport monitoring station and the Stockton–Hazelton Street monitoring station. The Tracy-Airport station monitors ozone, and the Stockton-Hazelton station monitors ozone, CO, PM10 and PM2.5. Air quality monitoring data from these stations are summarized in Table 3.6-2. These data represent air quality monitoring for the last 3 years (2005–2007) in which complete data are available.

As shown in Table 3.6-2, the Tracy-Airport monitoring station has experienced 26 violations of the state 1-hour ozone standard, and 44 violations of the national 8-hour ozone standard. The Stockton-Hazelton Street station has experienced no violations of the federal PM10 standard, 132.9 violations of the state PM10 standard, and 69.7 violations of the national PM2.5 standard. While these monitoring stations are located in San Joaquin County, they were used because they represent the nearest monitoring stations that have the same physical characteristics as the action area. The nearest monitoring station in Alameda County is located in Livermore. However, the Altamont Hills separate Livermore from the project area, so air quality conditions at the Livermore station would not be representative of conditions in the action area.

**Table 3.6-2.** Ambient Air Quality Monitoring Data Measured at the Tracy-Airport Monitoring Station and the Stockton–Hazelton Street Monitoring Station

| Pollutant Standards | 2005 | 2006 | 2007 |
|---|---|---|---|
| **Ozone (Tracy-Airport Station)** | | | |
| Maximum 1-hour concentration (ppm) | 0.121 | 0.097 | 0.123 |
| Maximum 8-hour concentration (ppm) | 0.103 | 0.083 | 1.103 |
| Number of days standard exceeded[a] | | | |
| NAAQS 1-hour (>0.12 ppm) | 0 | 0 | 0 |
| CAAQS 1-hour (>0.09 ppm) | 14 | 1 | 11 |
| NAAQS 8-hour (>0.08 ppm) | 22 | 6 | 16 |
| **Carbon Monoxide (CO) (Stockton-Hazelton St. Station)** | | | |
| Maximum 8-hour concentration (ppm) | 2.86 | 2.25 | 2.31 |
| Maximum 1-hour concentration (ppm) | 4.3 | 4.4 | 3.6 |
| Number of days standard exceeded[a] | | | |
| NAAQS 8-hour (≥9.0 ppm) | 0 | 0 | 0 |
| CAAQS 8-hour (≥9.0 ppm) | 0 | 0 | 0 |
| NAAQS 1-hour (≥35 ppm) | 0 | 0 | 0 |
| CAAQS 1-hour (≥20 ppm) | 0 | 0 | 0 |
| **Particulate Matter (PM10)[b] (Stockton-Hazelton St. Station)** | | | |
| National[c] maximum 24-hour concentration ($\mu g/m^3$) | 79.0 | 82.0 | 71.0 |
| National[c] second-highest 24-hour concentration ($\mu g/m^3$) | 76.0 | 80.0 | 68.0 |
| State[d] maximum 24-hour concentration ($\mu g/m^3$) | 84.0 | 85.0 | 75.0 |
| State[d] second-highest 24-hour concentration ($\mu g/m^3$) | 79.0 | 85.0 | 73.0 |
| National annual average concentration ($\mu g/m^3$) | 28.9 | 32.6 | 26.6 |
| State annual average concentration ($\mu g/m^3$)[e] | 29.8 | 33.4 | 27.7 |
| Number of days standard exceeded[a] | | | |
| NAAQS 24-hour (>150 $\mu g/m^3$)[f] | 0 | 0 | 0 |
| CAAQS 24-hour (>50 $\mu g/m^3$)[f] | 46.5 | 62.9 | 23.5 |
| **Particulate Matter (PM2.5) (Stockton-Hazelton St. Station)** | | | |
| National[c] maximum 24-hour concentration ($\mu g/m^3$) | 63.0 | 47.0 | 52.0 |
| National[c] second-highest 24-hour concentration ($\mu g/m^3$) | 46.0 | 47.0 | 50.0 |
| State[d] maximum 24-hour concentration ($\mu g/m^3$) | 70.0 | 53.3 | 66.8 |
| State[d] second-highest 24-hour concentration ($\mu g/m^3$) | 68.0 | 51.7 | 59.4 |
| National annual average concentration ($\mu g/m^3$) | 12.5 | 13.1 | 12.9 |
| State annual average concentration ($\mu g/m^3$) [e] | 12.5 | 13.5 | 13.5 |
| Number of days standard exceeded[a] | | | |
| NAAQS 24-hour (>65 $\mu g/m^3$) | 14.8 | 20.8 | 34.1 |

Sources: California Air Resources Board 2008b; U.S. Environmental Protection Agency 2008.

CAAQS = California ambient air quality standards. NAAQS = national ambient air quality standards.

[a] An exceedance is not necessarily a violation.

[b] Measurements usually are collected every 6 days.

[c] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[d] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California approved samplers.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard had each day been monitored.

*Air Quality Standards and Attainment Status*

The federal and state governments have established ambient air quality standards for seven criteria pollutants: ozone, CO, $NO_2$, $SO_2$, PM10, PM2.5, and lead. Ozone, PM10, and PM2.5 generally are considered regional pollutants because they or their precursors affect air quality on a regional scale. Pollutants such as CO, $NO_2$, $SO_2$, PM10, PM2.5, and lead are considered local pollutants that tend to accumulate in the air locally. In the area where the proposed project site is located, suspended particulate matter is a primary concern.

The EPA has classified Alameda County as an extreme nonattainment area with regard to the federal 1-hour ozone standard under 23 USC Sec. 104 (b)(2) and a marginal nonattainment area with regard to the federal 8-hour ozone standard. The EPA revoked the 1-hour ozone standard on June 15, 2005. The EPA has classified Alameda County as a moderate ($\leq$ 12.7 ppm) maintenance area for the federal CO standard and an unclassified/attainment area with regard to the federal PM10 and PM2.5 standards.

ARB has classified Alameda County as a serious nonattainment area for the state 1-hour ozone standard and an attainment area for the state CO standard. ARB has classified Alameda County as a nonattainment area for the state PM10 and PM2.5 standards.

### *Sensitive Receptors*

Sensitive populations (sensitive receptors) are more susceptible to the effects of air pollution than is the population at large. Sensitive receptors that are near localized sources of toxics and CO are of particular concern. For the purposes of impact assessment, the definition of sensitive receptors typically is expanded to include residences, playgrounds, rehabilitation centers, and athletic facilities. The closest residence is at least 2,000 feet away from the site of the Proposed Action.

### *Regulatory Setting*

*Federal*

#### Federal Clean Air Act

The federal Clean Air Act (CAA), promulgated in 1970 and amended twice thereafter (including the 1990 amendment), establishes the framework for modern air pollution control. The act directs the EPA to establish ambient air standards for six pollutants: ozone, CO, lead, $NO_2$, particulate matter, and $SO_2$. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety and the latter to protect environmental values, such as plant and animal life.

The primary legislation that governs federal air quality regulations is the Clean Air Act Amendments of 1990 (CAAA). The CAAA delegates primary responsibility for clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

**Federal Conformity Requirements**

The CAAA require that all federally funded projects come from a plan or program that conforms to the appropriate State Implementation Plan (SIP). Federal actions are subject to either the transportation conformity rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the general conformity rule.

The purpose of the general conformity rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the NAAQS. The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed action's total direct and indirect emissions fail to meet the following two conditions:

- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables 3.6-3 and 3.6-4, and
- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant). Emissions inventory data were obtained from the ARB's Emissions Inventory database (California Air Resources Board 2009).

If the two conditions above are not met, a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

However, if the above two conditions are met, the requirements for general conformity do not apply, as the proposed action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required.

**Table 3.6-3.** Federal *de Minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

| Pollutant | Emission Rate (Tons per Year) |
|---|---|
| **Ozone (VOC or $NO_X$)** | |
| Serious nonattainment areas | 50 |
| Severe nonattainment areas | 25 |
| Extreme nonattainment areas | 10 |
| **Other ozone nonattainment areas outside an ozone transport region** | **100** |
| Marginal and moderate nonattainment areas inside an ozone transport region | |
| VOC | 50 |
| $NO_X$ | 100 |
| CO: All nonattainment areas | 100 |
| $SO_2$ or $NO_2$: All nonattainment areas | 100 |
| PM10 | |
| Moderate nonattainment areas | 100 |
| Serious nonattainment areas | 70 |
| Pb: All nonattainment areas | 25 |

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is in nonattainment, and a conformity determination must be made.

**Table 3.6-4.** Federal *de Minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

| Pollutant | Emission Rate (Tons per Year) |
|---|---|
| Ozone ($NO_X$), $SO_2$ or $NO_2$ | |
| All maintenance areas | 100 |
| Ozone (VOCs) | |
| Maintenance areas inside an ozone transport region | 50 |
| Maintenance areas outside an ozone transport region | 100 |
| **CO: All maintenance areas** | **100** |
| PM10: All maintenance areas | 100 |
| Pb: All maintenance areas | 25 |

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is a maintenance area, and a conformity determination must be made.

**Ozone Attainment Plan**

The Ozone Attainment Plan (OAP) is the Bay Area's portion of California's SIP to achieve the national ozone standard.

In 1999 the Bay Area Air Quality Management District (BAAQMD), ABAG, and the Metropolitan Transportation Commission (MTC) adopted the 1999 OAP, which was submitted to the ARB in June 1999. The 1999 OAP was approved by the ARB in July 1999 and was then submitted to the EPA for approval. The EPA proposed to partially approve and partially disapprove (the reasonably available control measures [RACM] demonstration, the attainment demonstration, and the motor vehicle emissions budgets [MVEBs]) portions of the 1999 OAP on March 30, 2001. This disapproval action by the EPA started a sanctions clock, and the Bay Area became subject to the imposition of a 2 to 1 offset sanction.

In response, the BAAQMD, ABAG, and MTC began preparation of the 2001 OAP to correct the deficiencies in the 1999 OAP. On October 24, 2001, the BAAQMD, ABAG, and MTC adopted the 2001 OAP. The 2001 OAP was approved by the ARB on November 1, 2001, and submitted to the EPA for approval as a revision to the California SIP on November 30, 2001. The 2001 OAP included two commitments for further planning—a commitment to conduct a mid-course review of progress toward attaining the national 1-hour ozone standard by December 2003, and a commitment to provide a revised ozone attainment strategy to the EPA by April 2004. On April 22, 2004, the EPA approved the following elements of the 2001 OAP: emissions inventory; RACM; commitments to adopt and implement specific control measures; MVEBs; and commitments for further study measures. The EPA's approval of RACM and the MVEBs in the 2001 OAP terminates the sanctions clock for those plan elements.

The EPA made a final finding in April 2004 that the BAAQMD had attained the national 1-hour ozone standard. As a result, certain planning commitments outlined in the 2001 OAP no longer were required. While the EPA has prepared a finding of attainment for the region, the Bay Area has not been formally reclassified as an attainment area for the 1-hour standard. In order to be reclassified as an attainment area, the region must submit a redesignation request to the EPA.

*State*

Responsibility for achieving California's standards, which are more stringent than federal standards, is placed on the ARB and local air districts and is to be achieved through district-level air quality management plans that will be incorporated into the SIP. In California, the EPA has delegated authority to prepare SIPs to the ARB, which, in turn, has delegated that authority to individual air districts.

The ARB traditionally has established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving SIPs.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by CEQA.

**California Clean Air Act**

The California Clean Air Act (CCAA) of 1988 substantially added to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The CCAA focuses on attainment of the CAAQS, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The CCAA requires designation of attainment and nonattainment areas with respect to CAAQS. The CCAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for CO, $SO_2$, $NO_2$, or ozone. These clean air plans are designed specifically to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. No locally prepared attainment plans are required for areas that violate the state PM10 standards.

The CCAA requires that the CAAQS be met as expeditiously as practical but, unlike the federal CAA, does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

*Local*

**Bay Area Clean Air Plan**

The Bay Area Clean Air Plan (CAP) is a plan to reduce ground-level ozone levels in the San Francisco Bay Area and attain the state 1-hour ozone standard. It was developed by the BAAQMD, in cooperation with ABAG and MTC, in response to the CCAA of 1988, as amended. The CCAA requires all air districts exceeding the state ozone standard to reduce pollutant emissions by 5% per year, calculated from 1987, or achieve emission reductions through all feasible measures. The CCAA further requires that the CAP be updated every 3 years. As the Bay Area attained the state CO standard in 1993, the CCAA planning requirements for CO nonattainment areas no longer apply to the Bay Area. The first CAP, prepared in 1991, includes a comprehensive strategy to reduce air pollutant emissions by focusing on control measures to be implemented during the periods from 1991 to 1994 and 1995 through 2000 and beyond.

The update to the 1991 CAP, the 1994 CAP, continues the comprehensive strategy established by the 1991 CAP and continues its goals of reducing health impacts from ozone levels above the state ambient standard to compliance with the CCAA. The 1994 CAP has eight new proposed control measures for stationary and mobile source in addition to changes in the organization and scheduling some of the control measures from the 1991 CAP. The control measures proposed in the 1994 CAP constitute all feasible ozone-reducing measures in the Bay Area. In addition, the 1994 CAP projects pollutant trends and possible control activities beyond 1997.

The BAAQMD adopted the most recent update of the CAP on December 20, 2000. It is the third triennial update of the district's original 1991 CAP. The 2000 CAP reviews control strategies to ensure that "all feasible measures" to reduce ozone are incorporated into the CAP. In addition, the 2000 CAP updates the district's emission inventory, estimates emission reductions resulting from the CAP, and assesses air quality trends in the region.

### New Source Review

The BAAQMD adopted the New Source Review (Regulation 2 Rule 2) on June 15, 2005. The purpose of this rule is to provide for the review of new and modified sources and provide mechanisms, including the use of Best Available Control Technology (BACT), Best Available Control Technology for Toxics (TBACT), and emission offsets, by which authority to construct such sources may be granted. Projects in excess of 35 tons per year of ROG or $NO_X$ emissions must offset these emissions on at a 1.15 to 1.0 ratio. Projects in excess of 15 tons per year of PM10 emissions must offset emissions increases in excess of 1.0 tons per year at a 1.0 to 1.0 ratio.

### New Source Review of Toxic Air Contaminants

The BAAQMD adopted the New Source Review of Toxic Air Contaminants (Regulation 2 Rule 5) on June 15, 2005. The purpose of this rule is to evaluate potential public exposure and health risk, to mitigate potentially significant health risks resulting from these exposures, and to provide net health risk benefits by improving the level of control when existing sources are modified or replaced. The rule applies preconstruction permit review to new and modified sources of TACs and contains health risk limits and requirements for TBACT.

According to this rule, a project applicant must apply TBACT to any new or modified source of TACs where the source risk is a cancer risk greater than 1.0 in 1 million, and/or a chronic hazard index greater than 0.20. In addition, an

Authority to Construct or Permit to Operate will be denied for any new modified source of TACs if the project risk exceeds any of the following project risk limits:

- A cancer risk of 10.0 in one million,
- A chronic hazard index of 1.0, or
- An acute hazard index of 1.0.

### 3.6.3 Environmental Consequences

#### *Assessment Methods*

Construction of the Intertie would generate pollutant emissions from a variety of emission sources and activities. All phases of project construction—project mobilization, site preparation, site clearing and grubbing, and construction of the pipelines—would generate air emissions.

The primary pollutant-generating activities associated with these phases include:

- exhaust emissions from off-road construction vehicles and equipment;
- exhaust emissions from vehicles used to deliver supplies to the project site or to haul materials from the site;
- exhaust emissions from worker commute trips;
- fugitive dust from excavation of the pipe alignment; and
- fugitive dust from equipment operating on exposed earth and from the handling of sand, gravel, aggregate, and associated construction materials.

Construction of the Intertie may generate considerable air emissions. Terrestrial construction-related emissions are generally short-term but still may cause adverse air quality impacts. PM10 is the pollutant of greatest concern with respect to terrestrial construction activities. PM10 emissions can result from a variety of construction activities, including excavation, grading, demolition, vehicle travel on paved and unpaved roads, and emission of vehicle and equipment exhaust. Terrestrial construction-related emissions of PM10 can vary greatly depending on the level of activity, the specific operations taking place, the equipment being operated, local soils, weather conditions, and other factors. Construction-related emissions can cause substantial increases in localized concentrations of PM10. Particulate emissions from construction activities can lead to adverse health effects, as well as nuisance concerns such as reduced visibility and soiling of exposed surfaces.

*General Conformity*

Because the proposed action is being pursued by Reclamation, preparation of a General Conformity Analysis is required. As such, a quantitative evaluation of construction emissions was conducted.

The quantification of construction emissions was performed using the URBEMIS 2007 (Version 9.24) model. URBEMIS 2007 relies on ARB, EPA, and air district emission factors to estimate typical emissions (construction, area source, and vehicular) associated with land use development projects. This ARB-approved model is widely recommended and used by many California air districts for calculating emissions from a variety of projects.

## 3.6.4 Environmental Effects

### *Alternative 1 (No Action)*

Under the No Action Alternative, the Intertie would not be constructed or operated. There would be no effects on air quality.

### *Alternative 2 (Proposed Action)*

*Construction Effects*

**Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities**

Project construction would result in short-term emissions of diesel exhaust from on-site heavy-duty equipment. Construction of the project would result in the generation of diesel PM emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities.

Various construction activities are anticipated to involve the operation of diesel-powered equipment. In October 2000, the ARB identified diesel exhaust as a TAC. Cancer health risks associated with exposures to diesel exhaust typically are associated with chronic exposure, in which a 70-year exposure period often is assumed. Although elevated cancer rates can result from exposure periods of less than 70 years, acute exposure (i.e., exposure periods of 2 to 3 years) to diesel exhaust typically are not anticipated to result in an increased health risk because acute exposure typically does not result in the exposure to concentrations that result in a health risk. No adverse change in health associated with exposure to diesel exhaust from project construction is anticipated because construction activities would occur over approximately 9 months and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. In addition, the nearest sensitive receptor would be located in excess of 2,000 feet from construction activities, and this would help to limit and minimize any exposure to diesel exhaust from construction activities. There would be no adverse effect.

### Impact AQ-2: Comply with General Conformity

As shown in Table 3.6-5 below, Alternative 2 would result in a net increase in ROG, $NO_X$, CO, PM10, and $CO_2$ emissions. However, these increases in emissions are below the federal *de minimis* threshold levels, as well as the regionally significant threshold. Consequently, implementation of Alternative 2 is found to be a conforming project, and there would be no adverse effect.

**Table 3.6-5.** Alternative 2 Emissions for 2009 (Tons per Year)

| Component | ROG | $NO_X$ | CO | PM10 | $CO_2$ (metric tons) |
|---|---|---|---|---|---|
| Grading for Pumping Plant and Intake Structure | 0.13 | 1.14 | 0.46 | 0.24 | 110.43 |
| Construction of Pumping Plant and Intake Structure | 0.90 | 8.26 | 3.02 | 0.35 | 768.80 |
| Grading for California Aqueduct Turnout Structure | 0.07 | 0.53 | 0.25 | 0.06 | 51.40 |
| Construction of California Aqueduct Turnout Structure | 0.35 | 3.24 | 1.19 | 0.14 | 301.83 |
| Grading for Pipeline | 0.03 | 0.25 | 0.10 | 0.06 | 26.01 |
| Grading for Transmission Line | 0.05 | 0.47 | 0.15 | 0.82 | 42.88 |
| Installation of Pipeline | 0.10 | 0.80 | 0.37 | 0.04 | 81.18 |
| Installation of Transmission Line | 0.35 | 3.18 | 1.16 | 0.13 | 296.13 |
| Coating of California Aqueduct Turnout Structure | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coating of Pumping Plant and Intake Structure | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Final Site Grading | 0.01 | 0.09 | 0.05 | 0.30 | 7.11 |
| Construct Roads and Parking Lot | 0.05 | 0.41 | 0.19 | 0.02 | 40.34 |
| Total Emissions | 2.04 | 18.38 | 6.94 | 2.16 | 1,726.13 |
| Federal *de minimis* Threshold Levels | 100 | 100 | 100 | NA | NA |
| Regionally Significant Threshold (10% threshold) | 13,475.8 | 17,958.0 | 70,404.9 | 7,767.2 | NA |

#### *Operation Effects*

Alternative 2 would require the use of four electrically powered pumps for water conveyance. However, these pumps will be powered by the transmission line that hooks into Tracy Substation, which delivers power from Reclamation's hydroelectric plants on upstream reservoirs. There would be no operational effects on air quality as a result of this alternative.

### *Alternative 3 (TANC Intertie Site)*

*Construction Effects*

#### Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities

Construction of the Alternative 3 Intertie would be similar to what was described for Alternative 2. The only difference is that there are scattered rural residences located within ¼ mile of this location, and this alternative may take slightly longer to construct as the pipeline is longer in this location. As stated above, health impacts associated with exposure to diesel exhaust from project construction are not anticipated to be substantial because construction activities would occur over a short period of time and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. There would be no adverse effect.

#### Impact AQ-2: Comply with General Conformity

Construction of the Alternative 3 Intertie would be the similar to what was described for Alternative 2. However, the pipeline component of Alternative 3 is longer than the pipeline that would be installed under Alternative 2, and therefore would have a slightly longer construction schedule for that phase. As shown in Table 3.6-6 below, Alternative 3 would result in a net increase in ROG, $NO_X$, CO, PM10, and $CO_2$ emissions. However, these increases in emissions are below the federal *de minimis* threshold levels and the regionally significant threshold. Consequently, implementation of Alternative 3 is found to be a conforming project, and there would be no adverse effect.

**Table 3.6-6.** Alternative 3 Emissions for 2009 (Tons per Year)

| Component | ROG | $NO_X$ | CO | PM10 | $CO_2$ (metric tons) |
|---|---|---|---|---|---|
| Grading for Pumping Plant and Intake Structure | 0.13 | 1.14 | 0.46 | 0.24 | 110.43 |
| Construction of Pumping Plant and Intake Structure | 0.90 | 8.26 | 3.02 | 0.35 | 768.80 |
| Grading for California Aqueduct Turnout Structure | 0.07 | 0.53 | 0.25 | 0.06 | 51.41 |
| Construction of California Aqueduct Turnout Structure | 0.35 | 3.24 | 1.19 | 0.14 | 301.83 |
| Grading for Pipeline | 0.11 | 0.99 | 0.42 | 0.64 | 104.04 |
| Grading for Transmission Line | 0.1 | 0.94 | 0.3 | 1.64 | 85.76 |
| Installation of Pipeline | 0.24 | 1.97 | 0.90 | 0.09 | 199.04 |
| Installation of Transmission Line | 0.7 | 6.36 | 2.32 | 0.26 | 592.26 |
| Coating of California Aqueduct Turnout Structure | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coating of Pumping Plant and Intake Structure | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Final Site Grading | 0.01 | 0.09 | 0.05 | 0.30 | 7.11 |
| Construct Roads and Parking Lot | 0.05 | 0.41 | 0.19 | 0.02 | 40.34 |
| Total Emissions | 2.66 | 23.93 | 9.1 | 3.74 | 2,261.02 |
| Federal *de minimis* Threshold Levels | 100 | 100 | 100 | NA | NA |
| Regionally Significant Threshold (10% threshold) | 13,475.8 | 17,958.0 | 70,404.9 | 7,767.2 | NA |

#### *Operation Effects*

Similar to Alternative 2, Alternative 3 would require the use of four electrically powered pumps for water conveyance. However, these pumps will be powered by the transmission line that hooks into Tracy Substation, which delivers power from Reclamation's hydroelectric plants on upstream reservoirs. There would be no operational effects on air quality as a result of this alternative.

### *Alternative 4 (Virtual Intertie)*

#### *Construction Effects*

**Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities**

No permanent features would be constructed under this alternative. Installation of the temporary intertie during emergencies would require some heavy equipment, such as a grader and haul trucks. As stated above, health impacts associated with exposure to diesel exhaust from project construction are not anticipated to be considerable because construction activities would occur over a very short period of time and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. In addition, there are no sensitive receptors near the site. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. There would be no adverse effect.

### Impact AQ-2: Comply with General Conformity

No permanent features would be constructed under this alternative. However, installation of the temporary, or virtual, intertie would require some heavy equipment, such as graders and haul trucks. As shown in Table 3.6-7 below, Alternative 4 would result in a net increase in ROG, $NO_X$, CO, PM10, and $CO_2$ emissions. However, these increases in emissions are below the federal *de minimis* threshold levels and the regionally significant threshold. Consequently, implementation of Alternative 4 is found to be a conforming project, and there would be no adverse effect.

**Table 3.6-7.** Alternative 4 Emissions for 2009 (Tons per Year)

| Component | ROG | $NO_X$ | CO | PM10 | $CO_2$ (metric tons) |
|---|---|---|---|---|---|
| Grading | 0.00 | 0.01 | 0.00 | 0.01 | 0.46 |
| Hauling Equipment | 0.02 | 0.28 | 0.08 | 0.03 | 34.19 |
| Generator operations | 5.99 | 75.58 | 23.28 | 2.32 | 7,385.83 |
| Total Emissions | 6.01 | 75.87 | 23.36 | 2.36 | 7,420.48 |
| Federal *de minimis* Threshold Levels | 100 | 100 | 100 | NA | NA |
| Regionally Significant Threshold (10% threshold) | 13,475.8 | 17,958.0 | 70,404.9 | 7,767.2 | NA |

#### *Operational Effects*

Alternative 4 would require the use of diesel generators that would be implemented during emergencies or maintenance activities when the temporary intertie is installed. As stated above, these generators would be subject to the BAAQMD New Source Review rule. All stationary internal combustion engines larger than 50 horsepower (hp) must obtain a BAAQMD Permit to Operate, and diesel engines also must comply with the BAAQMD-administered Statewide Air Toxics Control Measure (ATCM) for Stationary Diesel Engines.

The final ATCM regulation order states that new stationary emergency standby diesel-fueled engines (larger than 50 brake horsepower [bhp]) must emit diesel PM at a rate less than or equal to 0.15 grams per brake horsepower hour (g/bhp-hr), must meet the EPA's Tier 1 standards for ROG, $NO_X$, and CO emissions, and not operate more than 50 hours per year for maintenance and testing purposes. Engine operation for emergency use is not limited. It is currently unknown how many hours the generators would operate within a year, as operations are predicated solely on emergency usage requirements and an estimate of potential emergency situations is not available. To represent a worst-case scenario, it was assumed that the six diesel generators would operate 24-hours per day over a 365-day period. Emissions associated with operations under Alternative 4 are presented in Table 3.6-7, and the results presented indicate that operation of the generators would not result in emissions in excess of the *de minimis* standards identified above.

The use of Banks Pumping Plant to convey water in nonemergency situations would not result in changes in air quality. When CVP water is wheeled at Banks, CVP provides the power, which is hydroelectric and generated at upstream reservoirs. For this reason and because the diesel generators that would be used under Alternative 4 would be limited to the above standards, there would be no adverse effect.

# 3.7 Noise

## 3.7.1 Introduction

This section describes the existing environmental noise conditions in the project area and the consequences related to noise of constructing and operating the project alternatives.

## 3.7.2 Affected Environment

The Intertie would be located within the boundary of Alameda County. The following discussion provides background information on noise terminology and describes the existing environment in terms of sensitive receptors, existing noise levels, and regulatory requirements.

### *Noise Terminology*

Following are brief definitions of acoustic and vibration terminology used in this chapter:

- **Sound.** A vibratory disturbance created by a vibrating object that, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Maximum Sound Level ($L_{max}$).** The maximum sound level measured during the measurement period.
- **Minimum Sound Level ($L_{min}$).** The minimum sound level measured during the measurement period.
- **Equivalent Sound Level ($L_{eq}$).** The equivalent steady-state sound level that in a stated period of time would contain the same acoustical energy.
- **Percentile-Exceeded Sound Level ($L_{xx}$).** The sound level exceeded “x” percent of a specific time period. $L_{10}$ is the sound level exceeded 10% of the time.

- **Day-Night Sound Level ($L_{dn}$).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

$L_{dn}$ and CNEL values rarely differ by more than 1 dB. As a matter of practice, $L_{dn}$ and CNEL values are considered to be equivalent and are treated as such in this assessment. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

#### *Sources of Information*

The following key sources of information were used in the preparation of this section:

- Alameda County General Plan Noise Element (Alameda County Community Development Agency 1994).
- Alameda County General Ordinance Code.

### 3.7.3 Noise-Sensitive Land Uses

Noise-sensitive land uses generally are defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically are residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses.

The project area is primarily rural agricultural land with low-to-moderate-density residential development. Table 3.7-1 identifies noise-sensitive land uses in the vicinity of each build alternative and the distance between these uses and the location of proposed pumps and the nearest facility construction.

**Table 3.7-1.** Noise-Sensitive Land Uses in the Project Area for Each Alternative

| Land Use ID | Land Use | Distance to Pumps (feet) | Distance to Nearest Facility Construction (feet) | Location |
|---|---|---|---|---|
| **Alternative 2 (Proposed Action)** | | | | |
| R-1 | Rural residences | 1,900 feet | 1,900 feet | Northeast |
| R-2 | Rural residences | 2,700 feet | 2,300 feet | West |
| **Alternative 3 (TANC Intertie)** | | | | |
| R-3 | Rural residences | 850 feet | 840 feet | East |
| R-4 | Rural residences | 2,000 feet | 800 feet | Southwest |
| **Alternative 4 (Virtual Intertie)** | | | | |
| R-1* | Rural residences | 3,500 feet | 3,500 feet | North |
| R-2* | Rural residences | 4,700 feet | 4,600 feet | Northwest |

* These are the same residences identified for Alternative 2.

### *General Noise Levels in Project Study Area*

The existing noise environment in the project area is governed primarily by vehicles traveling along I-205 and I-580. Events at the Altamont Motorsports Parks, agricultural activities, and occasional aircraft overflights also are a source of noise in the area.

Population density and ambient noise levels tend to be closely correlated. Areas that are not urbanized are relatively quiet, while more urbanized areas are subjected to higher noise levels from roadway traffic, industrial activities, and other human activities. Table 3.7-2 summarizes typical ambient noise levels based on population density.

**Table 3.7-2.** Population Density and Associated Ambient Noise Levels

| | dBA, $L_{dn}$ |
|---|---|
| Rural | 40–50 |
| Small town or quiet suburban residential | 50 |
| Normal suburban residential | 55 |
| Urban residential | 60 |
| Noisy urban residential | 65 |
| Very noise urban residential | 70 |
| Downtown, major metropolis | 75–80 |
| Adjoining freeway or near a major airport | 80–90 |

Source: Hoover and Keith 1996.

Noise levels in the rural category are representative of noise levels where noise from traffic on I-205 and I-580 is not dominant. The receiver locations identified in Table 3.7-1 are located in the range of 1,200 to 3,330 from I-205 or I-580. Peak hour traffic noise levels at these distances have been estimated using traffic data developed by Caltrans and the Federal Highway Administration (FHWA) Traffic Noise Model (Version 2.5). Peak hour noise levels are in the range of 53 to 58 dBA. These values correspond to $L_{dn}$ values in the range of 55 to 60 dBA.

## 3.7.4 Environmental Consequences

### *Assessment Methods*

The noise from potential construction activities was evaluated using methodology developed by the Federal Transit Administration (FTA) (Federal Transit Administration 2006). Noise from operation of the Proposed Action and alternatives was evaluated using equipment data provided the project engineers and reference noise source data (Hoover and Keith 1996).

### *Regulatory Setting*

#### *Federal*

There are no federal regulations or laws related to noise that apply to the Proposed Action.

#### *State*

There are no state regulations or laws related to noise that apply to the Proposed Action.

#### *Local*

**Alameda County General Plan**

The Proposed Action is in Alameda County. Alameda County has established policies and regulations concerning the generation and control of noise that could adversely affect their citizens and noise-sensitive land uses.

The General Plan is a document required by state law that serves as the jurisdiction’s blueprint for land use and development. The plan is a comprehensive, long-term document that provides details for the physical development of the jurisdiction, sets policies, and identifies ways to put the policies into action. The General Plan provides an overall framework for development in the jurisdiction and protection of its natural and cultural resources. The Noise Element of the General Plan (Alameda County Community Development Agency 1994) contains planning guidelines relating to noise.

However, the noise element does not contain specific policies or land use compatibility standards that are applicable to the Proposed Action.

The Alameda County General Ordinance Code establishes noise standards for areas within the unincorporated county (Tables 3.7-3 and 3.7-4). Construction activities that occur between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday, and between 8:00 a.m. and 5:00 p.m. Saturday and Sunday are exempt from the county's noise ordinance. In addition, construction and maintenance and repair operations conducted by public agencies and/or utility companies or their contractors that are deemed necessary to serve the best interests of the public are exempt from the county's noise ordinance.

**Table 3.7-3.** Alameda County Code Exterior Noise Level Standards*

| Category | Cumulative Number of Minutes Allowable in Any 1-Hour Time Period | Daytime Limit (dBA) (7:00 a.m.–10:00 p.m.) | Nighttime Limit (dBA) (10:00 p.m.–7:00 a.m.) |
|---|---|---|---|
| 1 | 30 | 50 | 45 |
| 2 | 15 | 55 | 50 |
| 3 | 5 | 60 | 55 |
| 4 | 1 | 65 | 60 |
| 5 | 0 | 70 | 65 |

* For residential, school, hospital, church, or public library land uses.

**Table 3.7-4.** Alameda County Code Exterior Noise Level Standards for Commercial Properties

| Category | Cumulative Number of Minutes Allowable in Any 1-Hour Time Period | Daytime Limit (dBA) (7:00 a.m.–10:00 p.m.) | Nighttime Limit (dBA) (10:00 p.m.–7:00 a.m.) |
|---|---|---|---|
| 1 | 30 | 65 | 60 |
| 2 | 15 | 70 | 65 |
| 3 | 5 | 75 | 70 |
| 4 | 1 | 80 | 75 |
| 5 | 0 | 80 | 80 |

## 3.7.5 Environmental Effects

### *Alternative 1 (No Action)*

The No Action Alternative would not result in changes in noise or effects on noise-sensitive land-uses because there would be no construction or changes in operation of the existing facilities.

### *Alternative 2 (Proposed Action)*

*Construction Effects*

**Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise**

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance and shielding between construction noise sources and noise-sensitive areas. Construction noise impacts result primarily when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or construction lasts over extended periods of time.

Construction of the Proposed Action would be completed within about 12–15 months after award of the construction contract. Construction activities would include installing cofferdams, constructing intake and outlet structures, constructing the pumping plant, connecting the pumps to the intake and outlet structures, constructing access roadways on the site, and constructing a transmission line on the west side of the canal from the Intertie to the Tracy substation, about 4.5 miles to the north.

It is anticipated that the equipment listed in Table 3.7-5 would be used in the construction process. Typical $L_{max}$ noise levels for each piece of equipment also are shown in Table 3.7-5 (Federal Highway Administration 2006). The acoustical use factor—the percentage of time per hour that the equipment typically would be used—is indicated. $L_{eq}$ values are determined from the $L_{max}$ value and the use factor.

**Table 3.7-5.** Construction Equipment Noise Emission Levels

| Equipment | Typical Noise Level (dBA-$L_{max}$) 50 feet from Source | Acoustical Use Factor | Typical Noise Level (dBA-$L_{eq}$) 50 feet from Source |
|---|---|---|---|
| Air Compressor | 80 | 40 | 76 |
| Backhoe | 80 | 40 | 76 |
| Concrete mixer | 85 | 40 | 81 |
| Crane (mobile) | 85 | 16 | 77 |
| Drill rig | 85 | 20 | 78 |
| Dump truck | 84 | 40 | 81 |
| Line truck* | 84 | 40 | 81 |
| Aerial lift truck* | 84 | 40 | 81 |
| Excavator | 85 | 40 | 81 |
| Front-end loader | 80 | 40 | 76 |
| Generator | 82 | 50 | 79 |
| Pump | 77 | 50 | 74 |
| Roller | 85 | 20 | 78 |
| Vibratory compactor | 80 | 20 | 73 |
| Vibratory pile driver | 95 | 20 | 88 |

* Expected to be similar to dump truck.

Source: Federal Highway Administration 2006.

Typical non-impact construction activities, excluding pile driving, is expected to generate $L_{max}$ values in the range of 77 to 85 dBA and $L_{eq}$ values in the range of 74 to 81 dBA at a distance of 50 feet. Pile driving required for the placement of sheet piles is expected to generate $L_{max}$ values of 95 dBA and $L_{eq}$ values of 88 dBA at 50 feet.

Noise produced by construction equipment typically attenuates over distance at a rate of about 6 dB per doubling of distance based solely on geometry. Additional attenuation in the range of 1 to 2 dB per doubling of distance is provided by ground absorption. Noise levels are further reduced where shielding is provided by intervening terrain, walls, or structures located between the construction and noise-sensitive uses.

Under Alternative 2, the closest residence would be about 1,900 feet from the facility site. Table 3.7-6 summarizes predicted noise levels from typical construction equipment and pile driving at this distance that has been calculated using the source levels identified above and an attenuation calculation method that includes effects of both geometric attenuation and ground absorption (Federal Transit Administration 2006).

**Table 3.7-6.** Construction Noise Levels under Alternative 2

| Distance from Facility to Nearest Residence | Typical Construction Equipment at 50 feet | Pile Driving at 50 feet | Typical Construction Equipment at 1,900 feet | Pile Driving at 1,900 feet |
|---|---|---|---|---|
| 1,900 feet | 77 to 85 dBA-$L_{max}$<br>74 to 81 dBA-$L_{eq}$ | 95 dBA-$L_{max}$<br>88 dBA-$L_{eq}$ | 35 to 43 dBA-$L_{max}$<br>29 to 32 dBA-$L_{eq}$ | 53 dB-$L_{max}$<br>46 dBA-$L_{eq}$ |

During construction of the powerline, activities could occur closer to residences. However, construction activities associated with the powerline would be limited in duration to several days for any one location. Construction noise would be lower in acoustically shielded locations and at noise-sensitive receivers located farther from the project site.

Construction activities that occur between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday, and between 8:00 a.m. and 5:00 p.m. Saturday and Sunday, are exempt from the county's noise ordinance. Additionally, construction conducted by public agencies and/or utility companies or their contractors that is deemed necessary to serve the best interests of the public is exempt from the county's noise ordinance. As a result, construction of the project occurring during any hours, day or night, would be exempt from the ordinance.

Although construction equipment is exempt from the ordinance, the results in Table 3.7-6 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

*Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices*

To reduce the potential for annoyance from construction noise, the construction contractor would employ noise-reducing construction practices between the hours of 7:00 p.m. and 7:00 a.m. on Monday through Friday and 5:00 p.m. and 8:00 a.m. on Saturday and Sunday such that the noise from construction does not exceed the applicable noise criteria in the Alameda County noise ordinance (Tables 3.7-3 and 3.7-4).

Measures that can be used to limit noise may include, but are not limited to:

- limiting hours of construction operation;
- locating equipment as far as practical from noise-sensitive uses;
- using sound-control devices such as mufflers on equipment;
- using equipment that is quieter than standard equipment;
- selecting haul routes that affect the fewest number of people;
- using noise-reducing enclosures around noise-generating equipment;

- constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (terrain, structures) to block sound transmission; and
- temporarily relocating residents (i.e., providing hotel vouchers) during periods of high construction noise that cannot be effectively reduced by other means.

*Operation Effects*

**Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Intertie Operation**

Noise from the operation of the Intertie pumping plant would be governed primarily by the facility pumps. The facility would have four 1,000-horsepower (hp) electric pumps housed in a pre-engineered steel shell building. Each pump is anticipated to produce a sound level of 97 dBA at 3 feet (Hoover and Keith 1996). Four pumps operating simultaneously would produce a sound level of 103 dBA at 3 feet. This corresponds to a sound level of 79 dBA at 50 feet. The building sheet is anticipated to provide at least 10 dB of noise reducing, resulting in a nominal source level of about 69 dBA at 50 feet.

The nearest residence is located 1,900 feet from the plant site. Assuming the effect of geometric attenuation and ground absorption, the predicted noise level at the nearest residence would be 27 dBA. Because this is below the applicable Alameda County noise standards, no adverse impact is anticipated.

### *Alternative 3 (TANC Intertie Site)*

*Construction Effects*

**Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise**

Noise impacts resulting from construction under Alternative 3 would be similar to the impacts identified under Alternative 2. As discussed above, typical construction equipment is expected to generate $L_{max}$ values in the range of 77 to 85 dBA and $L_{eq}$ values in the range of 74 to 81 dBA at a distance of 50 feet. Pile driving required for the placement of sheet piles to shore excavations is expected to generate $L_{max}$ values of 95 dBA and $L_{eq}$ values of 88 dBA at 50 feet.

Under Alternative 3 the closest residence would be about 800 feet from the facility site. Table 3.7-7 summarizes predicted noise levels from typical construction equipment and pile driving at this distance.

**Table 3.7-7.** Construction Noise Levels under Alternative 3

| Distance from Facility to Nearest Residence | Typical Construction Equipment at 50 feet | Pile Driving at 50 feet | Typical Construction Equipment at 800 feet | Pile Driving at 800 feet |
|---|---|---|---|---|
| 800 feet | 77 to 85 dBA-$L_{max}$<br>74 to 81 dBA-$L_{eq}$ | 95 dBA-$L_{max}$<br>88 dBA-$L_{eq}$ | 46 to 54 dBA-$L_{max}$<br>40 to 43 dB-$L_{eq}$ | 64 dB-$L_{max}$<br>57 dBA-$L_{eq}$ |

Although construction equipment is exempt from the County's noise ordinance, the results in Table 3.7-7 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

*Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices*

Described above.

#### *Operation Effects*

### Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Intertie Operation

Pump operations and equipment under Alternative 3 would be the same as under Alternative 2. The resulting nominal noise source level is expected to be 69 dBA at 50 feet.

The nearest residence is located 850 feet from the plant site. Assuming the effect of geometric attenuation and ground absorption the predicted noise level at the nearest residence would be 33 dBA. Because this is below the applicable Alameda county noise standards, no adverse impact is anticipated.

## *Alternative 4 (Virtual Intertie)*

#### *Construction Effects*

### Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise in Excess of Applicable Standards

Under Alternative 4, temporary equipment would be placed when needed. There would be no pile driving. There would, however, be heavy equipment used to place the temporary equipment. Noise impacts associated with placement of temporary equipment would be similar to the impacts identified under Alternative 2. The duration of impacts would be less. As discussed above, typical construction equipment is expected to generate $L_{max}$ values in the range of 77 to 85 dBA and $L_{eq}$ values in the range of 74 to 81 dBA at a distance of 50 feet.

Under Alternative 4, the closest residence would be about 3,500 feet from the facility site. Table 3.7-8 summarizes predicted noise levels from typical non-impact construction equipment at this distance.

**Table 3.7-8.** Construction Noise Levels under Alternative 4

| Distance from Facility to Nearest Residence | Typical Construction Equipment at 50 feet | Typical Construction Equipment at 3,500 feet |
|---|---|---|
| 3,500 feet | 77 to 85 dBA-$L_{max}$<br>74 to 81 dBA-$L_{eq}$ | 29 to 37 dBA-$L_{max}$<br>23 to 26 dB-$L_{eq}$ |

Note: No pile driving under this alternative.

Although construction equipment is exempt from the ordinance, the results in Table 3.7-8 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

*Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices*

Described above.

*Operation Effects*

**Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Temporary Intertie Operation**

Under Alternative 4, temporary diesel-powered pumps would be used to transfer water. It is anticipated that 10 portable pumps powered by 425-hp turbocharged diesel engines would be used. Each pump is anticipated to produce a sound level of 87 dBA at 50 feet. Six pumps operating simultaneously would produce a sound level of 95 dBA at 50 feet.

The closest residence is about 3,500 feet from the temporary site. Assuming the effect of geometric attenuation and ground absorption, the predicted noise level at the nearest residence would be 47 dBA. This result indicates that operation of the temporary pumps could result in exceedance of the Alameda County night noise ordinance standard of 45 dBA. Operation of the temporary pumps therefore is considered to result in an adverse effect.

Implementation of Mitigation Measure NZ-MM-2 would reduce this impact.

*Mitigation Measure NZ-MM-2: Employ Noise-Reducing Measures for the Temporary Pumps*

To reduce the potential for annoyance from operation of the temporary pumps, the project applicant will implement noise-reducing measures such that noise from operation of the pumps does not exceed Alameda noise ordinance standards at the nearest residence. Measures that can be implemented to reduce noise from the pumps includes:

- use of upgraded silencing mufflers on the engines and
- construction of temporary barriers between the pump array and noise-sensitive land uses, or taking advantage of existing barrier features (terrain, structures) to block sound transmission.

# 3.8 Climate Change

## 3.8.1 Introduction

This section provides an assessment of the potential impacts of the Intertie project on climate change and the potential effects of the climate change on the project. The potential impacts that the Intertie and its alternatives may have on greenhouse gas (GHG) emissions are presented quantitatively. The emissions analysis is focused exclusively on potential climate change; the quantification of emissions associated with conventional air quality pollutants is addressed in Section 3.6, Air Quality. In addition to the GHG analysis, a discussion of how California's climate is expected to evolve as a consequence of worldwide GHG emissions is described qualitatively.

There are no formal guidelines on how to address climate change in NEPA documents and the state of climate change practice is changing continuously. In this section, various state and local regulations and court rulings are discussed to provide perspective on the interrelation of climate change and environmental impact assessment. Note that many of the regulations and court proceedings listed below do not have direct bearing on the Intertie project; they are discussed to provide prospective and context for climate change issues and should not be considered binding requirements for this project or its alternatives.

## 3.8.2 Environmental Setting

This section presents an overview of statewide, national, and global GHG emission inventories. The characteristics, sources, and units used to quantify the six gases listed in Assembly Bill (AB) 32 (i.e., carbon dioxide [$CO_2$], methane [$CH_4$], nitrous oxide [$N_2O$], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [$SF_6$]) will be documented.

### *Global Climate Change*

Global climate change is caused in part by anthropogenic emissions of GHGs released into the atmosphere (through combustion of fossil fuels) and by other activities that affect the global GHG budget (such as deforestation and land-use change). According to the California Energy Commission (CEC), GHG emissions in California are attributable to human activities associated with industrial/manufacturing, utilities, transportation, residential, and agricultural sectors as well as natural processes (California Energy Commission 2006a).

GHGs play a critical role in the Earth's radiation budget by trapping infrared radiation emitted from the Earth's surface, which could have otherwise escaped to space. Prominent GHGs contributing to this process include water vapor, $CO_2$, $N_2O$, $CH_4$, ozone, certain HFCs and fluorocarbons, and $SF_6$. This phenomenon, known as the "greenhouse effect" keeps the Earth's atmosphere near the surface warmer than it would otherwise be and allows for successful habitation by humans and other forms of life. The combustion of fossil fuels releases carbon that has been stored underground into the active carbon cycle, thus increasing concentrations of GHGs in the atmosphere. Emissions of GHGs in excess of natural ambient concentrations are thought to be responsible for the enhancement of the greenhouse effect and to contribute to what is termed "global warming," a trend of unnatural warming of the Earth's natural climate. Higher concentrations of these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface.

Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors) and toxic air contaminants (TACs), which are primarily pollutants of regional and local concern. Because GHG emissions have long atmospheric lifetimes, GHGs are effectively well-mixed globally and are expected to persist in the atmosphere for time periods several orders of magnitude longer than criteria pollutants such as ozone.

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant for the understanding of climate change; its potential impacts; and options for adaptation and mitigation. The IPCC predicts substantial increases in temperatures globally of between 1.1 to 6.4° Celsius (depending on scenario) by the year 2100 (Intergovernmental Panel on Climate Change 2007a).

Climate change could potentially impact the natural environment in California, and the world at large, in the following ways (California Climate Change Center 2006):

- rising sea levels along the California coastline, particularly in San Francisco and the Sacramento–San Joaquin River Delta (Delta) due to ocean expansion, melting ice sheets, and other mechanisms;
- changing extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent;
- increasing wildfire frequency and intensity;
- increasing heat-related human deaths, infectious diseases, and increasing risk of respiratory problems caused by deteriorating air quality;
- decreasing snow pack and spring runoff in the Sierra Nevada mountains, affecting winter recreation and water supplies;
- increasing severity of winter storms, affecting peak stream flows and flooding;

- changing growing season conditions that could affect California agriculture, causing variations in crop quality and yield; and
- changing distribution of plant and wildlife species due to changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

These changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 million to 59 million by the year 2040 (California Energy Commission 2005a). As such, the number of people potentially affected by climate change as well as the amount of anthropogenic GHG emissions expected under a "business as usual" scenario is expected to increase.

### *Greenhouse Gases*

The characteristics, sources, and units used to quantify the six gases listed in AB 32 ($CO_2$, $CH_4$, $N_20$, HFCs, PFCs, and $SF_6$) are documented in this section, in order of abundance in the atmosphere. Note that water vapor, although the most abundant GHG, is not included in AB 32 because natural concentrations and fluctuations far outweigh anthropogenic influences.

In order to simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the *global warming potential* (GWP) methodology defined in the IPCC reference documents (Intergovernmental Panel on Climate Change 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of $CO_2$ equivalents ($CO_2e$), which compares the gas in question to that of the same mass of $CO_2$ ($CO_2$ has a GWP of 1 by definition). For example, a high GWP represents high infrared absorption and long atmospheric lifetime when compared to $CO_2$. One must also select a time horizon to convert GHG emissions to equivalent $CO_2$ emissions to account for chemical reactivity and lifetime differences between various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons of $CO_2e$ emitted per year.

The *atmospheric residence time* of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal (Seinfeld and Pandis 2006). The atmospheric residence time of a gas is in effect a half-life measurement of how long a gas is expected to persist in the atmosphere when taking into account removal mechanisms such as chemical transformation and deposition.

Units commonly used to describe the concentration of GHGs in the atmosphere are parts per million (ppm), parts per billion (ppb) and parts per trillion (ppt), which refer to the number of molecules of the GHG in a sampling of one million, one billion or one trillion molecules of air, respectively. Collectively, HFCs, PFCs, and $SF_6$ are referred to as high global warming potential gases (HGWPG). $CO_2$ is by far the largest component of worldwide $CO_2$e emissions, followed by $CH_4$, N20, and HGWPGs in order of decreasing contribution to $CO_2$e.

*Carbon Dioxide*

$CO_2$ is the most important anthropogenic GHG and accounts for more than 75% of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of $CO_2$ will remain elevated for decades after GHG mitigation efforts to reduce GHG concentrations are promulgated (Intergovernmental Panel on Climate Change 2007b).

Increasing concentrations of anthropogenic $CO_2$ in the atmosphere are largely due to emissions from the burning of fossil fuels, gas flaring, cement production, and land-use changes. Three quarters of anthropogenic $CO_2$ emissions are the result of fossil fuel burning (and to a very small extent, cement production), and approximately one quarter of emissions are the result of land-use change (Intergovernmental Panel on Climate Change 2007a).

Anthropogenic emissions of $CO_2$ have increased concentrations in the atmosphere most notably since the Industrial Revolution; the concentration of $CO_2$ has increased from about 280 to 379 ppm over the last 250 years (Intergovernmental Panel on Climate Change 2007c). IPCC estimates that the present atmospheric concentration of $CO_2$ has not been exceeded in the last 650,000 years and is likely to be the highest ambient concentration in the last 20 million years (Intergovernmental Panel on Climate Change 2007a; Intergovernmental Panel on Climate Change 2001).

*Methane*

$CH_4$, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions and has a GWP of 21 (Association of Environmental Professionals 2007; Intergovernmental Panel on Climate Change 1996).

Anthropogenic emissions of $CH_4$ are the result of growing rice, raising cattle, combusting natural gas, and mining coal (National Oceanic and Atmospheric Administration 2005). Atmospheric $CH_4$ has increased from a preindustrial concentration of 715 to 1,775 parts per billion in 2005 (Intergovernmental Panel on Climate Change 2007c). Though it is unclear why, atmospheric concentrations of $CH_4$ have not risen as quickly as anticipated (National Oceanic and Atmospheric Administration 2005).

### *Nitrous Oxide*

$N_2O$ is a powerful GHG, with a GWP of 310 (Intergovernmental Panel on Climate Change 1996). Anthropogenic sources of $N_2O$ include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. $N_2O$ is also used in rocket engines and racecars and as an aerosol spray propellant. Agricultural processes that result in anthropogenic $N_2O$ emissions are fertilizer use and microbial processes in soil and water (Association of Environmental Professionals 2007).

$N_2O$ concentrations in the atmosphere have increased from preindustrial levels of 270 ppb to 319 ppb in 2005 (Intergovernmental Panel on Climate Change 2007c).

### *Hydroflourocarbons*

HFCs are human-made chemicals used in commercial, industrial, and consumer products and have high GWPs (Environmental Protection Agency 2006a). HFCs are generally used as substitutes for ozone-depleting substances (ODS) in automobile air conditioners and refrigerants. Concentrations of HFCs have risen from zero to current levels. Because these chemicals are human-made, they do not exist naturally in ambient conditions.

### *Perfluorocarbons*

The most abundant PFCs include CF4 (PFC-14) and C2F6 (PFC-116). These human-made chemicals are emitted largely from aluminum production and semiconductor manufacturing processes. PFCs are extremely stable compounds that are only destroyed by very high-energy ultraviolet rays, which result in the very long lifetimes of these chemicals. PFCs have large GWPs and have risen from zero to current concentration levels.

### *Sulfur Hexafluoride*

$SF_6$, another human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and also as a trace chemical for study of oceanic and atmospheric processes (Environmental Protection Agency 2006a). In 1998, atmospheric concentrations of $SF_6$ were 4.2 ppt and steadily increasing in the atmosphere.

$SF_6$ is the most powerful of all GHGs listed in IPCC studies with a GWP of 23,900 (Intergovernmental Panel on Climate Change 1996).

### ***GHG Inventories***

A GHG inventory is a quantification of all GHG emissions and sinks within a selected physical and/or economic boundary. GHG inventories can be performed on a large scale (i.e., for global and national entities) or on a small scale (i.e., for a particular building or person).

Many GHG emission and sink specifications are complicated to evaluate because natural processes may dominate the carbon cycle. Though some emission sources and processes are easily characterized and well understood, some components of the GHG budget (i.e., the balance of GHG sources and sinks) are not known with accuracy. Because protocols for quantifying GHG emissions from many sources are currently under development by international, national, state, and local agencies, ad-hoc tools must be developed to quantify emissions from certain sources and sinks in the interim.

The following sections outline the global, national, and statewide GHG inventories to contextualize the magnitude of Intertie project-related emissions.

#### *IPCC Global GHG Inventory*

In the 2007 IPCC Synthesis Report, global anthropogenic GHG emissions were estimated to be 49,000 million metric tons of $CO_2e$ in 2004, which is 24% greater than 1990 emissions levels. $CO_2$ contributed to 76.7% of total emissions; $CH_4$ accounted for 14.3%; $N_2O$ contributed 7.9% of total emissions and fluorinated gases (HFCs, PFCs, and $SF_6$) contributed to the remaining 1.1% of global emissions in 2004. Energy supply was the sector responsible for the greatest amount of GHG emissions (25.9%), followed by industry (19.4%), forestry (17.4%), agriculture (13.5%), and transport (13.1%) (Intergovernmental Panel on Climate Change 2007c).

#### *U.S. Environmental Protection Agency National GHG Inventory*

The EPA estimates that total U.S. GHG emissions for 2004 amounted to 7,078 million metric tons of $CO_2e$, which is 13.1% greater than 1990 levels (U.S. Environmental Protection Agency 2008a). U.S. GHG emissions were responsible for 14.4% of global GHG emissions in 2004 (Intergovernmental Panel on Climate Change 2007c; U.S. Environmental Protection Agency 2008a). The largest contributors to U.S. GHG emissions in 2004 were electricity generation (33.4%), transportation (27.9%), and the industrial sector (19.6%) (U.S. Environmental Protection Agency 2008a).

### *Statewide GHG Inventory*

CEC's *Inventory of Greenhouse Gas Emissions and Sinks: 1990–2004* estimates that California is the second largest emitter of GHG emissions of the United States (California Energy Commission 2004). The commission estimates that in 1990 California's gross GHG emissions were between 425 and 452 million metric tons of $CO_2$e. The CEC estimates that in 2004, California's gross GHG emissions were 492 million metric tons of $CO_2$e. The transportation sector produced approximately 40.7% of California's GHG emissions in 2004. Electric power production accounted for approximately 22.2% of emissions, and the industrial sector contributed 20.5% of the total; agriculture and forestry contributed 8.3%, and other sectors contributed 8.3% (California Energy Commission 2006a).

The California Air Resources Board (CARB) recently released revised estimates of California's 1990 and 2004 emissions, estimating that 1990 emissions amounted to 433 million metric tons of $CO_2$e and 2004 emissions levels were 484 million metric tons of $CO_2$e (California Air Resources Board 2007a; California Air Resources Board 2007b). Based on California's 2004 population of 37 million, this amounts to approximately 13 tons of $CO_2$e per person (State of California, Department of Finance 2008). According to the Congressional Research Service, per capita GHG emissions for the ten states with the highest GHG emissions levels for 2003 range from 12.7 to 46.9 tons of $CO_2$e per person (Congressional Research Service 2007).

## ***Climate Change Predictions for California***

There is a great deal of interest about future climate change effects on California water resources. DWR prepared a major study in 2006, *Progress on Incorporating Climate Change into Management of California's Water Resources* (California Department of Water Resources 2006), and included two sections on climate change effects in the 2005 California Water Plan Update (California Department of Water Resources 2005). Each of these studies described the general process of assuming a future change in $CO_2$ levels, and using a general circulation model (GCM) to estimate the likely changes in temperature and precipitation. The GCM results then are used to extract monthly estimates of precipitation, temperature, and humidity for the California region. The GCM models generally provide 150-year time-series of seasonal weather conditions throughout the globe, which begin about 1950 and continue to 2100. The first 50 years of GCM results should generally match the historical period, and the next 100 years of GCM results forecast future climate change. The simulated weather conditions vary greatly from year to year because of all the climate processes that affect our regional temperatures and precipitation. DWR reports that some of the GCM results indicate higher precipitation, and some suggest lower precipitation for the California region.

#### *Climate Change Predictions for the Central Valley and Key State Water Project Regions*

Although there is broad scientific consensus that anthropogenic GHG emissions will result in long term global (i.e., planet-wide averaged) warming, it is challenging to utilize global estimates to predict the climate change associated with a specific locale. For example, if the global temperatures were to increase by 2 degrees centigrade, certain regions (e.g., Greenland) may have an average temperature increase considerably greater than 2 degrees whereas other locals may actually have a decrease in average temperature.

The process of taking GCM results and applying them to sub-regions is referred to as *downscaling*. Downscaling GCM simulations to a specific sub-region is a complex and evolving science made difficult by the need to have adequate regional data.

Appendix R of the CVP/SWP Longterm Operations Plan is titled the *Sensitivity of Future Central Valley Project and State Water Project Operations to Potential Climate Change and associated Sea Level Rise* (hereafter referred to as Appendix R). Appendix R is one of the most recent and compressive efforts to downscale potential climate change predictions to assist in CVP and SWP operational planning. A review of the main findings of Appendix R as listed discussed below.

The Appendix R study had the following three components:

- Definition of regional climate change scenarios
- Definition of sea level rise assumptions, and
- Selection of methods for conducting “scenario-impacts” analysis

Similar to the DWR approach, four climate change scenarios were employed to estimate a range of climate change possibilities in the year 2030. One sea level rise scenario was used for 2030 that assumed at 1-foot sea level rise coupled with a 10% increase in tidal range. Based on regional climate change and sea level estimates, monthly changes in water quality and quantity were defined and simulated. Key results of this study were consistent with previous literature studies; highlights of the study include the following:

- Climate change is expected to cause a greater fraction of annual runoff to occur during winter and early spring at the expense of spring and summer flow,
- Changes in natural runoff and water supply are more affected by changes in precipitation patterns than by changes in mean-annual temperature, and
- Sea level rise impacts on salt water intrusion resulted in a significant decrease in CVP and SWP deliveries.

The four scenarios were used in the CVP/SWP Longterm Operations Plan to analyze the sensitivity of baseline conditions to climate change. The scenarios define a range of climate change predictions with respect to both warming (with all scenarios being warmer than historical conditions) and annual precipitation (with annual precipitation both higher and lower than historical conditions). These scenarios, as listed below, define boundaries for potential climate change that include most of the climate change predictions:

- Greater than historical precipitation and a smaller increase in temperature;
- Greater than historical precipitation and a larger increase in temperature;
- Less than historical precipitation and a smaller increase in temperature;
- Less than historical precipitation and a larger increase in temperature.

The "wetness" of the historical hydrology used for the CALSIM II model analysis lies within the range of the scenarios used in the global warming analysis performed in the CVP/SWP Longterm Operations Plan. All of the scenarios consider temperatures which are above the historical temperatures, so that the historical conditions are outside of the range of most of the climate change predictions. However, Appendix R of the CVP/SWP Longterm Operations Plan noted that CVP and SWP water deliveries and carryover storage were "much more sensitive to scenario changes in mean-annual precipitation," and that "the influence of scenario changes in mean-annual air temperature on either metric was minor" (Appendix R, page R-4). This indicates that it is much more important that the historical hydrology used for the CALSIM II model is within the range of potential future precipitation than it is to be within the range of potential future temperatures.

Each of these scenarios also includes an assumed one foot rise in sea level. (CVP/SWP Longterm Operations Plan, pages 9-94 to 9-95). If sea level rise only is considered (i.e., no changes in temperature and precipitation are assumed), CVP and SWP deliveries would decrease, and there would be greater salinity intrusion into the Delta. However, Appendix R also indicates that "the wetter regional climate change scenarios showed that such sea level rise effects on salinity intrusion were offset by increased upstream runoff and delta outflow" (Appendix R, page R-4). This indicates that the historical hydrology used for the CALSIM II model provides a reasonable basis to evaluate future conditions over the time frame considered in this EIS.

These general conclusions appear to be consistent with Table 9-22 of the CVP/SWP Longterm Operations Plan (beginning on page 9-96). That table shows that the "base study" (which did not include climate change effects) results were generally inside of the range of the four sensitivity scenarios with respect to end of September reservoir storage, river flows, and delta parameters (which include pumping at Jones and Banks Pumping Plants).

Based on the analysis of the sensitivity of the baseline to climate change in the CVP/SWP Longterm Operations Plan, as summarized above, it is concluded that the historical hydrology used for the CALSIM II modeling provides a reasonable basis to evaluate the impacts of the Intertie.

### *Regulatory Setting*

Climate change has only recently been widely recognized as an imminent threat to the global climate, economy, and population. Thus, the climate change regulatory setting—nationally, statewide, and locally—is complex and evolving. The following section identifies key legislation, executive orders, and seminal court cases relevant to the environmental assessment of Intertie project GHG emissions.

#### *Federal Regulations*

**Federal Action on Greenhouse Gas Emissions**

In 2002, President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the U.S. economy by 18% by 2012. No binding reductions were associated with the goal. Rather the EPA administers a variety of voluntary programs and partnerships with GHG emitters in which the EPA partners with industries producing and utilizing synthetic gases to reduce emissions of these particularly potent GHGs.

**April 2007 Supreme Court Ruling**

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007) the U.S. Supreme Court ruled that the EPA was authorized by the federal Clean Air Act (CAA) to regulate $CO_2$ emissions from new motor vehicles. The court did not mandate that the EPA enact regulations to reduce GHG emissions but found that the only cases in which the EPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change. On July 11, 2008, EPA released an Advanced Notice of Proposed Rulemaking (ANPR) inviting comments on options and questions regarding regulation of GHGs under the CAA. The ANPR announced a 120-day public comment period to conclude on November 28, 2008.

**Corporate Average Fuel Economy Standards**

In response to the U.S. Supreme Court ruling, the Bush Administration issued an executive order on May 14, 2007, directing the EPA and Departments of Transportation (DOT) and Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, nonroad vehicles, and nonroad engines by 2008. On December 19, 2007, the Energy Independence and Security Act of 2007

(EISA) (discussed below) was signed into law, which requires an increased Corporate Average Fuel Economy (CAFE) standard of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020. EISA requires establishment of interim standards (from 2011 to 2020) that will be the "maximum feasible average fuel economy" for each fleet. On October 10, 2008, the National Highway Traffic Safety Administration (NHTSA) released a final environmental impact statement analyzing proposed interim standards for model years 2011 to 2015 passenger cars and light trucks. NHTSA is expected to issue a final rule on interim standards in November 2008.

**Energy Independence and Security Act of 2007**

In addition to setting increased CAFE standards for motor vehicles, the EISA includes other provisions:

- Renewable Fuel Standard (RFS) (Section 202);
- Appliance and Lighting Efficiency Standards (Section 301–325);
- Building Energy Efficiency (Sections 411–441).

Additional provisions of the EISA address energy savings in government and public institutions, promoting research for alternative energy, additional research in carbon capture, international energy programs, and the creation of "green jobs."

**Reporting Requirements**

Congress passed the "Consolidated Appropriations Act of 2008" (HR 2764) in December 2007, which includes provisions requiring the establishment of mandatory GHG reporting requirements. The measure directs EPA to publish draft rules by September 2008 and final rules by June 2009 to mandate GHG reporting "for all sectors of the economy." It also directs EPA to determine what thresholds to use. As of the time of release of this document, the EPA has not developed draft rules as directed by the act.

*State Regulations*

A variety of legislation has been enacted in California relating to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents. The Office of Planning and Research (OPR) has been directed to develop guidelines for the mitigation of GHG emissions and their effects. CARB must adopt regulations for the implementation of AB 32 beginning in January 2010. OPR recently released a draft guidance document for treatment of GHGs under CEQA. This document is purely advisory and, once finalized, will serve as guidance only. In addition, on October 24, 2008, CARB released a draft staff proposal entitled *Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases* *under the California Environmental Quality Act* (Draft CARB Thresholds). The Draft CARB Thresholds provide a framework for developing significance thresholds for industrial, commercial, and residential projects. However, as of the time of release of this document, many details remain unresolved and the document is still in draft form.

## 3.8.3 Environmental Consequences

### *Assessment Methods*

This analysis discloses both the Intertie alternatives' contribution to climate change and the effects that climate change may have on the project. The Intertie alternatives have the potential to contribute to climate change as a result of energy use during construction and operation.

There are lifecycle, construction, and operational GHG emissions associated with dams which would result in non-zero GHG emission factors for energy production. However, since hydroelectric power has considerably lower GHG emissions than those emanating from fossil fuel power plants, the GHG emission associated with hydroelectric energy production are considered net carbon neutral. This assumption simplifies the GHG analysis without changing its ultimate conclusion.

The quantification of construction emissions was performed using the URBEMIS 2007 (Version 9.24) model, which takes into account the GHG components described above. This same model was used to determine emissions associated with operation of the temporary intertie under Alternative 4.

## 3.8.4 Environmental Effects

### *No Action Alternative*

Under the No Action Alternative, there would be no construction or operational changes that would result in changes in GHG emissions or energy use. Changes in the environment related to climate change likely would require adjustments in operations of CVP, SWP, and other systems to control and capture flows and maintain a reliable water supply.

### *Alternative 2: (Proposed Action)*

*Construction*

**Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions**

Construction activities associated with the Intertie would result in a temporary increase of GHG emissions. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 1,726 metric tons of $CO_2$ would be released during construction. It is not expected that substantial GHG emissions would be generated during construction, as construction activities are anticipated to be temporary and are minor compared to the local, state, federal, and global GHG inventory.

*Operation*

**Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations**

As described in Section 5.2, Power Production and Energy, the use of the Intertie and associated increase in Jones pumping would require approximately a 1% increase in CVP power use. However, the CVP system generates this energy, and the Intertie would be connected to this power source at the Tracy substation. The power generated by the CVP is hydroelectric and does not result in a net increase of GHG emissions. As such, the Intertie operations would not result in an increase in GHG emissions.

**Impact CC-3: Project Performance under Changed Conditions**

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would be a valuable tool in addressing these changed conditions as it would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

### *Alternative 3 (TANC Intertie Site)*

*Construction*

**Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions**

Construction activities associated with the Intertie would result in a temporary increase of GHG emissions. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 1,922 metric tons of $CO_2$ would be released. It is not expected that substantial GHG emissions would be generated during construction, as construction activities are anticipated to be temporary and are minor when compared to the local, state, federal, and global GHG inventory.

*Operation*

**Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations**

As described in Section 5.2, Power Production and Energy, the use of the Intertie and associated increase in Jones pumping would require approximately a 1% increase in CVP power use. However, the CVP system generates this energy, and the Intertie would be connected to this power source at the Tracy substation. The power generated by the CVP is hydroelectric and does not result in a net increase of GHG emissions. As such, the Intertie operations would not result in an increase in GHG emissions.

**Impact CC-3: Project Performance under Changed Conditions**

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

### *Alternative 4: (Virtual Intertie)*

*Construction*

**Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions**

Construction activities associated with the Virtual Intertie would result in minor temporary increases in GHGs when the temporary intertie structure is installed during emergencies. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 34 metric tons of $CO_2$ would be released. It is not expected that substantial GHG emissions would be generated during construction.

*Operation*

**Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Virtual Intertie Operations**

There are two potential mechanisms for GHG emissions related to the Virtual Intertie: Banks pumping and the temporary Intertie pumping. As described in Section 5.2, Power Production and Energy, the use of Banks Pumping Plant would require approximately a 1% increase in power use, and the CVP provides power for the water wheeled by the SWP for the CVP. This power is hydroelectric, and therefore no additional GHGs are expected to be emitted.

When the temporary Intertie is installed during emergencies, six 425-hp diesel generators would be used to power the movement of this water. It is currently unknown how many hours the generators would operate within a year, as operations are predicated solely on emergency usage requirements and an estimate of potential emergency situations is not available. To represent a worst-case scenario, it was assumed that the six diesel generators would operate 24-hours per day over a 365-day period. Based on this assumption, it is anticipated that a maximum of 7,420 metric tons of $CO_2$ would be emitted a year. However, this is the worst-case scenario, and actual emissions are expected be much less because operation of these pumps would be limited to emergency periods, which are expected to occur very infrequently and for short periods of time. As such, the Virtual Intertie operations would not result in a substantial increase in GHG emissions as operational emissions are minor when compared to the local, state, federal, and global GHG inventory.

**Impact CC-3: Project Performance under Changed Conditions**

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

#### *Inter-Comparison of Alternative GHG Emissions*

The construction and operational GHG emissions associated with the four project alternatives are presented in Figure 3.8-1. As shown in this figure, there are no construction emissions associated with the no action alternative. The proposed Intertie GHG emissions were the lowest of the action alternatives. The 1-year operational emissions for a single year of Alternative 4 operations could be as much as five times those associated with Alternative 2 or 3. Conservative assumptions were used to determine the Alternative 4 operational assumptions, so one year operational emissions may be overestimated. However, Alternatives 2 and 3 would create emissions only during construction, which would be temporary, whereas Alternative 4 would have fewer construction-related emissions each time it is constructed, but could be constructed multiple times, depending on emergency and maintenance needs. Alternative 4 would also result in operational emissions during maintenance and emergencies. As it is unknown how often the temporary intertie would be installed and operated, it is difficult to quantify the emissions associated with it.

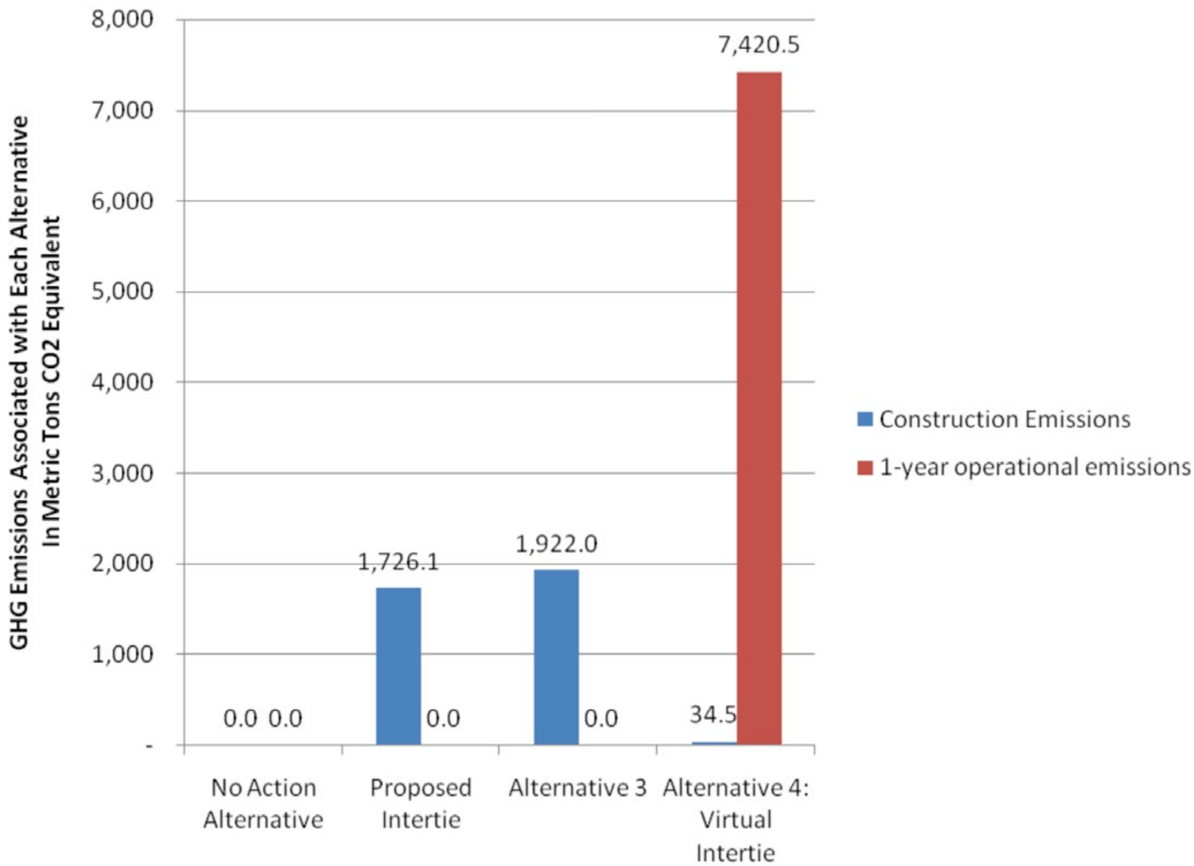




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**Figure 3.8-1**
**A Comparison of the Operational and Construction Emissions Associated with Each Project Alternative**